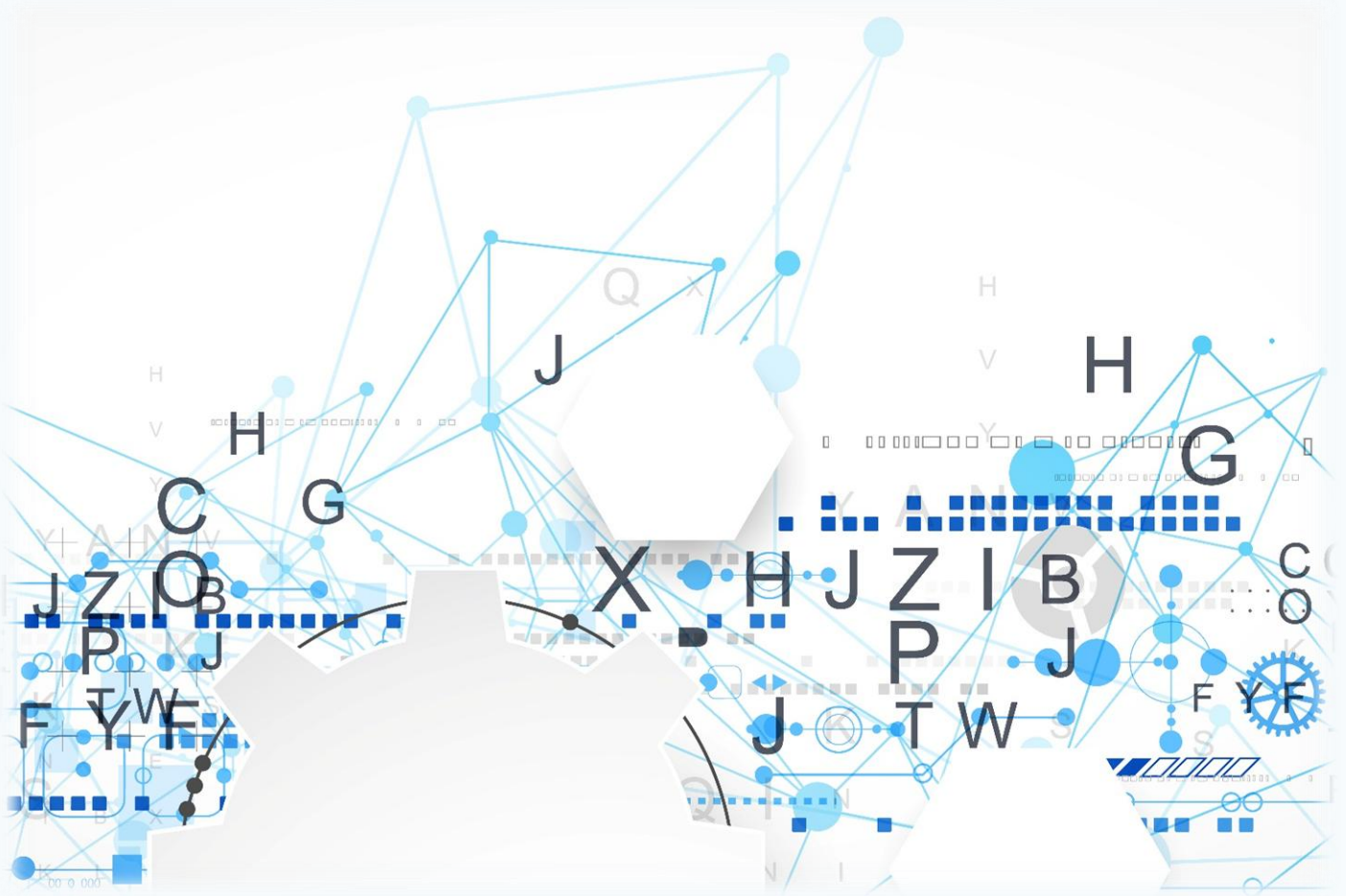


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FOSTERING PRODUCTIVITY – REMOVING BARRIERS THAT WASTE ENERGY

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In leading and managing health, aged and social care organisations, a central and enduring imperative is the effective utilisation and transformation of available resources into high-quality outcomes for patients, clients and consumers. Contemporary understandings of productivity in these sectors emphasise quality-adjusted performance, alongside a coordinated focus on organisational and system-wide efficiency. This favours a focus from conceptions of productivity centred on outputs and throughput, towards models that focus on value, outcomes and impact.

The Australian Productivity Commission has examined and reported on healthcare productivity, identifying key constraints arising from system fragmentation, regulatory duplication and insufficient coordination across the health system [1]. At the several levels, its recommendations emphasise the alignment of health regulation across care settings; the strengthening and embedding of collaborative commissioning arrangements; and increased investment in preventive and early intervention for consumer-focused care.

Strong leadership can improve productivity not by intensifying effort but by maximising the cognitive and relational capacity of effective organisations. This can be achieved through reducing system friction. As well as optimising the flow of care and support for individuals and implementing more robust and sophisticated work design. McKinsey's 2026 report [2] highlights that organisational productivity gains depend on refining workflows, redesigning work around technology-enabled workforces and maintaining strategic focus on a small number of high impact priority areas. Evidence from health organisations further demonstrates that targeted workflow interventions can deliver efficiency gains [3] while also producing meaningful improvements in wellbeing for our workforces.

Research and practice demonstrate that productivity is often constrained by workflow inefficiencies, administrative burden and excessive cognitive load rather than by deficiencies in workforce effort. Interventions that redesign work—through task redistribution, workflow simplification and reductions in cognitive load—can consistently improve both performance and system efficiency. In healthcare settings productivity is further limited by transaction costs, coordination failures and system friction. Effective leadership and management therefore create productivity not by intensifying performance demands but by redesigning work and strengthening inter agency collaboration to remove friction and optimise cognitive flow.

Mark Avery

Editor-in-Chief

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REFLECTIONS ON THE BENEFITS AND BARRIERS IN DEVELOPING AND IMPLEMENTING A NOVEL DIGITAL ENDOSCOPIC REFERRAL PATHWAY

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ABSTRACT

ISSUE

Gastrointestinal endoscopies are commonly requested, with variable alignment to accepted indications. A healthcare network had several, variable, paper-based referral management practices, with consequent variation in care delivery.

INTERVENTION

A digital, single-entry point referral pathway with embedded triage criteria and real-time reporting was implemented.

OUTCOMES

Thus far, 14,588 referrals managed, with 10,939 exited, 25.3% without a procedure. Additionally, the "on-rate" for new outpatient appointments for relevant units decreased by 56.8%.

CONCLUSION

Endoscopic referrals and care delivery can be managed safely and efficiently across sites using a purpose-designed digital pathway. Changing established workflow was challenging, with iterative refinements ongoing.

KEYWORDS

endoscopy, digital platform, harm minimisation, low-value procedures, outpatient clinics

THE ISSUE

Gastrointestinal (GI) endoscopies are amongst the most commonly requested and provided medical procedures. Over 900,000 colonoscopies alone are performed annually in Australia [1]. As GI symptoms are extremely common [2], and Australia has a National Bowel Cancer Screening Program (NBCSP) [3-5], there is a wealth of local evidence for when endoscopies are indicated and conversely, when they are not. Reducing the delivery of these unindicated procedures,

commonly referred to as 'Low Value Care' (LVC), is an important aspect of creating better value in healthcare for individuals, the community and funders/taxpayers [6].

Attempts have been made to reduce LVC with guidelines and by promotion of initiatives such as 'Choosing Wisely' [7,8], but without systems to underpin these, they are aspirational and only influence willing/engaged clinicians and do so inconsistently. There are substantial data in each edition of the Australia Commission on Safety and Quality in Health Care (ACSQHC) Australian Atlas of Healthcare Variation Series [9] suggesting poor adherence to guidelines for both upper GI endoscopy and colonoscopy. This is likely due to the procedure delivery process being contingent on multiple 'uncontrolled' decision points, including consumers, progressing via General Practitioners, triaging clinicians, and endoscopists, making substantial variation in care delivery almost inevitable. Additionally, processing and managing large volumes of referrals, including those representing LVC, almost certainly leads to harm by delaying care for those in whom an endoscopy is indeed needed for diagnosis and/or ongoing management

In designing a solution to these well-documented problems, a systems-based approach to GI endoscopic service delivery, with embedded referral criteria, transparent documentation and consistent decision-making seems logical. Here an attempt to implement a systematic pathway for the delivery of GI endoscopic services is presented, along with the barriers and benefits encountered.

STARTING POINT

Two healthcare sites in a single healthcare network, with up to seven discrete clinical units could receive and/or deliver endoscopic services. There were multiple discrete, non-transparent triage practices, variable waiting times and progression journeys for referrals/people. Some referrals were declined, some routed to initial outpatient review and some to various facilitated access pathways, with multiple different sub-waiting lists. Referrals were paper-based and physically moved amongst various locations at the two sites. There was no ability to report on total time from referral to 'decline decision' or procedure delivery, or to report total referral volumes, indications, acceptance rates, outpatient referral rates or treat-in-turn adherence. In addition, there was no ability to provide network-level reporting on wait times for specific indications, such as NBCSP participants.

INTERVENTION

An administrative review process was undertaken to map the flow of endoscopic referrals at each site and for each unit. Site-and unit-based processes were compared and possible efficiencies identified. Key administrative functions were identified and noted. Internal and external guidelines for referral triaging were reviewed and a guidance for internal use was developed.

Workshops involving all units were undertaken over a 12-month period, with administrative, nursing and medical staff invited. Virtual attendance was facilitated and recordings made to support participation. The new administrative and triage workflows were documented and consulted on. Senior medical staff from both sites were invited to develop and review the triage guideline documents for use by qualified endoscopic nursing staff.

A digital platform using Novari ACT™, was employed to enable a single entry and management point for all referrals, so these could be tracked from receipt to decline decision (with referring doctor notified), or accepted, booked and procedure delivered. The platform was customised for local needs as identified during consultation as described above. The platform also provided reporting information for all referrals on lead time, in-process and lag time metrics, including total time from referral to pathway exit and data by requested indication.

Once referrals were administratively verified and confirmed by nurse triage to align to a recognised indication, consumers were invited to complete their own health assessment questionnaire digitally. If all answers were in the 'green zone' (as designated according to local existing triage practice), consumers were provided with detailed information regarding their procedures. This included preparation (tailored to their bowel habit using a visual of the Bristol Stool Scale) and invited

to provide consent digitally - meaning they could be triaged, screened for general health risks, be given all the appropriate information and provide consent digitally. This saved them time, avoided travel and made a prior outpatient clinic review unnecessary. Any issues detected during this process could be managed by an experienced endoscopy nurse or escalated for medical staff review (by a consultant).

OUTCOMES TO DATE

The pathway commenced in Oct 2023. To February 2025, 14,588 referrals were received; with 10,939 exited from the pathway, 8,170 with a procedure delivered and 2,769 (25.3%) without (judged unindicated). In February 2025, 3,649 referrals remained within the pathway at various stages. Common reasons to decline a referral included: outside guidelines, too old (beyond guideline age for surveillance), too comorbid and too soon/repeat not indicated. It is now possible to report in real-time on referral inflows, outflows and progress along the pathway. Over the first seven months of the new pathway, net referral rates to gastroenterology and colorectal outpatient clinics were reduced by 56.8% and 54.1% respectively, compared to May-October 2023. At present, about 50% of the referrals now arrive using the digital form, making triage and administrative processes faster.

WHAT WAS SUCCESSFUL

Introducing a unified pathway across units and sites with a single digital entry-point and a unified queue transformed referral processing, replacing variable, paper-based workflows with a consistent, transparent, trackable system, providing real-time reporting. Creating a new nursing role, for experienced clinical endoscopy nurse specialists, empowered to apply standardised triage guidelines, proved particularly effective, removing duplicates and ensuring faster, more consistent triage while maintaining clinical oversight. Embedding agreed criteria into the platform enabled early exit of low-value referrals, easing demand and reducing pre-endoscopy clinic reviews. These changes delivered more equitable, timely, guidelines-aligned care and demonstrated how a system-based, multidisciplinary, digital approach can successfully address entrenched inefficiencies in public health endoscopic service delivery. Essentially, the new process enabled an assurance framework around endoscopic referral management and service delivery.

CHALLENGES

Implementing change is hard, and the new pathway highlighted several practical and cultural hurdles innate in system-level change. Some medical staff expressed discomfort over loss of autonomy in triage decisions, despite being invited to develop triage criteria, the documentation of these and efforts to embed guideline-based flexibility, perhaps related to changing longstanding local practices. Many medical staff worked part-time in this health service, making meaningful engagement in consultations, even virtually, more problematic. The absence of a clearly endorsed decision-maker sometimes created ambiguity about who should resolve issues where uncertainties arose, slowing progress. Finally, collaboration across professional boundaries, bringing together administrative, nursing and medical staff, required ongoing negotiation of roles, expectations and communication styles, which at times delayed progress, despite a genuine shared goal to address/improve endoscopy waitlists and referral issues.

CONCLUSIONS

A single digital entry point for endoscopic procedures is feasible and can be done. It enables a health service to deliver a more consistent and reliable service and to have the data to support a robust assurance framework. It can reduce harm and save costs by reducing LVC, in the endoscopy suite and outpatients. This creates additional internal capacity for progressing referrals for those in need without additional resources consumed. This approach helps avoid capacity and waitlist issues recently highlighted in NSW [10] making implementation worth considering more broadly.

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BEHAVIORAL STRATEGIES TO ADDRESS HEALTHCARE OVERUTILIZATION: A SOUTH KOREAN POLICY PROPOSAL FOR DELAYED REIMBURSEMENT

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ABSTRACT

The South Korean healthcare system faces significant challenges, including high service utilization, unnecessary consultations, and escalating healthcare expenditures, which strain the National Health Insurance (NHI). This perspective proposes a delayed reimbursement model to mitigate the overconsumption of healthcare services. Under this model, patients prepay for medical services, and the NHI reimburses a proportion of the cost after a designated period. This approach leverages behavioral economics principles, such as the “pain of paying,” which posits that upfront payments can deter unnecessary medical usage.

The delayed reimbursement model aims to reduce frivolous medical spending by imposing immediate out-of-pocket costs on patients. The phased implementation will initially focus on non-urgent and potentially overutilized services, ensuring that essential or high-priority medical care remains unaffected. By addressing behavioral factors contributing to overutilization and incorporating socioeconomic status considerations, this model promotes the NHI's financial stability while maintaining equitable access to healthcare.

KEYWORDS

Healthcare Overutilization, Delayed Reimbursement, Behavioral Economics, Healthcare Sustainability, South Korean Healthcare Policy

INTRODUCTION

South Korea's healthcare system is facing significant challenges, including excessive utilization of medical services, wasteful healthcare expenditures, and a high number of unnecessary medical consultations [1, 2]. These issues have led to unsustainable spending patterns, placing a heavy financial strain on the National Health Insurance (NHI) [3, 4]. South Korea also records the highest outpatient utilization among OECD countries, with 18.0 annual physician consultations per capita compared to the OECD average of 6.5, highlighting the magnitude of the overutilization problem [5]. This stark global comparison underscores the urgent need for strategic reforms to ensure long-term sustainability.

Recent policy discussions have proposed reducing private health insurance coverage to curb overconsumption; however, this approach has faced strong opposition from healthcare providers and patient advocacy groups due to concerns about increased financial burdens on patients [6]. Such measures could also translate into higher out-of-pocket costs for specific populations, potentially adding to their financial strain.

Reducing private health insurance coverage imposes a greater economic strain on patients, but a delayed reimbursement model offers a promising alternative. Behavioral economic principles, such as loss aversion and the psychological impact of upfront payments, can effectively address overutilization when integrated into a delayed reimbursement framework [7-11]. Thus, innovative strategies are required to manage healthcare utilization effectively while safeguarding access to medically necessary and high-priority services.

SITUATION AND ISSUES

The NHI covers a significant portion of medical expenditures, leaving patients to pay only a small fraction of the total costs under South Korea's fee-for-service system [12, 13]. While this ensures broad access to affordable healthcare, it inadvertently fosters the perception that medical services are low-cost. Consequently, patients are less likely to consider the actual cost of care, contributing to high utilization rates. According to the OECD Health Statistics 2025, South Korea records 18.0 annual in-person doctor consultations per capita, the highest among OECD countries and nearly triple the OECD average of 6.5 [5].

In addition to high outpatient utilization, the NHI faces mounting financial pressure due to growing demand for services [12-14]. The practice of "medical shopping," in which patients consult multiple providers for the same condition, further increases inefficiency and system-wide costs. Korea also maintains a high level of healthcare system capacity, with 12.6 hospital beds per 1,000 population compared with the OECD average of 4.2, and 87 CT, MRI, and PET scanners per million population compared with the OECD average of 51 [5].

Beyond equipment availability, diagnostic imaging is heavily utilized. CT and MRI examination volumes per 1,000 population are among the highest in the OECD, and national use of these modalities has continued to increase over the past decade [5]. This combination of abundant capacity and sustained growth in diagnostic testing contributes to unnecessary examinations and additional fiscal strain on the NHI.

Financial pressure is further amplified by Korea's rapid growth in healthcare spending. Although Korea spends \$US4,797 per capita on healthcare, which remains below the OECD average of \$US5,967, OECD analyses indicate that Korea's per-capita public health spending grew at an exceptionally rapid pace, increasing by more than 7% per year in real terms between 2001 and 2023, the fastest growth among all OECD countries [5]. Looking ahead, spending is projected to continue rising by approximately 3.6% annually from 2024 to 2045, compared with the OECD average projection of 2.6%. Health spending as a share of GDP reached 8.4% in 2024, approaching the OECD average of 9.3%. These patterns demonstrate not only high utilization but also a sustained and accelerated expenditure trajectory that intensifies financial pressure on the NHI.

Demographic changes further intensify these pressures. Korea's population aged 65 and over accounted for 18.2% of the total population in 2023, close to the OECD average of 18.5%. However, it is projected to rise to more than 40% by 2050, the highest among all OECD countries and far above the OECD average projection of 26.4% [5]. This rapid demographic shift is expected to increase demand for chronic disease management, diagnostic evaluation, and long-term care, further straining the NHI.

Systemic stress has been further aggravated by the medical workforce disruptions that began in February 2024, driven by disputes over workforce shortages and resource distribution [13, 15]. These disruptions revealed existing operational weaknesses and increased both service instability and financial pressures within the NHI. The broader fragility of the healthcare system became increasingly evident during this period.

Projections from the National Assembly Budget Office (NABO) indicate that, without intervention, the NHI's accumulated reserves could be depleted by 2028 or even earlier [14, 16]. This potential for rapid reserve depletion highlights the urgency of implementing targeted reforms to improve system efficiency and address persistent overutilization.

PROPOSED SOLUTIONS

This plan offers a novel approach in which patients pay for all medical care upfront, and NHI covers the remaining costs after a specific period. This delay is intended as a psychological barrier preventing unnecessary medical appointments. The "psychological barrier" leverages behavioral economic principles, particularly the "pain of paying," which posits that losses loom larger than gains [9-11, 17, 18]. Research also suggests that individuals react more strongly to immediate financial consequences than to deferred expenses, further supporting the efficacy of this strategy in reducing frivolous medical spending [8, 19].

Unlike traditional measures that increase patients' financial burdens, such as reducing the scope of insurance coverage, the delayed reimbursement model represents an innovative approach that leverages psychological deterrence without imposing additional economic strain. The phased implementation will begin with non-urgent services, such as elective consultations or minor procedures, where overutilization is most prevalent. This allows for a controlled rollout and ensures that essential medical care, including treatments for chronic conditions, necessary diagnostics, and urgent care, remains readily accessible.

To ensure equity and practicality, the model must incorporate tailored mechanisms, such as subsidies, installment payment options, and exemptions for vulnerable populations. Pilot programs conducted in selected regions will allow adjustments and refinements to optimize scalability and maintain the model's financial sustainability. Administrative challenges and stakeholder resistance can be mitigated through strategic communication and iterative adjustments during these pilot phases, ensuring a balanced and equitable approach to healthcare reform.

FINANCIAL ANALYSIS AND FEASIBILITY

A thorough financial evaluation is necessary to ensure the success of the delayed reimbursement model. Retaining prepayment funds temporarily before reimbursement provides a unique opportunity for short-term economic gains, such as interest income. This enhances the NHI's financial stability and offers a scalable mechanism for addressing similar fiscal challenges in other countries, particularly those grappling with rising healthcare costs.

Behavioral research consistently shows that people respond not only to the overall cost of care but also to how and when they experience that cost. Even when the total financial burden is identical, shifting payments to the point of service increases the salience of out-of-pocket spending and makes the immediate loss more psychologically impactful. This heightened sensitivity to upfront costs can discourage low-value or discretionary use, providing a behavioral pathway

through which the delayed reimbursement model may reduce unnecessary medical spending without increasing long-term financial burdens on patients [7-9, 11, 18-20].

Financial adjustments such as subsidies and installment plans should be further evaluated to ensure accessibility for vulnerable populations. Addressing disparities in healthcare access through these mechanisms will enhance the model's scalability and social acceptance. By combining financial projections with behavioral economic insights, the delayed reimbursement model offers a robust framework for tackling inefficiencies and ensuring long-term sustainability.

CONCLUSION

By addressing the root causes of overutilization and fostering cost-effective healthcare behavior, the delayed reimbursement model offers a scalable, equitable solution to balance affordability, quality, and sustainability. Future studies should evaluate its scalability across diverse socioeconomic contexts to optimize its global application.

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CONFLICTS OF INTEREST

The author declares that there is no conflict of interest.

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DEVELOPING AND IMPLEMENTING A LABORATORY COMPETENCY ASSESSMENT FRAMEWORK (L-CAF): LESSONS IN WORKFORCE CAPABILITY AND MANAGEMENT PRACTICE IN AOTEAROA NEW ZEALAND

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ABSTRACT

AIM:

This case study analyses the management strategies used to develop and implement the Laboratory Competency Assessment Framework (L-CAF), an initiative designed to address critical gaps in workforce competency assessment and enhance quality and patient safety in New Zealand clinical laboratory service.

APPROACH:

The management practice involved a co-design methodology with laboratory personnel at various levels and roles within a tertiary diagnostics service in New Zealand, a phased implementation strategy, and a strategic shift from a compliance-driven to a development-focused human resource model. The problem was analysed through regulatory reviews, structured stakeholder engagement, and operational gap analysis, guided by principles of participatory change management.

CONTEXT:

The initiative was undertaken within the Department of Pathology and Laboratory Medicine at Auckland City Hospital, Te Whatu Ora – Health New Zealand, a sector facing inconsistent evaluations and skill gaps that impacted service quality and equity.

MAIN FINDINGS:

Management interventions led to improved assessment consistency, heightened staff engagement in professional development, and a cultural shift towards continuous learning. Key success factors included staff co-design, leadership endorsement, and flexible adaptation to departmental workflows. Early quantitative indicators demonstrate substantial progress in the staged implementation of L-CAF and transition to the MediaLab Compass electronic platform. As of December 2025, the majority of departments had completed alignment of their competency assessments with L-CAF requirements, with a growing number commencing training activities and several departments having fully transitioned to the Compass platform. Collectively, these data reflect strong initial uptake and progressive digital implementation across services. Challenges included initial resistance and resource allocation for training and implementation in some departments.

CONCLUSIONS:

The L-CAF case demonstrates that effective management of competency assessment systems requires moving beyond technical checklists to a holistic, staff-engaged framework underpinned by change management theory. This approach is a powerful lever for improving workforce capability and operational quality, leading to equitable and safe patient care. The framework offers a replicable, theoretically informed model for healthcare managers internationally.

KEYWORDS

competency assessment, workforce development, quality improvement, change management, clinical laboratories, healthcare management

INTRODUCTION

Competency assurance is the foundation of safe, high-quality healthcare, particularly in pathology and laboratory medicine where diagnostic accuracy directly influences patient outcomes [1]. In Aotearoa New Zealand, clinical laboratories have traditionally relied on compliance-driven models of assessment, centred on technical checklists designed to meet minimum regulatory standards [2]. While effective in verifying baseline proficiency, these approaches failed to capture broader competency domains such as critical thinking, professional behaviours, communication, and cultural responsiveness [3].

The narrow focus of traditional assessments created several challenges. Inconsistent evaluation practices contributed to unrecognised skill gaps, while the lack of emphasis on cognitive and behavioural domains limited opportunities for meaningful professional growth. For instance, audits of laboratory incident reports within our setting revealed that a proportion of recurring errors were attributable not to technical failure, but to lapses in critical decision-making or communication, domains unaddressed by checklist assessments. This compliance-centric culture risked undermining both workforce capability and patient safety, particularly in high-stakes environments where precision and reliable decision-making are essential. Moreover, the absence of a structured, multi-dimensional framework led to variability in workforce capability across departments, creating disparities in service quality and equity of care [4].

To address these challenges, the Department of Pathology and Laboratory Medicine at Auckland City Hospital, Health New Zealand | Te Whatu Ora developed and implemented the Laboratory Competency Assessment Framework (L-CAF). This paper analyses the management approaches applied in diagnosing the problem, designing and implementing the intervention, and evaluating its outcomes. It situates the initiative within established change management theory to derive broader lessons for health management practice.

APPROACH TO ANALYSING THE PROBLEM

A comprehensive and systematic analysis was undertaken by the L-CAF project group to understand the extent and root causes of the competency assessment gap. This diagnostic phase was critical to ensuring that the subsequent intervention was both targeted and evidence based.

First, a regulatory and practice review was conducted, examining standards such as the Health Practitioners Competence Assurance Act (HPCAA) 2003 [5] and the Medical Sciences Council of New Zealand Competence Standards for Medical Laboratory Science Practitioners in Aotearoa New Zealand [6]. This review identified a significant inconsistency between the broad expectations of professional practice articulated in policy and the narrow, technical focus of real-world assessment tools.

Second, structured workforce feedback was gathered to capture diverse perspectives. The project group comprised 26 participants, including 3 administration staff, 4 laboratory technicians, 4 scientists, 4 Technical Specialists (senior scientists),

6 people leaders, 4 senior leaders, and 1 workforce professional leader, ensuring representation across professional roles and seniority levels. Data were collected through four focus groups and two brainstorming sessions. The qualitative data from these sessions were analysed using structured thematic analysis to identify recurring patterns and insights. Key themes highlighted widespread concerns about the narrow technical focus of traditional assessments, the absence of meaningful evaluation of critical thinking and professional practice, and a lack of consistency in verification processes. Figure 1 presents a summary of key themes from the brainstorming sessions.

Third, a gap analysis was conducted to compare the domains assessed by traditional methods (e.g. technical checklists) with the broader competencies required for safe and effective practice in a modern, culturally diverse healthcare environment. This analysis revealed notable omissions, particularly in the areas of critical thinking and professional practice. The findings were further supported by a review of laboratory error and incident reports by different departments, which highlighted recurring quality and safety issues linked to gaps in workforce capability. These reports also identified errors associated with unmet training needs and inconsistencies in assessment, further corroborating the analysis and underscoring the need for a more multifaceted and structured competency assessment framework.

FIGURE 1 KEY THEMES IDENTIFIED THROUGH WORKFORCE BRAINSTORMING SESSIONS

What is working well?	What is NOT working well?	How do you envision competency assessment & verification?
Process: - Competency sign-off questionnaires to test knowledge and procedure changes are working well. - Auditing EQA performance & participation. - Monthly document review (an auditing tool with focus on training needs) Tool: - Excel competency record. - Paperless competency spreadsheet Resource: - Quiz time	Process: - A tick-box exercise. Current process is too rushed, not actually assessing the person. A reactive approach. - Signoff without re-assessment. - Competency seems to focus on the delivery of a procedure and not on professional development and competency. - Supervisor driven. - Moderation between competency assessors is missing. - Soft skills are not assessed. - Process changes not covered in the assessment. - Frequency of assessment no clear. - Learning outcomes, objectives, requirements, and criteria for success are not detailed/not clear for staff. - Trainees don't have clear, standardised guidelines to follow. - Expectations for trainees are not clear. - Vague competency levels and required knowledge. - Not aligned with methods. Tool: - Too much paper. Need an electronic system. - System doesn't alert staff to when competency signoff is due (i.e., email notification needed). Resource: - Available time for training and competency assessment & verification. - Trainers are not always available (e.g., due to shift work), leading to inconsistency.	Process: - Learning outcomes are detailed. - Consistent and standardized. - Clear objectives, expectations with well-defined criteria and learning outcomes. - Succinct, efficient, effective, and transparent. - The professional practice domain from GEPP is included in the framework. - Focus not only on scientific and technical competencies but also on other important skills such as problem-solving/soft-skills. - A system where staff take responsibility for keeping their competency up to date. Self-driven. - Practitioners have a choice of verification methods. These include practical/visual assessment and verbal explanation. - Practitioners own their competency journey/outcome. - Competency evidence is collected over time as part of a continuous development continuum. - Interval periods required to assess competency (e.g., novice=yearly, expert=bi-yearly). - Record of troubleshooting errors and solutions. - Processes in place to help/support staff if they do not meet competency assessment criteria. Tool: - Quiz to assess knowledge. - E-competency tool. - Observation of bench practice (how do we ensure that staff are being taught the same thing?). - KPIs. Resource/Evaluation: - Trends and incidents. - Not onerous. A system that isn't too time-consuming.

MANAGEMENT INTERVENTIONS AND APPROACHES

To address the identified gaps, an intervention centred on four strategic shifts was implemented. The overall change strategy was implicitly aligned with Kotter's eight step model for leading change, emphasising creating a coalition,

developing a vision, and generating short-term wins [7]. This theoretical underpinning provided a structured approach to moving from problem diagnosis to sustainable implementation.

STRATEGIC SHIFTS:

The intervention was guided by a fundamental rethinking of the approach to competency assessment:

- **From technical to multi-dimensional:** Rather than focusing narrowly on technical abilities and skills, assessment was expanded to include critical thinking and professional practice, encompassing communication, ethics, and cultural safety.
- **From static to continuous:** Competency assurance also moved from a static, one-off process to a continuous and dynamic model that incorporated scenario-based assessments, peer reviews, and reflective exercises.
- **From compliance to developmental:** Assessment was repositioned from being a compliance-driven task to a developmental journey that fosters growth. Practitioners are empowered to take ownership of their progression along the competency continuum, moving beyond meeting minimum standards toward actively building capability, strengthening professional development, and advancing excellence.
- **From isolated to integrated:** Competency development was embedded into daily workflows, rather than being treated as an isolated activity.

THE LABORATORY COMPETENCY ASSESSMENT FRAMEWORK (L-CAF):

To implement these shifts, the Laboratory Competency Assessment Framework (L-CAF) was constructed around three foundational elements. First, competencies were categorised using the KASH model (Knowledge, Attitudes, Skills, and Habits) [8] and distributed across three primary domains: Technical Proficiency, Critical Thinking, and Professional Practice (see Table 1). Second, five-tiered proficiency levels (from Novice to Expert) were established to create defined progression pathways and articulate expected benchmarks for each developmental stage (Table 2). Finally, L-CAF employs diverse verification methods such as direct observation, mock events, case studies, peer review, and scenario-based simulations to assess these competencies. Each method is designed to evaluate one or more elements of the KASH model, and its selection is deliberately aligned with the specific competency being assessed (see Table 3).

TABLE 1 KASH MODEL (SOURCES: ADAPTED FROM THE KASH MODEL [8], WITH DEFINITIONS DEVELOPED BY THE AUTHORS)

KASH Model	Definition
Knowledge (K)	Assessment of foundational understanding of theories, principles, and role-specific information.
Attitudes (A)	Evaluation of professional disposition, mind-set, and approach to work. This may include teamwork, cultural competence, and adherence to organisational values.
Skills (S)	Assessment of practical and technical abilities, including both direct skills and applied knowledge.
Habits (H)	Assessment of routine practices, consistent behaviours, and reliability in work.

TABLE 2 PROFICIENCY LEVELS (SOURCES: AUTHORS' OWN WORK)

Level	Focus	Definition
1 (Novice)	Gaining Experience	• Demonstrates a basic understanding of concepts, principles, and tasks related to the competency. • May lack experience but can perform routine tasks under direct supervision. • Demonstrates awareness of the importance of accuracy, safety, and compliance in all tasks. Actively seeks feedback and guidance to improve performance and build confidence. • Begins to develop problem-solving skills by recognising and reporting issues appropriately.

		Meets baseline competency expectations in knowledge application, technical skills and adherence to protocols.
2 (Developing)	Consolidating Knowledge and Skills	- Demonstrates a solid understanding of concepts and principles and begins to integrate knowledge into practice. - Has the ability to perform routine tasks independently and manage complex tasks with guidance from more experienced practitioners. - Demonstrates consistent attention to detail and reliability in completing tasks, and growing confidence in addressing recurrent challenges and participating in problem-solving activities. - Achieves competency assessment benchmarks for routine tasks and shows measurable improvement in complex areas.
3 (Proficient)	Further Developing Knowledge and Skills	- Demonstrates comprehensive knowledge and skills and can apply competencies effectively across a full range of typical situations. - Has the ability to work autonomously within established frameworks and contributes to improving processes. - Consistently meets or exceeds lab quality, safety, and compliance standards. - Demonstrates the ability to address unforeseen challenges and make decisions with minimal guidance, and reliability in delivering high-quality outcomes and ensuring compliance with standards. - Demonstrates strong professional practice through clear communication, teamwork, and responsibility for assigned work.
4 (Advanced)	Becoming Expert	- Demonstrates advanced knowledge and specialised skills, applying competencies effectively in new or complex situations. - Has the ability to provide expert advice, mentorship, and guidance to less experienced practitioners. - Actively participates in training and competency assessment, ensuring knowledge transfer and skill development among less experienced practitioners. - Consistently exceeds performance expectations in assessments and contributes to quality and innovation. - Demonstrates leadership in recommending and implementing best practices, ensuring alignment with organisational goals, and a commitment to fostering quality, safety, equity and patient centred care through innovative approaches.

5 (Expert)	Acknowledged Leader	• Demonstrates expert-level knowledge and mastery of competencies, applying them in the most complex situations. • Develops new methodologies, framework, or innovations in lab practices. • Has the ability to develop new approaches, procedures, or frameworks that advance the field. • Demonstrates strategic leadership, inspiring others and shaping organisational policies and practices, as well as the capacity to influence industry standards and contribute to the profession at a national or international level.

TABLE 3 VERIFICATION METHODS - DESCRIPTIONS AND EXAMPLES (SOURCES: AUTHORS' OWN WORK)

Domains	Verification Method	KASH Model	Description and Example
Knowledge & Technical Proficiency	Knowledge Assessment	K	Description: Quizzes, exams, or structured questionnaires that evaluate foundational knowledge. Example: A written test on SOPs for a laboratory analyser.
	Direct Observation	S	Description: Supervisors or trainers observe practitioners performing tasks in real-time. Example: Observing a scientist perform a blood smear preparation and staining procedure.
	Review of Daily Work	S, H	Description: Analysis of routine documentation, task logs, or output reports for consistency and accuracy. Example: Reviewing patient result logs for accuracy and timeliness.
	Presentation	S	Description: Practitioners present on specific topics or projects to demonstrate knowledge and communication skills. Example: A presentation on the findings of a quality improvement project related to reducing sample processing errors.
Analytical, Reflective & Critical Thinking Abilities	Reflection	A, H	Description: Practitioners self-assess their performance, identifying strengths and areas for growth. Example: Writing a reflective summary on lessons learned from participating in a complex diagnostic case.
	Scenario-Based Assessment	K, A	Description: Practitioners respond to hypothetical or real-world scenarios to illustrate decision-making and critical thinking. Example: Describing how to handle a situation where a sample's integrity is compromised.
	Case Study Analysis	K	Description: Practitioners analyse real or simulated cases, explaining their rationale and decision-making process. Example: Reviewing and presenting on a case involving antimicrobial susceptibility testing results.
Peer & Collaborative Evaluation (Interpersonal Skills)	Peer Review	A, H	Description: Colleagues evaluate an individual's performance, providing feedback on technical, professional and interpersonal skills.
			Example: Reviewing and providing feedback on a colleague's calculation for preparing the correct dilution of a reagent/sample.

	Discussion	K, A	Description: Structured discussions on strategies, challenges, or problem-solving approaches.
			Example: Discussing strategies for optimising workflow in response to increased sample volumes.
	Multi-Disciplinary Meeting (MDM)	K, A	Description: MDMs facilitate discussion among different professionals to review cases, share knowledge, and make collaborative decisions.
			Example: A multidisciplinary team reviewing a complex diagnostic genetics case to determine the best diagnostic and treatment approach.
Practical & Applied Assessment	Mock Event	S, A	Description: Simulated scenarios assess individual or team actions under controlled conditions.
			Example: Conducting a simulated chemical spill response drill in the laboratory.
	Quality Assurance (QA) Monitoring	S, H	Description: Using QA data to evaluate individual performance over time.
			Example: Analysing error rates in data entry for routine test results to identify trends.
	Clinical Review Audit	S, H	Description: Clinical review audits assess documentation, adherence to protocols, and decision-making processes within clinical settings.
			Example: Auditing a set of laboratory reports to evaluate whether they meet quality and clinical guidelines.

IMPLEMENTATION STRATEGY:

A phased and participatory implementation strategy ensured the framework was both practical and sustainable, directly applying principles of participatory change management and organisational learning.

- **Co-design and coalition building:** Laboratory staff from all levels were engaged in co-designing the framework, which fostered ownership and relevance to daily practice, aligning with Kotter's "creating a guiding coalition".
- **Pilot testing and iterative refinement:** Pilot testing was conducted within selected departments, allowing for iterative refinement based on frontline feedback prior to wider adoption, creating early, tangible examples of success.
- **Champion model:** A champion model was employed, with 26 departmental champions trained to lead peer training and promote the benefits of the framework.
- **Digital integration:** Integration of assessment tools into the MediaLab Compass module was planned to streamline tracking, reduced administrative burden, and enhanced audit readiness.

DISCUSSION OF OUTCOMES

REPORTED OUTCOMES AND IMPACT:

Early indicators, though yet to be quantified in the long term, point to highly positive outcomes. Initial feedback from pilot departments has been overwhelmingly positive. Staff report greater clarity in competency expectations and increased confidence in their developmental pathways. Assessors and supervisors note the verification process is more structured and meaningful. Qualitatively, there has been an observed increase in reflective conversations about practice and safety, signalling a positive cultural shift towards continuous learning.

Substantial early progress is also evident in the staged implementation of L-CAF and the transition to the MediaLab Compass electronic platform. As of December 2025, 12 of 15 departments (80%) had completed the review and updating of their existing competency assessments to align with L-CAF requirements. In parallel, 4 of 15 departments (26.7%) had commenced training, education, and trial activities within the MediaLab Compass module, reflecting early digital engagement and readiness for platform transition. At the time of reporting, 2 of 15 departments (13.3%) had fully

transitioned their updated competencies onto the Compass electronic platform. Collectively, these data demonstrate strong initial alignment with the framework, with progressive and measurable uptake of digital implementation across services.

Externally, the framework has received strong endorsement from the Regional Operations Managers Group and attracted interest from other laboratories within Aotearoa New Zealand, highlighting its potential for system-wide standardisation.

IMPLICATIONS FOR MANAGEMENT PRACTICE

The L-CAF initiative offers several theoretically significant lessons for health managers, demonstrating how established change management principles can be operationalised to achieve sustainable practice improvement. The success of the framework can be interpreted through the lens of Kotter's model for leading change, which emphasises the importance of creating a guiding coalition, generating short-term wins, and anchoring new approaches in the culture [7]. First, the co-design methodology proved essential not only for securing buy-in but also for actively "creating a guiding coalition" as per Kotter's model. Involving end-users in the development process transformed the framework from a top-down mandate into a shared solution. This participatory approach, rooted in organisational learning theory, valued staff expertise and directly addressed potential resistance by fostering a sense of ownership and collective responsibility for the change. It ensured the intervention was grounded in the reality of daily practice, moving beyond abstract policy to actionable, relevant processes.

Second, the management of implementation challenges, such as initial staff resistance and resource constraints, was informed by the need to "generate short-term wins" and build momentum. Resistance, often stemming from perceptions of added administrative burden, was mitigated through the champion model, a tactic that decentralises advocacy and support, and by demonstrating how the framework streamlined and gave greater meaning to existing assessment duties. The phased roll-out and pilot testing allowed for the celebration of early successes within departments, providing tangible proof of concept and building confidence in the new system. This approach aligns with change management theory, which posits that demonstrating quick, visible benefits is critical to overcoming scepticism and sustaining engagement during transitional periods.

Third, the strategic balance between standardisation and flexibility emerged as a critical success factor, reflecting a nuanced application of change principles. While the L-CAF provided a consistent, organisation-wide structure (the "what"), managers supported practitioners in selecting the most appropriate verification methods for their specific roles and contexts (the "how"). This balance prevented the rigidity of a one-size-fits-all model, which often provokes rejection, and instead promoted adaptive integration. This flexibility is key to embedding change within complex systems, as it allows a core innovation to be contextualised without losing its foundational principles.

Finally, the roles of leadership and technology underscore the multifaceted nature of anchoring change. Sustained endorsement from people leaders provided crucial legitimacy and maintained strategic alignment with national standards like the HPCAA. This leadership alignment ensured the initiative was perceived not as a fleeting project but as an integral component of professional practice and regulatory compliance. Concurrently, the planned digital integration into the MediaLab Compass module was treated as an enabler rather than a driver. For long-term sustainability and scalability, the framework is being systematically embedded into standard operating procedures, induction programmes, and performance dialogues. Its modular design, coupled with the documented co-design process and champion network, provides a clear blueprint for adaptation across other laboratory settings and allied health professions, offering a replicable model for building organisational capability through theoretically informed, participatory change management.

STRENGTHS AND LIMITATIONS:

The primary strengths of this management approach lie in its strong theoretical foundation (KASH model), its practitioner-

informed design, and its scalable, modular structure that aligns with national healthcare quality and equity goals. A key limitation is the current lack of long-term quantitative data on its impact on hard metrics such as error rates or staff retention, though these are planned for future evaluation. The initial investment of time and resources required for training and change management may also be a barrier for some organisations, though the long-term benefits in quality and safety are anticipated to outweigh these costs.

CONCLUSIONS

This case study demonstrates that the management of competency assessment is a strategic function, directly linked to patient safety, workforce capability, and service quality. The L-CAF initiative provides a validated and practical model for health managers seeking to modernise workforce development by shifting competency assurance from a compliance-driven activity to a developmental, growth-oriented process, underpinned by established change management theory. The key transferable lessons include the critical importance of staff engagement through co-design, which fostered ownership and sustainability; flexibility to accommodate departmental contexts while maintaining core principles; and strong leadership endorsement, which ensured alignment with regulatory frameworks and supported uptake. Digital integration further enhanced scalability, usability, and audit readiness.

The framework's success shows its potential as a transferable model for other laboratory services and allied health professions, both within New Zealand and across the Asia-Pacific region. By embedding multidimensional assessment into daily practice and aligning technical, cognitive, and behavioural competencies with patient safety and service quality, L-CAF offers a replicable pathway and benchmark for building a more resilient, capable, and high-performing healthcare workforce, ultimately contributing to more equitable and robust health systems.

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DECLARATION OF CONFLICTING INTERESTS:

The authors declare that there is no conflict of interest.

ETHICAL APPROVAL:

This case study involved the analysis of management practices within the L-CAF framework and did not include interventions with human participants or identifiable personal data. In accordance with institutional and national guidelines, ethical approval was not required for this study.

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EMBEDDING ENTERPRISE RISK MANAGEMENT IN AN ACADEMIC HEALTH SYSTEM: THE NATIONAL UNIVERSITY HEALTH SYSTEM CASE STUDY

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ABSTRACT

BACKGROUND:

Academic Health Systems (AHSs) operate in complex environments where clinical, academic, and research functions intersect, creating interdependent risks that conventional governance models cannot fully address. Enterprise Risk Management (ERM) provides a structured approach to navigating these risks, yet limited studies describe its implementation within AHSs.

APPROACH:

NUHS implemented the OneNUHS ERM Framework, built on two complementary pillars of system and culture. The system pillar focused on establishing governance structures, standardised risk assessment processes while the culture pillar emphasised cultivating a risk-awareness through leadership visibility, capability building, and sustained risk communication.

OUTCOMES:

NUHS maintained a stable enterprise risk profile alongside a steady improvement in audit outcomes, with increasing proportions of reports achieving "Satisfactory" and "Good" ratings. Engagement from the first line of defence strengthened over time, reflecting a shift from a "push" model of risk management to a "pull" mindset where operational teams actively sought risk insights. Insights generated through ERM activities also supported broader organisational improvements, including process optimisation.

IMPLICATIONS:

The NUHS experience demonstrates that effective and sustainable ERM requires deliberate alignment between systems and people. Health systems seeking to strengthen ERM should embed risk management as an organisational practice that supports both governance and enterprise value creation.

KEYWORDS

Enterprise risk management; academic health system; organisational culture; governance; risk awareness; health leadership

INTRODUCTION

Academic Health Systems (AHS) combine clinical service, education, and research within one organisational structure. This multi-mission structure advances healthcare quality and innovation but also exposes AHSs to diverse and unique risks beyond conventional hospital operations. Effective management of such complexity requires integrated governance that aligns risk awareness across clinical, academic, and administrative domains [1,2].

Enterprise risk management (ERM) has long been recognised as a cornerstone of organisational resilience. First conceptualised in the financial sector [3], its application to healthcare has grown steadily over the past two decades in managing cross-cutting risks such as patient safety, workforce sustainability, and cybersecurity [4–6]. Yet, few studies have demonstrated success in embedding risk awareness into everyday culture and decision-making.

In Singapore, the National University Health System (NUHS) functions as an integrated AHS with a network of tertiary and secondary care hospitals, national centers, polyclinics, community and home care services, and the National University of Singapore's health faculties [7]. In 2016, NUHS embarked on a journey to move beyond siloed, compliance-driven risk approaches to the OneNUHS ERM Framework, built on two reinforcing pillars: a robust governance system and a risk-aware culture.

This case study adds to the growing body of research on healthcare risk governance by illustrating how ERM can be operationalised within an Academic Health System. It offers practical insights into the interplay between system and culture, an area still underexplored in ERM literature.

THE CHALLENGE: MANAGING RISKS IN AN ACADEMIC HEALTH SYSTEM

As an AHS, NUHS operates in a complex risk landscape. Unlike a single-entity, service-centric hospital, an AHS must simultaneously balance patient safety, research productivity, and educational excellence. These missions' function under differing regulatory regimes, funding mechanisms, performance incentives, and professional cultures. Clinical services prioritise safety and operational continuity. Research entities accept a degree of uncertainty inherent in innovation. Academic faculties value intellectual autonomy and scholarly independence. The coexistence of these varied priorities introduces structural tension that requires deliberate alignment at the enterprise level.

In addition, risks within an AHS are highly interdependent. For example, a cybersecurity breach may compromise clinical operations and research data integrity. Research misconduct may erode public confidence in clinical programmes. Workforce burnout may undermine both patient care and academic teaching quality. Risks therefore do not remain confined within functional silos but can propagate rapidly across domains, amplifying reputational, operational, and regulatory consequences.

For NUHS, this complexity is further heightened by its role as a publicly funded healthcare cluster. As a steward of public resources, NUHS operates under ministerial oversight and public accountability. Decisions concerning resource allocation must balance innovation with fiscal prudence and equity of access. This public mandate elevates expectations of transparency, trust, and system-wide coherence.

Prior to 2016, NUHS institutions had developed their own risk processes tailored to local priorities. The absence of a formalised, cluster-wide framework limited visibility of enterprise-level risks and cross-institutional dependencies. Introducing a unified ERM approach therefore required careful navigation of institutional sovereignty.

Rather than replacing existing systems through a purely top-down directive, the OneNUHS ERM Framework was developed through a process of co-creation with the institutions. This approach enabled NUHS to establish a shared governance architecture, common risk language and risk culture aspirations, while respecting the operational realities of individual institutions.

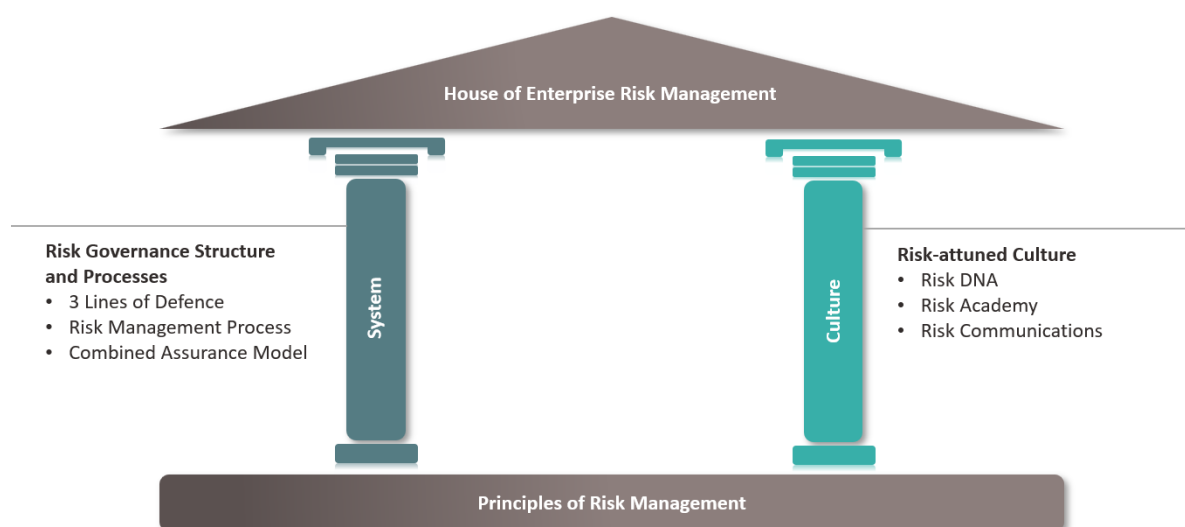
Importantly, while NUHS had established clinical risk governance structures including mechanisms for patient safety reporting and clinical quality oversight, they did not fully address enterprise-wide risks that extended beyond clinical domains, such as data protection and cybersecurity. Hence, the introduction of the OneNUHS ERM Framework served to complement existing risk management process at both institutional and cluster level, without the intention to overhaul or replace.

In this context, ERM was not merely a compliance exercise nor a mechanism for risk avoidance. It was conceived as a strategic enabler to protect value by strengthening internal controls, and to create value by optimising synergies across clinical, academic, and research domains. Embedding ERM within such a multifaceted and publicly accountable system required more than structural redesign. It demanded coordinated cultural and leadership transformation across the cluster.

BUILDING THE TWO PILLARS OF ERM

Effective risk management at NUHS rests on two interdependent pillars: System and Culture. The System represents the governance structures, processes, and accountabilities that form the organisation's risk management "hardware" [8]. In contrast, Culture embodies the shared norms and behaviours that determine how individuals recognise, discuss, and respond to risks [9]. This "heart-ware" element is essential for influencing attitudes and embedding risk management into everyday practice. Together, the 'hardware' and 'heartware' of risk management ensures alignment between processes and people.

FIGURE 1. THE NUHS HOUSE OF ERM COMPRISING TWO PILLARS: SYSTEM AND CULTURE



PILLAR 1: STRENGTHENING THE SYSTEM

Governance Structure

NUHS adopted the *Three Lines Model* [10] and adapted to NUHS' context to delineate clear roles and responsibilities across the organization at the various line of defence. The first line of defence (1LOD) comprises NUHS institutions and corporate office departments which are directly responsible for managing risks and controls within their respective operational areas.

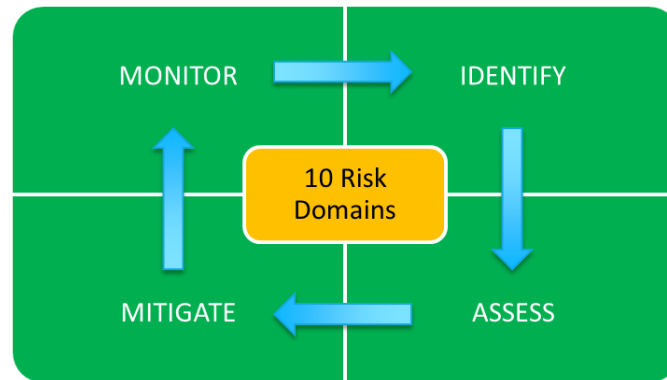
The second line of defence (2LOD) is fulfilled by the NUHS Group ERM Office which plays an advisory role to 1LOD. It provides analysis and reporting on the adequacy and effectiveness of risk management activities such as internal controls. The third line of defence (3LOD) consists of both internal and external auditors, providing objective assurance to the Board Audit and Risk Committee (ARC), which oversees governance, risk and audit matters independently.

Key to this structure is the Risk Management Steering Committee (RMSC), chaired by the NUHS Chief Executive. The RMSC ensures that risk issues raised across the cluster are escalated, discussed, and addressed at the highest level of leadership.

Risk Management Process

Aligned with ISO 31000:2018 – Risk Management: Guidelines [9], NUHS adopted a well-established and globally recognised framework that defines risk management as a structured, iterative process (Figure 2). As one of the most authoritative international standards, its adoption enabled NUHS to develop a shared language of risk, allowing risks to be surfaced and discussed systematically at RMSC.

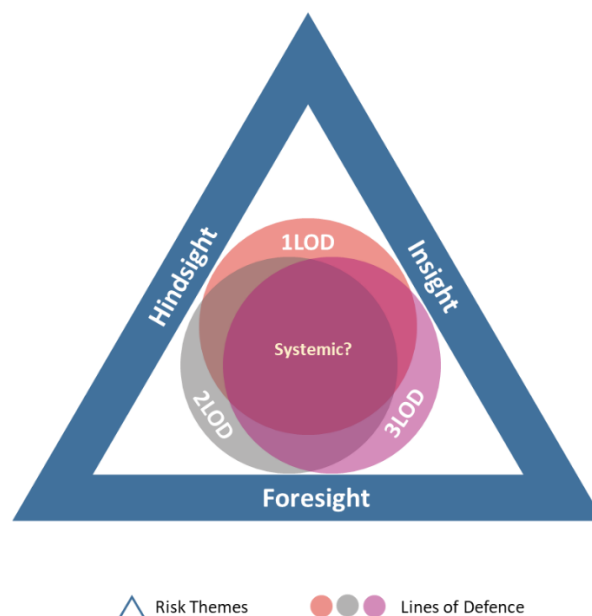
FIGURE 2. RISK MANAGEMENT PROCESS ALIGNED WITH ISO 31000:2018 – RISK MANAGEMENT: GUIDELINES.



Combined Assurance Model

NUHS also implemented a Combined Assurance Model to harmonize assurance activities across the Three Lines of Defence (Figure 3). Central to this is the use of Control Self-Assessments (CSAs), where managers and frontline staff collaboratively identify risks, evaluate the effectiveness of controls, and design processes to address any gaps. This participatory approach empowers staff, reinforces accountability, and heightens risk awareness at the operational level.

FIGURE 3. NUHS COMBINED ASSURANCE MODEL INTEGRATING THE THREE LINES OF DEFENCE



PILLAR 2: FOSTERING A CULTURE OF RISK AWARENESS

Recognising that systems alone do not guarantee effective governance, NUHS leadership deliberately positioned risk culture as a strategic priority. Visible leadership, particularly the Chief Executive's active chairing of the RMSC and direct risk communications by institution CEOs at various forums, signalled that risk transparency was expected and supported. Leadership messaging framed risk identification not as fault-finding, but as stewardship of patient trust and institutional integrity.

From this heart-ware perspective, risk management is more than a compliance exercise. It reflects collective attitude and everyday behaviors that guide decision [9]. To embed this mindset, NUHS introduced several initiatives designed to engage staff and foster a shared sense of responsibility for risk.

Risk DNA

NUHS launched the Risk DNA campaign, anchored by the tagline “See Something, Do Something.” Introduced during a NUHS Chief Executive’s Townhall session in April 2016, this simple and memorable phrase which encouraged employees to act when encountering risks.

Risk Academy

Risk Academy is a learning platform that offers training workshops that equip staff with foundational risk management knowledge and championed desired behaviors through real-life success stories.

Risk Communications

NUHS implemented ongoing risk communications to keep staff informed and vigilant. Relevant information, such as cybersecurity alerts, was regularly disseminated, reminding staff to report issues in line with the “See Something, Do Something” ethos.

RESULTS AND IMPACT

IMPROVED ENTERPRISE OVERSIGHT

The Key Risk Indicators (KRIs) developed through the standardised risk assessment process strengthened enterprise-level risk visibility and oversight across functional domains. With consistent monitoring and reporting to the RMSC, risk exposures could be tracked systematically at the cluster level rather than remaining confined within institutional silos. In recent reporting cycles, 80% of KRIs across domains in operations, human capital and legal recorded zero significant incidents, reflecting stable risk profiles and effective implementation of preventive controls.

Sustained improvements were also observed in assurance outcomes. Over a five-year period, the proportion of Audit Reports achieving a “Good” rating more than doubled compared to earlier years when reports were frequently assessed as “Need Strengthening”.

CULTURAL MATURITY

Beyond governance processes, OneNUHS ERM also contributed to a visible strengthening of risk awareness across the organisation. Capability building was an important component of this effort. More than 120 managers participated in Control Self-Assessment (CSA) workshops and risk training programmes, establishing a common understanding of risk concepts and control evaluation.

Over a five-year period, 21 CSAs comprising more than 450 validated responses were conducted across functional domains. These participatory exercises strengthened cross-functional dialogue, improved the quality of risk information, and fostered shared accountability for control gaps across institutions.

Cultural maturity was also reflected in staff responsiveness to emerging digital risks. In a sector-wide simulated phishing email exercise, NUHS achieved a 95% passing rate, indicating strong awareness and vigilance among employees in identifying and responding to potential cybersecurity threats.

ENTERPRISE VALUE CREATION

As ERM processes matured, NUHS observed a shift in mindset from “push” to “pull” [13]. Rather than risk management being driven solely by the risk function, organisational stakeholders increasingly sought risk insights because they recognised their operational value. This shift represents one of the most significant outcomes of the OneNUHS ERM

implementation, reflecting a transition from focusing on the robustness of risk processes to recognising the broader value that risk management can create for the organisation.

This shift in mindset was demonstrated in the increasing engagement initiated by the first line of defence (1LOD), where operational teams proactively sought to strengthen internal controls and address emerging risks. As a result, the Compliance Review enabled by Data Analytics (CReDA), a process excellence initiative, emerged as a spin-off from risk management activities. CReDA developed automation tools to streamline previously manual and labour-intensive processes. These tools enabled the first line of defence to take greater ownership of operational risk management while improving process efficiency and control effectiveness.

CReDA solutions have since been applied across multiple operational areas, including facilities management, hospitality services, and portering functions across all three NUHS acute hospitals.

LESSONS LEARNT AND CONCLUSION

The NUHS experience offers several lessons for healthcare leaders seeking to embed enterprise risk management within complex health systems. First, it demonstrates that structured processes alone are insufficient unless supported by an enabling culture. Similarly, culture cannot flourish without clear systems to guide good behaviours.

Second, leadership visibility matters. The decision for the NUHS Chief Executive to personally chair the RMSC signalled that risk management was a strategic priority rather than an administrative exercise. This legitimised risk discussions and empowered frontline managers to surface issues without hesitation.

Thirdly, simplicity proved essential in driving adoption. The concise and memorable slogan "See Something, Do Something" resonated more deeply with staff than complex manuals or frameworks. Equally important was capability building, which ensured that staff possessed the competencies and confidence to participate meaningfully in risk activities.

Together, these lessons underscore the importance of aligning systems, people and purpose to embed risk management as a lived practice rather than a procedural requirement. More broadly, the NUHS experience illustrates how ERM can evolve from a compliance-oriented function into a strategic capability within an AHS. While NUHS operates within the distinctive environment of an AHS, the underlying principles demonstrated in this case may be relevant to any other healthcare organisation navigating similar complex operating environment.

As healthcare systems continue to face increasing technological disruption, regulatory complexity and evolving public expectations, effective ERM with the ability to identify and respond to emerging risks will remain essential to support resilient and adaptive healthcare organisations [13].

AUTHORSHIP

All authors have made substantial contributions to the conception, design, and execution of this work, including the analysis and interpretation of information presented in the manuscript. All listed authors have reviewed and approved the final version of the paper and agree to its submission to the Asia Pacific Journal of Health Management. Authorship criteria were applied in accordance with the guidelines of the International Committee of Medical Journal Editors (ICMJE).

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The authors used OpenAI's ChatGPT (GPT-5, 2025 version) to support language refinement and citation formatting during manuscript preparation. The authors reviewed and verified all generated content for accuracy, originality and adherence to the journal's guidelines. The final manuscript reflects the authors' own analysis and interpretation.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest that could have influenced the content or conclusions of this manuscript.

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ADDING VALUE TO THE RECRUITMENT OF SENIOR HEALTH SERVICE MANAGERS: A VALUES-BASED RECRUITMENT TOOL

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ABSTRACT

OBJECTIVE:

'Values' of Health Service Managers (HSMs) can be identified by a central organising concept of leadership, which is underpinned by emotional intelligence. Values, whether conscious or not, serve as guiding principles that shape and influence behaviour. Utilising Values-Based Recruitment (VBR) increases the likelihood of hiring the right HSM with values that align with their organisation's values. This paper reports on the development of a 360 Degree Values-Based Reference Tool (360 VBRT).

DESIGN:

A Participatory Action Research (PAR) methodology was adopted to iteratively develop a deep understanding of the values held by HSMs, identify ways to assess values and develop solutions to enhance recruitment processes. This study has taken a pragmatic approach, building on previous work that recommended organisations should adopt a values-based recruitment framework, which includes values-based assessment tools. Reflexive Thematic Analysis (RTA) was used as an inductive approach to identify and interpret patterns within the data. Building on the foundation constructed in previous research, this study sought to develop and enhance the 360 VBRT.

RESULTS:

By integrating insights from multiple referees, the 360 VBRT offers a comprehensive understanding of the applicant's values. This strengthens the recruitment process and improves the likelihood of selecting the most suitable HSM. Identifying candidates whose values align with an organisation's values, alongside skills, knowledge and experience, supports recruiting the right person to the right role.

CONCLUSION:

This study demonstrates that inclusion of the 360 VBRT has potential to enhance recruitment by increasing the likelihood of appointing a HSM whose values align with their organisation's values. This study highlights the need to identify values of HSMs during recruitment to enhance recruitment suitability. Employees whose values align with an organisation are more likely to be motivated, authentically lead teams, contribute to enhanced service performance, deliver high-quality care, which improves outcomes for consumers.

KEYWORDS

Values; health service manager; values-based recruitment; reference checking; leadership; participatory action research.

INTRODUCTION

Recruiting a Health Service Manager (HSM) whose values align with the organisational values – in addition to their skills, knowledge, and experience – supports strong leadership, a positive workplace culture and enhances provision of high-quality healthcare. An investigation into failings of the Mid Staffordshire NHS Trust was instrumental in the development of Values-Based Recruitment (VBR). The inquiry, led by Robert Francis QC, was conducted as there were concerns regarding the mortality rate and number of complaints compared to other NHS Trusts. The Francis report [1], identified widespread issues including systematic failures in management, poor leadership and a negative culture tolerant of poor standards of care, which ultimately led to significant harm to health service consumers. There were many recommendations from the report including putting consumers first, improving healthcare standards and workplace behaviour, developing a common culture with shared values, and recruiting a workforce whose values are congruent with the organisational values.

Values-Based Recruitment (VBR) is a flexible approach to recruitment that enables diverse methods of assessment with a focus on identifying applicants whose values align with their organisation. The aim of VBR is to recruit a workforce that fosters compassionate, person-centred care and ethical practice [2]. The literature [3] suggests that VBR has benefits that include reducing recruitment costs as a result of lowering staff turnover, increasing staff morale, job satisfaction, and improving workplace culture. A values-aligned workforce enhances organisational effectiveness whilst also contributing to positive outcomes for staff, consumers and the broader community [4]. By aligning management with service values, organisations are better positioned to foster a positive culture and psychological safety, ultimately improving healthcare service delivery and quality of care [5,6]. As such, this research contributes to the body of knowledge on HSM recruitment and enhances the VBR framework with the addition of the 360 Values-Based Reference Tool (360 VBRT) that was developed as part of this study.

A previous in-depth discussion of the first two Participatory Action Research (PAR) cycles of this study [7] provides background to this paper. Data analysis from PAR cycles one and two found that values of senior HSMs were identified by a central organising concept of leadership which is underpinned by emotional intelligence. Emotional intelligence has been described as the ability to perceive, understand, manage and regulate your own emotions, ultimately guiding thinking and behaviour (8). Within the concept of leadership, the study found that HSMs embody a range of values that promote effective, person-centred ethical leadership. These values included honesty, authenticity, compassion, kindness, integrity, curiosity, courage, trustworthiness, hope and optimism.

This paper reports on the third and fourth PAR cycles including development of the 360 VBRT. PAR cycle three explored the values-based reference tool, its content and usability. PAR cycle four invited research participants to trial the tool, using a fictional person of their choosing, to assess how well the reference tool worked.

METHODOLOGY

This study adopted a PAR methodology which is an iterative process that facilitates ongoing feedback by actively involving the same participant group through a series of action cycles comprised of plan, act, observe and reflect [9]. PAR builds knowledge iteratively through successive cycles, it is a dynamic and progressive process of co-constructing knowledge to inform action [10]. Each PAR cycle was grounded in the participants' practical wisdom and supported through iterative member checking to validate themes at each focus group. Consistent with the work of Lindhult [11], this adaptive methodology provided reliability as a dynamically regulated process which facilitated consensus, guided progression through each PAR cycle, acknowledged the subjective and active role of researchers and ensured findings were representative of the participants' voice.

Reflexive Thematic Analysis (RTA) developed by Braun and Clarke [12], was used to identify and interpret patterns within the data. Analysis included constant comparison of data, systematic coding and iterative theme refinement to maintain

internal consistency and reliability. Initial codes were generated, themes were identified and represented by central organising concepts which were presented as thematic diagrams to facilitate discussion and gain consensus. Regular review by the three-member research team strengthened reliability and the co-construction of knowledge. This inductive method of data analysis provided a systematic and reflexive approach to identify items of interest and refine analysis. RTA enabled a systematic and reflexive approach, strengthening reliability through transparent analytic processes and acknowledging researcher subjectivity. Ongoing researcher reflexivity, supported through a research diary and thematic diagrams, enhanced credibility and analytic rigour by validating interpretations to ensure they were representative of the participants voice. RTA considers the researchers' role in knowledge production at the core of this approach as it is collaborative and reflexive, enabling a richer, more nuanced understanding of the data [13].

Leading on from the Gregory et al. [7] study, a 360 VBRT was co-designed to support identification of candidate values as part of recruitment. By integrating perspectives of multiple referees, the 360 VBRT provides a rich and robust understanding of applicants, strengthening recruitment and reducing potential bias.

PAR cycle three focus groups reviewed the 360 VBRT. This interactive process provided rich data that enabled further refinement to the reference tool. PAR cycle four trialled and evaluated the revised 360 VBRT to assess its content, function and usability. The evaluation survey sought information that enabled further enhancement and finalisation of the 360 VBRT.

PARTICIPANTS

The participant cohort comprised a total of 18 (n=18) senior HSMs from diverse professional backgrounds and health settings across Tasmania (Australia), which encompassed metropolitan, rural, and remote areas. Importantly, the cohort were knowledgeable and experienced in recruitment. The diversity of the participant group provided both breadth and depth of collective wisdom which strengthened the co-designed values-based reference tool. See Figure 1 for number of participants by profession, Figure 2 for region of management and Table 1 for participant area of health speciality.

FIGURE 1: NUMBER OF PARTICIPANTS BY PROFESSION

Profession	Number	Profession	Number
Registered Nurse	5	Psychologist	1
Administration	3	Social Worker	1
Medical Practitioner	2	Scientist	1
Physiotherapist	2	Occupational Therapist	1
Health Consumer	1	Specialist Therapist	1

FIGURE 2: REGION OF MANAGEMENT.

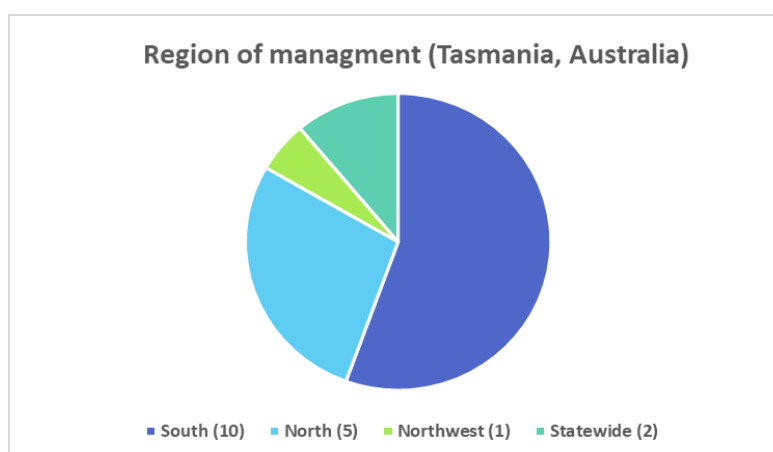


TABLE 1: PARTICIPANT AREA OF HEALTH SPECIALTY

Participant area of health speciality		
Mental health (n=3)	Critical care (n=1)	Child and parenting health (n=1)
Primary health (n=1)	Radiology (n=1)	Pathology (n=1)
Medical administration (n=1)	Education (n=2)	Recruitment / HR (n=2)
Health reform (n=1)	Clinical regulation (n=1)	Quality and safety (n=1)
Consumer (n=1)	Healthcare supplies (n=1)	

In total, 18 participants engaged in cycles one, two, three and four. Due to other commitments, not every participant joined every cycle. There were two focus groups per cycle, with an average of nine participants per group in the first three PAR cycles and ten in PAR cycle four. The stages for PAR cycles three and four were between August 2023 and May 2025.

ETHICS APPROVAL

Ethics approval was obtained from the University of Tasmania, Human Research Ethics Committee (ID: 26793) and the Tasmanian Department of Health, Research Governance Office.

RESULTS

PAR CYCLE THREE

The 360 VBRT seeks three different professional references that have direct knowledge of the applicant: a subordinate, peer and manager. Additionally, the applicant completes the 360 VBRT as a self-assessment. The insights from all four people aims to provide a holistic view of the applicant's skills, knowledge, experience and values. The 360 VBRT was trialled by research participants in this cycle and evolved as the study progressed. Participant responses were thematically analysed to inform and strengthen the subsequent refinement and next iteration of the 360 VBRT. The responses from PAR cycle three are summarised in Table 2.

TABLE 2: SUMMARY OF PAR CYCLE THREE FEEDBACK ON THE 360 VBRT

Summary of PAR cycle three feedback on the 360 VBRT	
Theme	Sample of participants' responses
Usability and usefulness	- Participant R '... really like the ability to select performance on a scale as opposed to lots of free text.' - Participant J 'I really like the tool ... I can see how you can adjust this and take it back to whole of agency values.' - Participant E 'it's effective ... it doesn't require me to sit and think of words ... I decide and tick a box ... it might look like there's a volume, like in terms of size it might look big, but in terms of just ripping through it, it wouldn't be too bad at all.' - Participant B 'getting overwhelmed by the number of check boxes ... opportunity to consolidate the volume of values.' - Participant S 'I think the cohort is gonna be really motivated ... they've said yes to being a referee.' - Participant H 'good to have a place to add some comments that are text based, there might be something that the referee wants to comment on that isn't covered'
Appropriate content	Participant R 'good representation across the qualities you'd want to see in a leadership position.'

	- Participant B 'it covers all bases ... loved the question (would you be happy to work with this applicant again? If no, why not?) ... yes or no gives you a lot.' - Participant S 'to validate ... you need the duplicate questions ... repeat questions gives you a kind of nicer, richer response and you see where the outliers are'
Clear and simple language	- Participant F 'wording may be too subjective (uses appropriate humour)' - Participant B '... should be objectified a little more ... concepts may not be understood by people ... without understanding what it's made up of.' - Participant L 'I don't understand what ... trauma informed manner means (don't use concepts)'
Collating references from different cohorts	- Participant K 'I would look at where the referee report was coming from and take that into account ... I may weigh more from one referee than another ... it would depend on the position that you're recruiting to.' - Participant F 'four of these from different individuals trying to marry them up and interpret them against each other ... who would you weigh more ... and what if there is a marginal discrepancy ... (follow up in second interview ... which is not unusual when recruiting higher level managers)' - Participant B 'self-rating, potentially being a red flag or offering further insights into someone's lack of insight or self-critical nature ... we like the concept of self-reference report'

Data analysis and synthesis enhanced the 360 VBRT, this enabled consolidating similar statements to reduce repetition and improve user experience. Simple, clear, and concise language was used, any reference to concepts were removed. Participants were invited to trial the revised 360 VBRT in PAR cycle four. Table 3 provides a sample from the 360 VBRT trialled in PAR cycle four.

TABLE 3: SUMMARY SAMPLE OF THE 360 VBRT

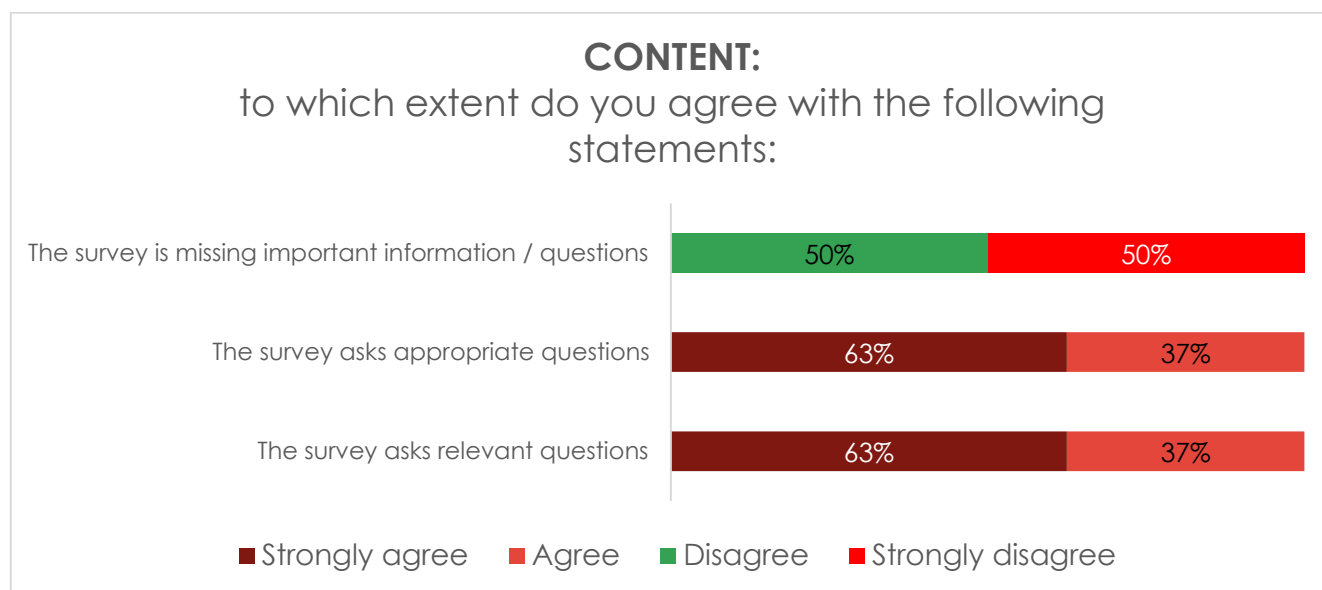
360 VBRT – sample					
General applicant and referee information ...					
Values-Based Reference:					
From your experience and to the best of your knowledge, please rate how often the applicant demonstrates the following:					
Personal: Item (15 in total)	Always	Usually	Rarely	Never	Unknown
Excellent interpersonal skills and ability to connect well with others					
Team: Item (12 in total)	Always	Usually	Rarely	Never	Unknown
Is a positive role model that leads by example					
Strategic: Item (12 in total)	Always	Usually	Rarely	Never	Unknown
Implements meaningful change and deals with uncertainty					
Broad questions and general comments ...					

PAR CYCLE FOUR

The fourth cycle focused on assessing the effectiveness of the 360 VBRT. An anonymous link was sent to participants; the tool was completed 13 times as there was an option to repeat it. Participants were invited to trial the tool using a fictional person of their choosing. For ethical reasons, researchers decided that participants should not use details of any real person, as this study is researching the usability of the tool. A second anonymous survey was sent to participants, inviting them to complete the 360 VBRT – process evaluation. Ten of the original 18 participants remained in PAR cycle four, eight were no longer contactable.

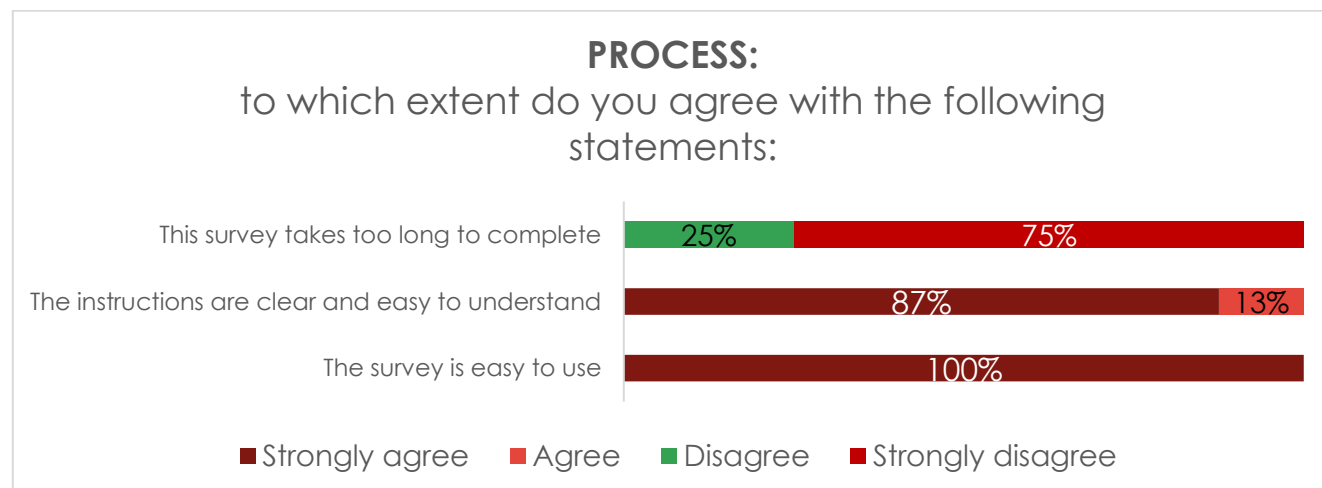
After participants trialled the 360 VBRT, PAR cycle four focused on exploring four domains of evaluation including content, process, sustainability, and outcome. The 'process evaluation' survey was completed eight times, an 80% response rate. Figures 3 – 6 present the results of the survey by domain.

FIGURE 3: 360 VBRT PROCESS EVALUATION: CONTENT



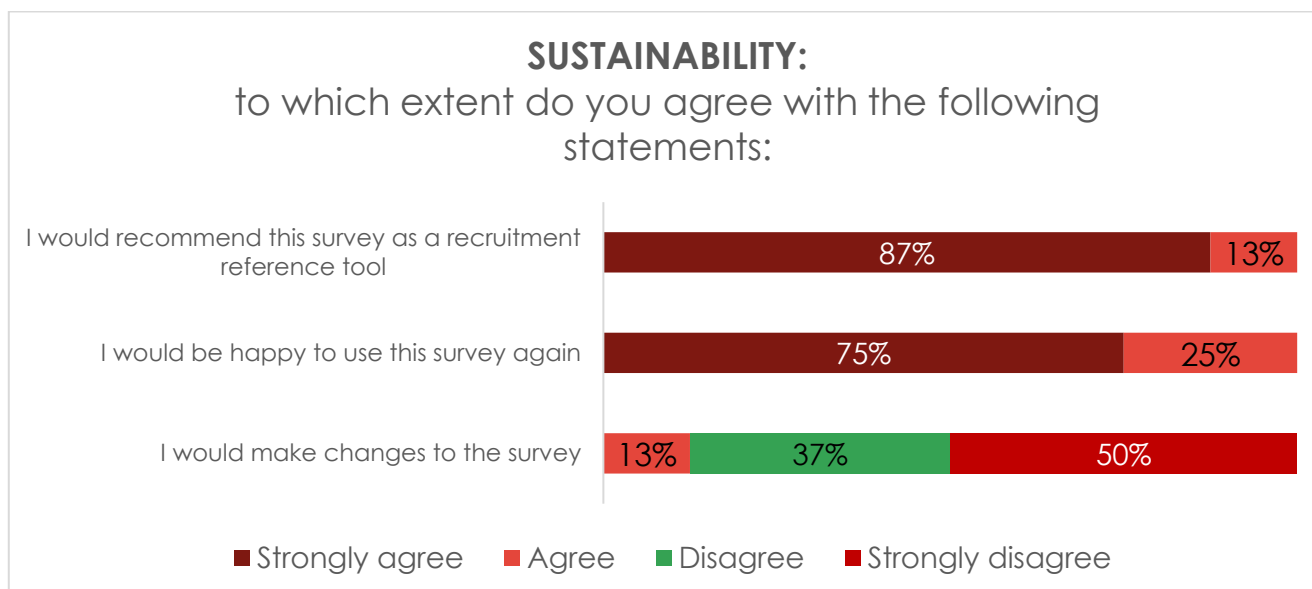
All respondents agreed that content of the 360 VBRT asked relevant and appropriate questions, with 63% strongly agreeing. Respondents found the 360 VBRT 'had appropriate and relevant questions' 'that could be easily adapted as needed, to fit with organisations, but are good as is'. All respondents disagreed there was essential information missing, no changes were proposed.

FIGURE 4: 360 VBRT PROCESS EVALUATION: PROCESS



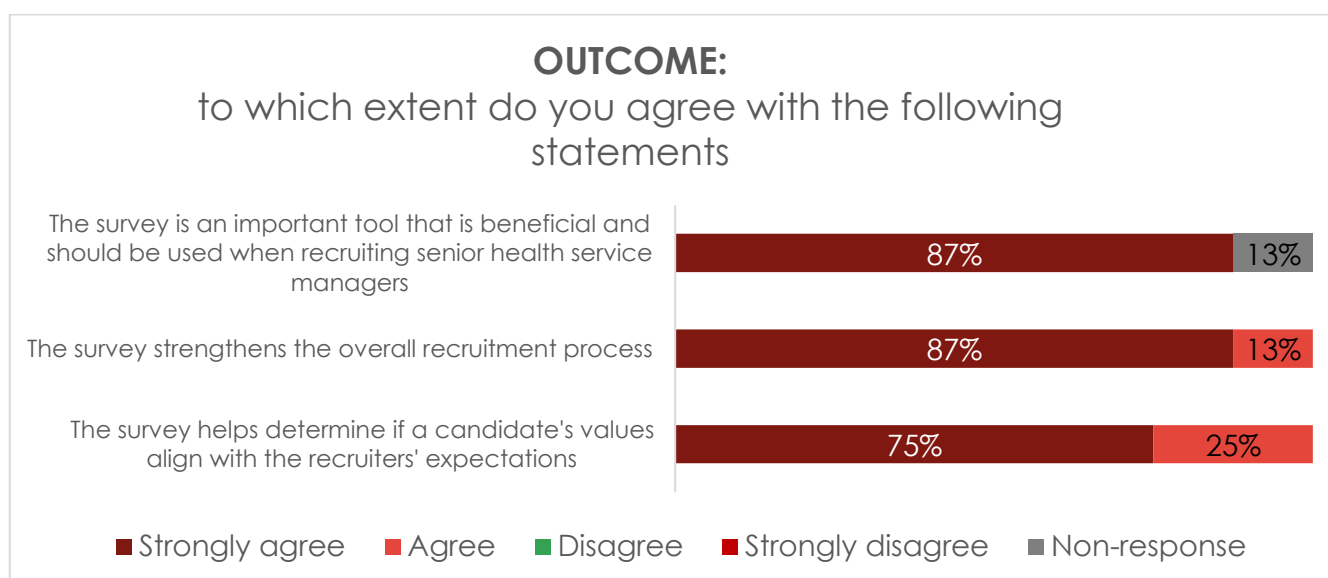
Most respondents described the 360 VBRT as 'easy to use and time efficient'. During PAR cycle three, a small number (n=3) of participants commented on the number of items in the survey and were concerned the tool might take too long to complete. Therefore, the number of items were consolidated and reduced. The process evaluation survey found that all respondents disagreed the tool took too long to complete, with 75% strongly disagreeing. On average, it took respondents 7.5 minutes to complete the 360 VBRT when one outlier was removed (they took just under 28 minutes). Overall, 100% of respondents agreed the 360 VBRT was easy to use.

FIGURE 5: 360 VBRT PROCESS EVALUATION: SUSTAINABILITY



Respondents strongly agreed they would recommend the 360 VBRT and be happy to use it again. 87% of respondents indicated they would not make any changes to the tool. However, one respondent commented that 'it was easy to complete the survey with an excellent candidate ... but some blind areas [should be] captured in the survey ... I had to write about them.' The 360 VBRT provides a combination of free text and Likert scales.

FIGURE 6: 360 VBRT PROCESS EVALUATION: OUTCOME



Respondents commented that the 360 VBRT will 'help identify the human area in addition to practical things' and is 'extremely helpful in aligning applicants with organisational values'. Most respondents (87%) strongly agreed the 360 VBRT strengthens a recruitment process, with 13% providing no response to this question. No respondents reported any issues with accessing the tool and no specific improvements were suggested.

The 360 VBRT process evaluation survey combined Likert scales and free text responses to measure participant agreement and analyse response patterns to reflect inter-rater consistency. Findings demonstrated strong and consistent agreement among participants, further validating the reliability and robustness of the 360 VBRT.

DISCUSSION

This study explored values of HSMs and how they could be identified during recruitment, which resulted in the development of a values-based reference tool. This study has shown that identifying values are key to understanding how HSMs make decisions, interact with others, and respond to challenges. Hence, identifying values will help predict future performance and assist in hiring decisions, as it is essential to employing the right person with values that align with their organisation. This is consistent with Herkes et al [14] who found that similar values between individuals and their workplace has the potential to positively impact organisational outcomes and improve care to health service consumers. Identifying values such as compassion are essential as they are key to quality healthcare, consumer satisfaction and improved clinical outcomes [15]; compassion also influences how challenges and complex situations [16] are navigated.

Based on results of the first two PAR cycles of this study, a 360 Degree Values-Based Reference Tool (360 VBRT) was developed. PAR cycle three enabled participants to interact with the tool during focus groups. This led to further improvements including combining some value statements to reduce repetition and simplify language. This cycle has demonstrated that the participants reflections could be applied in the fine-tuning phase of the cycle, allowing for continuous improvement of the 360 VBRT [17], demonstrating the strength of PAR in the development of the tool. PAR cycle four invited participants to trial the 360 VBRT. Results indicate it had appropriate and relevant questions, was easy to use and would be beneficial for recruitment. The findings suggested that the 360 VBRT could determine whether a candidate's values align with the organisational values, therefore demonstrating the potential for a strong addition to recruitment [18]. This is in line with the view of Vincent [19] that 360 degree reference checks are vital to evaluate an applicant and that it is a necessary step to ensure the right candidate is employed. Moreover, reference checks have potential to serve as reliable and valid predictors of future job performance. With an appropriate tool, references can provide third-party insights into critical aspects of candidate values and behaviour [20].

Inclusion of self-assessment was important as it provides further opportunity to gain deeper insights into the applicant's values. Highly successful HSMs are often aware of their own values and how they align with their organisation's; their values are motivators for behaviour, whether conscious or not [21]. Another important function of the 360 VBRT, is that it provides an opportunity to identify whether the candidate exhibits behavioural consistency across interactions with individuals of varying roles and statuses. The 360 VBRT was developed with the view to obtain values-based insights, including how consistently the candidate upheld their values when interacting with others, regardless of position or status. This is important, as HSMs who treat people fairly and consistently, regardless of rank, tend to enhance staff engagement, improve job satisfaction, create psychological safety and promote shared meaning at work [22,23].

The 360 VBRT makes a point of difference compared to a traditional reference, as it seeks broad perspectives, integrates diverse viewpoints, and has a values focus. In addition, traditional references tend to be unreliable, biased or ineffective and are unsuitable for VBR [18]. Multiple perspectives strengthen the credibility of feedback and provide a more comprehensive and balanced method of reference checking. Given the risk of referee bias, the structured 360 VBRT offers an important mitigation strategy by directing referees to focus on and rank observable behaviours rather than provide general impressions, thereby enabling meaningful comparison across referee responses. Additionally, triangulating reference data with information from other stages of the recruitment process – such as interviews, applications and resumes – supports a more holistic assessment of the candidate. Intentionally comparing all references helps minimise reliance on any single, potentially bias referee. The study found that obtaining references from a variety of sources enables recruiters to consider diverse perspectives, identify behavioural consistency and make informed decisions about an applicant's values alignment with the organisation, beyond their skills and experience.

Multiple references from various sources – including peers, subordinates, and managers – are fundamental to evaluating whether candidate's values consistently align with the organisation. The tool uses simple language and is organised into three domains that identify personal, team and strategic values. Integrating a triad of 'value' domains supports recruiters to assess whether there is alignment between the individual and organisation [24,]. Findings suggest that collectively, the

triad of value domains offers a robust perspective of applicants, as personal, team and strategic values are identified and considered through insights from diverse professional perspectives.

VBR supports recruiting those whose values align with the organisation [25], the 360 VBRT strengthens this process. The findings indicate that personal and organisational values alignment supports a positive workplace culture with shared purpose, meaning and ways of working. Recruiting a value aligned workforce increases the likelihood of delivering better-quality services that are person-centred, compassionate and ethical. Additionally, people are more likely to stay with an organisation when their values are congruent with their workplace; this reduces turnover, creates stability, improves reputation, enhances trust and supports positive consumer outcomes [26]. The findings suggest that incorporating values into recruitment strengthens the selection process and improves the likelihood of appointing an individual who is capable and whose values align with their organisation.

STRENGTHS OF THIS RESEARCH

Having the same participant cohort over the entire project facilitated sustained collaboration and enhanced co-design of the 360 VBRT. This process was inclusive of diverse opinions and represented the participants collective wisdom. Participants were HSMs involved in recruitment, came from diverse professional backgrounds and health settings across major regions of Tasmania, Australia. There was strong emphasis on the participant voice whilst also maintaining anonymity given people are easily identified in a small community.

The 360 VBRT is a strong addition to VBR and supports the recruitment of HSMs whose values align with their organisation. This is important as a value-aligned workforce can foster a positive culture, enhance engagement, performance and retention which all contributes to improved quality of care and consumer outcomes.

This study contributes to the literature on VBR which emerged after the Francis Report [1]. It appears that there are fewer studies on VBR since 2019, yet recruiting the right people with the right skills and values remains important, this study contributes to the existing body of knowledge. Furthermore, the co-designed 360 VBRT offers a focused and meaningful method for identifying the values of candidates which enables a deeper understanding of the applicant beyond their skills and knowledge.

LIMITATIONS

Study limitations include the narrow scope of participants in terms of location, role and sample size. A greater diversity of participants may provide a broader understanding of the topic being studied. Due to unavoidable events, the time over which the research was undertaken extended. 18 participants in total collectively participated in the study, 55% were unable to participate in all four cycles.

FUTURE RESEARCH

The 360 VBRT is ready to trial in a recruitment campaign and therefore further research could explore efficacy of the tool, performance, retention and other outcomes of those employed using the 360 VBRT as part of their recruitment process. In this study, the participant cohort was limited to senior managers in Tasmania, Australia. Future research could expand the scope by engaging alternative cohorts – such as consumers, frontline clinicians, clinical managers and HSMs from other states or countries – to explore how the 360 VBRT functions across diverse professional, organisational and cultural contexts. Furthermore, the 360 VBRT could be trialled beyond the healthcare sector.

To express an interest in accessing the tool, please contact the corresponding author.

CONCLUSIONS

PAR cycles three and four of this study led to finalising the 360 VBRT. This tool enables recruiters to identify a candidate's values from the insights of diverse professionals (subordinate, peer, and manager). Diverse perspectives support better hiring decisions, as identifying values provide deeper insights beyond just exploring skills and experience. Employees whose

values align with their organisation's values are more likely to be motivated, authentic, contribute to enhanced service performance, and deliver high-quality care that enhances consumer outcomes. The inclusion of the 360 VBRT enhances recruitment by increasing the likelihood of recruiting a HSM who has values congruent with their organisation. Fundamentally, having the right values-aligned HSM can foster a positive workplace culture where staff feel valued, supported and motivated, which ultimately leads to improved outcomes for consumers and the organisation. The 360 VBRT offers a structured and rigorous method of exploring values to inform decision-making during recruitment and is a strong addition to VBR.

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STAFF ENGAGEMENT IN MALE, FEMALE AND NON-BINARY DOCTORS WORKING IN NON-PROFIT AUSTRALIAN HOSPITALS

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ABSTRACT

Given the importance of equal opportunity for all staff, this study will assist employers and policy makers better understand issues pertaining to engagement differences experienced by male, female and non-binary medical staff working in non-profit Australian hospitals by sex.

A survey was emailed to all medical staff working at two public hospitals and five private hospitals in three states, seeking responses to 30 pre-determined items. The survey used a valid and reliable instrument which provided an overall index of medical engagement, against which male, female and non-binary respondents relative engagement is ranked highest to lowest.

The results indicate that overall, male doctors (N=659) are more engaged than their female colleagues. Female doctors (N=316) working at the seven sites are less empowered and valued when compared to their male counterparts. The data also indicate that females feel the work culture is less collaborative than it is for males. This is particularly evident when comparing the results to the Australian (AU) norms. Non-binary doctors were significantly more disengaged compared to male and female colleagues. The results vary when compared by site, sex, jurisdiction, and sector.

The profile of medical engagement varies at the sites, and by sex. Differences appear to be related to how valued and empowered doctors feel and whether they are encouraged to develop their skills to progress their careers. Activity aimed at female and non-binary staff are required to address the lower levels of engagement than their male counterparts, particularly for non-binary staff.

KEYWORDS

Medical Leadership, engagement, health policy, clinical, sex, non-binary

INTRODUCTION

It is increasingly recognised that improvement in healthcare needs the positive involvement and engagement of doctors who are willing and able to adopt roles that make them highly influential in planning and delivering service change [1–3]. Highly engaged staff are more likely to bring their heart and soul to work, to take the initiative, and ‘go the extra mile’ and to collaborate effectively with others [4].

Virtually all health organisations have medical leaders in positions such as medical and clinical directors or service leads, but manifestly organisations differ in their level of performance [5]. The logic, therefore, suggests that some medical leaders are contributing to successful organisations in a way that others are not. It has been documented that the mechanism by which medical leadership influences organisational performance is via creating positive, supportive cultures in which individuals can flourish [6-7]. This has been called medical engagement and includes: the active and positive contribution of doctors within their normal working roles, to maintaining and enhancing the performance of the organisation, which itself recognises this commitment in supporting and encouraging high quality care [8].

In Australia (AU), a recent study has shown that medical engagement is a multi-factorial phenomenon which spans the relevant multiple professional sub-cultures, and which is influenced by many interrelated factors, within the organisational context [9]. Despite reports highlighting the need for greater medical engagement [10,2], and the benefits of medical engagement being widely understood [5], there is currently no information on the status of medical staff engagement in male, female and non-binary doctors working in non-profit AU hospitals.

The authors acknowledge the vital importance of language used to describe sex. For example, we identified research into ‘gender’, that went onto to describe the participants by their sex. Table 1 describes the terms used by the World Health Organisation and used in this article. This study focussed on the individual and organisational characteristics that influence employee engagement of male, female and non-binary doctors working in two public and five private hospitals operated by the same health care provider.

TABLE 1 DEFINITIONS AND TERMINOLOGY

Sex	Either of the two main categories (male and female) into which humans and most other living things are divided on the basis of their reproductive functions.
Gender	Refers to a person's innate, deeply felt internal and individual experience of gender, which may or may not correspond to the person's physiology or designated sex at birth
Transgender	Transgender' is an umbrella term for people whose gender identity and expression does not conform to the norms and expectations traditionally associated with the sex assigned to them at birth; it includes people who are transsexual, transgender or otherwise gender non-conforming
Non-binary	Does not identify with the two main categories (male or female) into which humans are divided on the basis of their reproductive functions.

Source: Adapted from World Health Organisation WHO, 2006, 2016, 2024

BACKGROUND

The term engagement initially emerged in the management literature when Kahn wrote about ‘personal engagement’ with one’s work which he characterised as emotional, cognitive, and physical [7]. Kahn’s theory was later expanded on to describe engagement as a multi-dimensional psychological state experienced by the individual in relation to their work. The most widely adopted measure of this is the Utrecht Work Engagement Scale, which evaluates work related vigour, dedication, and absorption [20].

There is now also a substantial base of research and literature about the need for engagement in the healthcare field. Much of the early commentary tends to pinpoint the need for such behaviour and describe how when clinicians are not engaged, things can go tragically wrong [21,22]. More recent material has described activity to either impede or enhance engagement - barriers including poorly defined career pathways, lack of expertise and time to be involved, or enablers such as shared values, developing professional cultures, inter-disciplinary collaboration and involving service users [4,10,23].

The benefits of doctors engaging with a broader organisational perspective with respect to their clinical responsibilities and accountability are of sufficient magnitude to warrant the investment of time, effort, and resources. To the doctor these include improved job satisfaction and a reduced risk of burnout. To the health service organisation benefits include lower patient mortality rates, fewer serious clinical and workplace incidents, achievement of service targets, improved financial management, and reduced staff absenteeism and turnover [24]. Patients benefit from higher quality care and a better experience [24].

It is the contention of Spurgeon and Clark [5] that while cultures that promote employee satisfaction and commitment are necessary, the ability for medical staff to collaborate with colleagues is an essential factor in understanding medical engagement [3]. The concept of engagement is seen as a significant component of all successful organisations across a range of sectors [25,26]. Spurgeon et al [24] describe the continued evidence of the positive relationship between the assessed levels of medical engagement and independently assessed organisational performance. Because of these benefits, hospital managers, funders, and makers of policy around the world have been developing a range of mechanisms, organisational and institutional, to encourage, develop and support doctors to be more engaged [24].

A recent study of medical staff engagement at non-profit hospitals in AU did find that doctors working at the hospitals feel engaged and are making a positive contribution to the organisation, which recognises their contribution [9]. The study concluded that medical engagement spans the multiple professional sub-cultures, and is influenced by many interrelated factors, within the organisational context [9]. There is a paucity of research into medical staff engagement by sex. One Danish study found female general practitioners (GPs) had higher medical engagement than their male colleagues [27]. Recent studies in the United States of America (USA) have shown inequity between sexes in a variety of medical contexts [14,13,28–31].

METHODOLOGY

A questionnaire was emailed to all medical staff, estimated to be 3000, working at two public hospitals and five private hospitals in three states involved in the study – see Table 2. The survey instrument, the Medical Engagement Scale (MES), has already been used in AU, New Zealand, Europe, Scandinavia, and the UK [8,24]. Ethics approval was granted for the study and no identifiable data was collected.

The MES is a valid and reliable instrument which provides an overall index of medical engagement. The MES survey was developed with a very large sample of NHS staff (over 20,000) and has good reliability (0.7 to 0.93) [24]. The MES instrument has a hierarchical structure and provides an overall index of medical engagement together with an engagement score on three reliable meta-scales (Working in a Collaborative Culture; Having Purpose and Direction; and Feeling Valued and Empowered) with two sub-scales each.

TABLE 2 LOCATION OF HOSPITAL BY SECTOR AND JURISDICTION

Hospital site	Sector	Jurisdiction
A	Public	New South Wales
B	Public	Victoria
C	Private	Victoria
D	Private	Queensland

E	Private	Queensland
F	Private	New South Wales
G	Private	New South Wales

Source: Author

TABLE 3: MEDICAL ENGAGEMENT SCALE (MES)

Medical engagement scale (MES)		
Meta-Scale 1:	Working in a collaborative culture	Sub-Scale 1: Climate for positive learning Sub-Scale 2: Good interpersonal relationships
Meta-Scale 2	Having purpose and direction	Sub-Scale 3: Appraisal and rewards effectively aligned Sub-Scale 4: Participation in decision- making and change
Meta-Scale 3	Feeling valued and empowered	Sub-Scale 5: Development orientation Sub-Scale 6: Work satisfaction

Source: Adapted by author from Spurgeon P, Barwell F, Mazelan PM (2008)

The average medical engagement scores for all organisations in both the external UK and AU reference databases were ranked and split into five colour-coded levels of engagement bands relative to the MES norms.

TABLE 4 – FIVE COLOURED BANDS USED TO RANK ENGAGEMENT FROM HIGHEST RELATIVE ENGAGEMENT (GREEN) TO LOWEST RELATIVE ENGAGEMENT (RED)

Band (colour)	Relative engagement to MES norms
Bright green	Highest relative engagement (top 1/5th)
Pale green	High relative engagement (top 2/5th)
Yellow	Medium relative engagement (middle 3/5th)
Pink	Low relative engagement (4/5th)
Red	Lowest relative engagement (bottom 5/5th)

Source: Applied Research, UK.

Ethics approval was obtained from the Australian Institute of Business Human Research Ethics Committee, dated 5th September 2019, approval number 2019/L1/08. It was determined that the research met the requirements of the National Statement on Ethical Conduct in Human Research (2007). No patient or public involvement occurred.

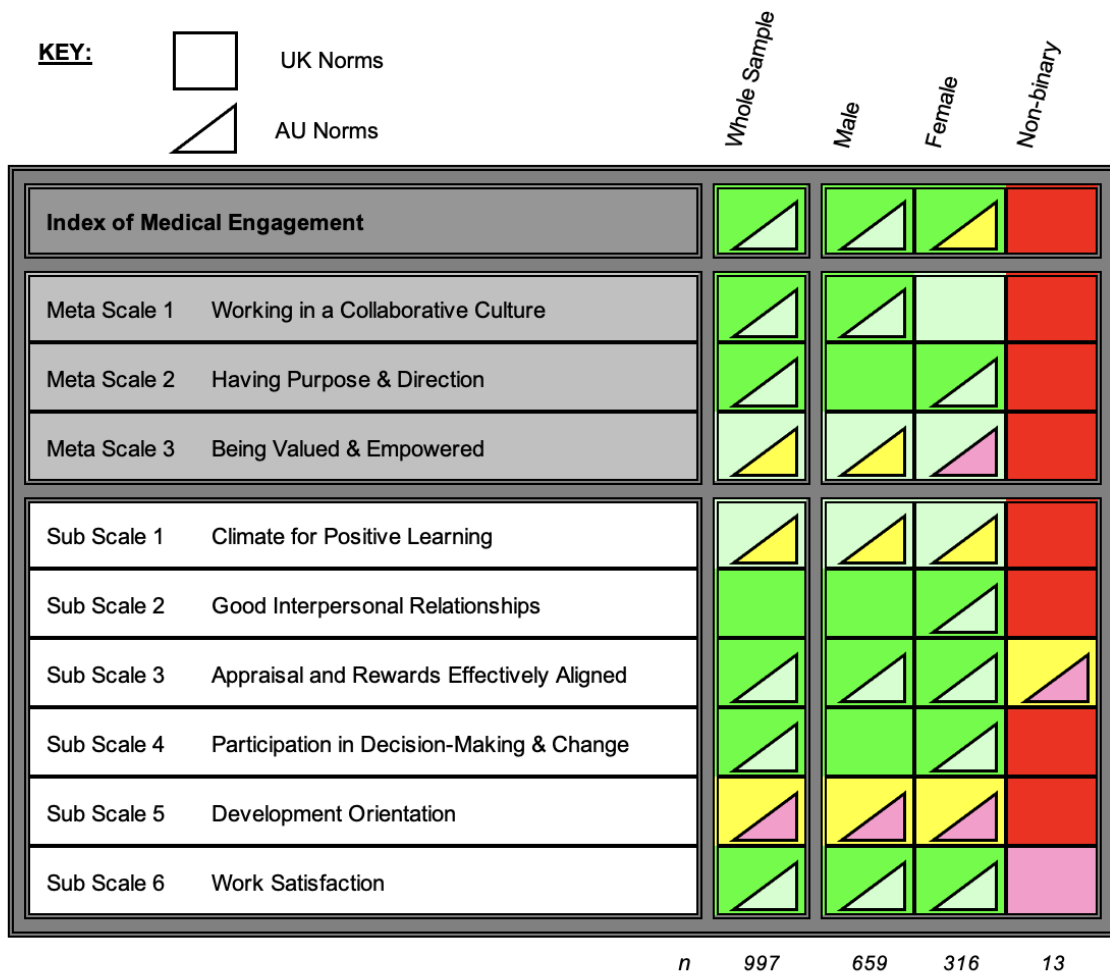
RESULTS

In total, 997 doctors responded to the survey. Figure 1 describes the combined profile of respondents by sex and MES items. Overall, male doctors (N=659) are more engaged than female doctors. Non-binary doctors rated the MES items in the lowest relative bands according to both UK and AU norms, with few exceptions where one or two sub-scales reached medium or low rankings.

Figure 2 shows engagement profiles by sex across the seven sites. Four non-binary doctors chose not to disclose their location but were included in the overall total (N=13). Male doctors were more engaged than females at five sites, while females were more engaged at one site. Female doctors (N=316) reported feeling less valued and empowered and perceived less collaboration in workplace culture compared to male colleagues. Non-binary doctors were notably disengaged across all sites. However, some satisfaction and pay alignment were reported by non-binary staff at select hospitals.

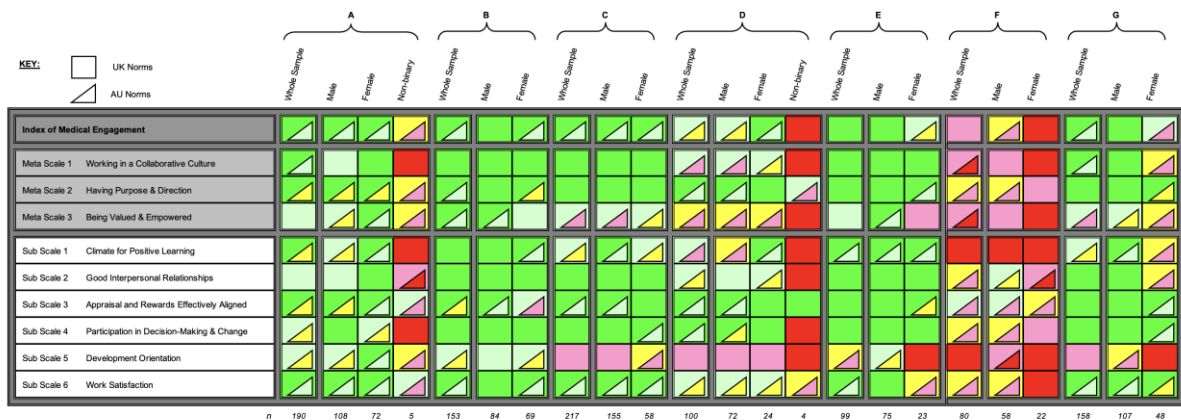
Comparative analysis using Tukey's Honest Significant Difference (HSD) test showed significant differences between non-binary doctors and their cisgender peers across several engagement dimensions. No significant differences were found between male and female (cisgender) doctors.

FIGURE 1 - LEVELS OF ENGAGEMENT FOR ALL DOCTORS BY SEX COMBINED FOR ALL SITES BENCHMARKED FOR UK AND AU (TRIANGLES IN FOREGROUND)



Source: Applied Research, UK

FIGURE 2 - LEVELS OF ENGAGEMENT FOR ALL DOCTORS BY SEX BREAKDOWN BY SITE BENCHMARKED FOR UK AND AU (TRIANGLES IN FOREGROUND) NB: FOUR NON-BINARY STAFF ELECTED NOT TO IDENTIFY THEIR LOCATION (SITE)



Source: Applied Research, UK

DISCUSSION

The results are consistent with international literature showing ongoing inequities in medicine based on sex [11,12,13]. For instance, fewer than 12.5% of large hospitals in AU had a female chief executive, and only 28% of medical schools had female deans [12]. In the USA, academic medicine continues to reflect disparities in faculty roles, leadership, and pay [13–19].

Australian studies also identify significant barriers to female medical engagement, including limited leadership roles and perceived lack of credibility [15,10]. These issues are especially prominent in male-dominated specialties [29,32], and surveys of junior doctors reflect stark contrasts in experience by sex [33]. Female doctors often avoid specialties not seen as family- or female-friendly [34], report worse work-life balance, and are less satisfied professionally [35].

There is limited research on non-binary doctors. One U.S. study estimates fewer than 1% of doctors identify as non-binary and many experience discrimination, identity concealment, and stigma [11]. In Australia, non-binary junior medical staff report twice the rate of harassment and discrimination compared to their peers [34]. Given the growing diversity of the medical workforce [34], these disparities have consequences for staff engagement and patient care. Studies show that female doctors, for example, may deliver more guideline-compliant and patient-centred care [34].

Non-binary people experience higher levels of incidence of mental health issue outcomes and healthcare dissatisfaction compared with female or males, so it follows that non-binary medical staff are less engaged than their female and male colleagues [36]. There is more research available on the experience non-binary patients which shows that non-binary patients benefit more from empathetic and supportive treatment [36]. It is possible that patients presenting at the study hospitals who are non-binary would benefit from being treated by non-binary doctors. More research is necessary to understand this link.

LIMITATIONS

The study was limited to seven hospitals located in three jurisdictions and owned by a single entity (Table 2) to which the researchers had access to conduct the study. These hospitals are comparable in size and scope of services to other Australian hospitals, which suggests that if the results could be replicated if process was repeated at other similar hospitals in Australia. For example, the hospitals have a very similar range of clinical speciality services and treat patients with similar conditions. It is noted that the hospitals do belong to a not-for-profit entity, so the findings may not be applicable to fully private or public health providers, and other settings like primary care, community care or aged care.

CONCLUSION

There is a growing base of research into inequity in medicine, especially in the USA, pertaining to the sex of the doctors. The focus of this material is on male and female doctors. There is a lack of research around how and why non-binary doctors are engaged in hospitals, and it is hoped that this study adds to the evidence base. Despite the manifest limitations in the study being confined to the not-for-profit sector in AU, this research will assist employing bodies, policy makers and workforce planners in their endeavours to provide appropriate support and opportunities for doctors in their workplace.

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DETERMINANTS OF INPATIENT SATISFACTION: A SERVQUAL BASED ANALYSIS

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ABSTRACT

OBJECTIVE:

This study aimed to analyze the quality of inpatient services at Labuang Baji Hospital, Makassar, using the SERVQUAL model to identify the gap between patient expectations and perceptions across five service dimensions: tangibles, reliability, responsiveness, assurance, and empathy.

DESIGN:

A cross-sectional analytic study was conducted among 267 inpatients using purposive sampling. Data were collected using a 22-item SERVQUAL questionnaire measuring expectations and perceptions across five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. Service quality gaps were calculated by subtracting perception scores from expectation scores. Multiple linear regression analysis was performed to assess the predictive influence of each dimension on patient satisfaction. Instrument reliability demonstrated strong internal consistency (Cronbach's alpha > 0.70 for all dimensions).

RESULTS:

All five SERVQUAL dimensions showed negative gaps, indicating that perceived service performance did not fully meet patient expectations. Responsiveness and assurance demonstrated the largest mean gaps. Multiple regression analysis revealed that all five dimensions significantly influenced patient satisfaction ($p < 0.05$), with empathy and assurance emerging as the strongest predictors. The model explained 67.7% of the variance in patient satisfaction ($R^2 = 0.677$), indicating substantial explanatory power.

CONCLUSION:

Inpatient service quality at Batara Siang General Hospital remains below patient expectations across all SERVQUAL dimensions. Interpersonal aspects of care particularly empathy, assurance, and responsiveness play a critical role in shaping patient satisfaction. Targeted managerial interventions focusing on communication, timeliness, and patient-centered care are recommended to enhance service performance and overall satisfaction.

KEYWORDS

Patient satisfaction, Service quality, SERVQUAL model, Tangibility, Reliability, Responsiveness, Assurance, Empathy

INTRODUCTION

Patient satisfaction is a central indicator of healthcare quality and reflects how effectively hospital services meet patient expectations [1,2]. In inpatient settings, satisfaction becomes particularly important due to the intensity and continuity of interactions between patients and healthcare providers. These interactions shape not only patients' perceptions of care but also their overall healthcare experience [3,4].

Service quality has been widely recognized as a key determinant of patient satisfaction. The SERVQUAL model provides a comprehensive framework to evaluate this relationship through five dimensions: tangibles, reliability, responsiveness, assurance, and empathy [5,6]. These dimensions capture both the technical and interpersonal aspects of healthcare delivery, allowing a more holistic assessment of service performance [7,8]. However, evidence consistently shows that gaps remain between expected and perceived service quality, especially in responsiveness and empathy, which are closely linked to patient-provider interaction.

Recent developments in healthcare research indicate a shift from a purely technical evaluation of services toward a more patient-centered approach. While earlier studies emphasized efficiency and procedural accuracy, contemporary perspectives highlight the importance of communication, emotional support, and individualized care [9–11]. This shift reflects a broader understanding that patients are not passive recipients of care but active participants whose experiences and perceptions influence satisfaction outcomes.

Patient satisfaction is also associated with important behavioral and clinical consequences, including treatment adherence, service utilization, and patient loyalty [12,13]. Dissatisfaction often arises when there is a mismatch between expected and perceived service quality, particularly in settings with limited resources and high patient demand [14,15]. These conditions are common in public hospitals in developing countries, where structural constraints may affect the consistency and responsiveness of care.

Despite the extensive use of the SERVQUAL model, many studies still focus on general service evaluations without adequately addressing inpatient contexts, where patients depend on continuous and coordinated care [16,17]. Empirical evidence from regional public hospitals remains limited, especially in Indonesia, where variations in service delivery may influence patient satisfaction differently across settings.

Therefore, this study aims to analyze the determinants of inpatient satisfaction using the SERVQUAL model by examining the influence of tangibles, reliability, responsiveness, assurance, and empathy on patient satisfaction in a regional public hospital in Indonesia.

METHODS

This study employed an observational analytic design with a cross-sectional approach to assess patient perceptions of inpatient service quality at a single point in time. The research was conducted in the inpatient wards of Batara Siang General Hospital, Pangkep, Indonesia, from January to June 2023.

This study received ethical clearance from the Health Research Ethics Committee (KEPK) of Makassar Health Polytechnic, Indonesia, with approval number 1070/M/KEPK-PTKMS/VII/2022. This approval was granted prior to data collection. Formal permission to contact and survey participants at Batara Siang General Hospital was granted by the Chair of the Medical and Nursing Committee, on January 5, 2023.

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STUDY POPULATION AND SAMPLING

The study population consisted of inpatients hospitalized during the study period. Eligible inpatients were approached directly by the research team during their hospitalization, informed about the study objectives and procedures, and invited to participate voluntarily after providing informed consent. The research team approached eligible inpatients after coordination with ward nurses, explained the study objectives, procedures, and voluntary nature of participation, and obtained written informed consent before administering the questionnaire. A total of 290 eligible inpatients were invited to participate, of whom 267 participants agreed and completed the questionnaire and were included in the final analysis. The age range of 20–50 years was intentionally defined to ensure a relatively homogeneous adult population capable of independently evaluating healthcare service experiences. Patients below 20 years and above 50 years were excluded to reduce potential response bias related to dependency status, caregiver-assisted responses, or geriatric complexity, which may influence perception-based assessments.

Inclusion Criteria, Participants were included if they: Were aged between 20 and 50 years, had been hospitalized for at least three days, were in stable clinical condition at the time of data collection, were able to communicate in Indonesian (with clarification in Bugis or Makassar when necessary), provided informed consent; **Exclusion Criteria,** Participants were excluded if they: Were in critical condition, had cognitive impairment affecting questionnaire comprehension, were discharged before completing three days of hospitalization.

INSTRUMENT AND DATA COLLECTION

Primary data were collected using a SERVQUAL-based questionnaire consisting of 22 items covering five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. Each item was measured using a 5-point Likert scale for both expectation and perception scores. Mentioning the local language such as Indonesian, Bugis, and Makassar is intended to help patients better understand the questionnaire. This multilingual approach enhanced response validity while maintaining standardization of questionnaire content. Supporting information from informal staff discussions and hospital documents was used only during the study preparation phase to contextualize the SERVQUAL dimensions. These sources were not included in statistical analysis.

VALIDITY AND RELIABILITY TESTING

Content validity was established through expert review involving two healthcare management academics and one senior hospital administrator to ensure item relevance and contextual appropriateness.

Internal consistency reliability was assessed using Cronbach's alpha coefficients based on the current dataset ($n = 267$). All SERVQUAL dimensions demonstrated acceptable reliability ($\alpha > 0.70$), indicating strong internal consistency of the instrument.

Construct validity was evaluated using corrected item-total correlations, with all items exceeding the recommended threshold of 0.30.

ANALYSIS DATA

Data analysis was conducted using SPSS version 26.00 software to assess service quality at Pangkep regional hospital. Descriptive analysis, specifically focusing on the dimensions of Tangibility, Reliability, Responsiveness, Assurance, and Empathy, was employed to evaluate overall participants satisfaction. A multiple linear regression model was utilized to examine overall patient satisfaction as the dependent variable, with the dimensions of participants satisfaction serving as the independent variables.

In this study, data analysis was conducted in two key stages. First, a gap analysis was performed to assess the basic differences between participants expectations and their actual perceptions of inpatient services across each item of the SERVQUAL instrument.

RESULT

SOCIODEMOGRAPHIC CHARACTERISTICS OF RESEARCH PARTICIPANTS AT BATARA SIANG HOSPITAL, PANGKEP

The sociodemographic characteristics outlined herein provide a comprehensive overview of the respondent population, highlighting variations that must be considered in understanding their preferences, needs, and satisfaction levels regarding healthcare services at Batara Siang Hospital in Pangkep. (Table 1).

TABLE 1. SOCIODEMOGRAPHIC CHARACTERISTICS AMONG 267 RESEARCH PARTICIPANTS AT BATARA SIANG GENERAL HOSPITAL, PANGKEP

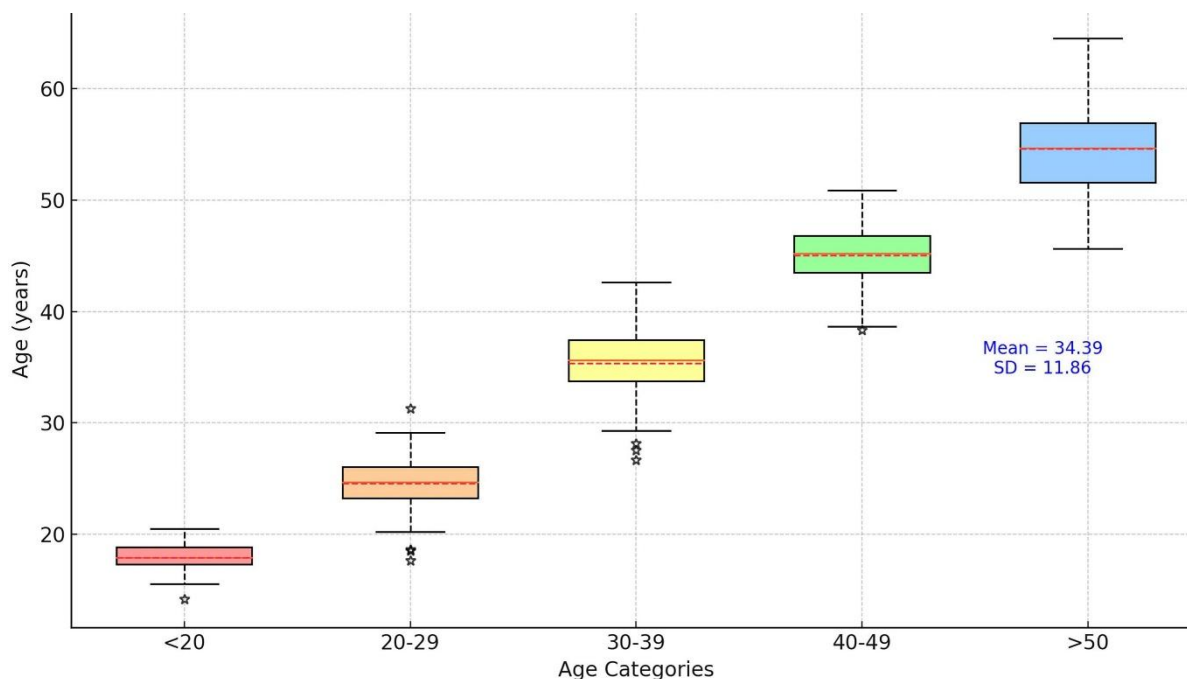
Characteristics	Total, n (%)	p value
Age, mean $\pm$ SD (years)	34.39 $\pm$ 11.86	.000
20 – 29	105 (39,3)	
30 – 39	76 (28,5)	
40 – 50	86 (32,2)	
Sex		
Male	119 (44.6)	.000
Female	148 (55.4)	
Education level		
Basic Educational	116 (43.4)	.000
Moderate Educational	107 (40.1)	
High Educational	44 (16.5)	
Employment		
Work	137 (51.3)	.000
Don't work	130 (48.7)	

The age distribution of respondents was reorganized into three categories to improve analytical clarity. The largest proportion of respondents was aged 20–29 years (39.3%), followed by 40–50 years (32.2%) and 30–39 years (28.5%). The mean age was 34.39 years (SD $\pm$ 11.86), indicating a predominantly productive-age inpatient population. There are more female respondents (55.4%) than male (44.6%), with a p-value of .000 indicating a significant difference in gender distribution. This suggests that female patients are more frequently involved in this survey, though further analysis is needed to determine the cause of this imbalance.

Respondents were categorized into three educational level groups, with the majority having completed primary education (43.4%) and secondary education (40.1%). Those with higher education constituted a smaller proportion (16.5%), and the p-value of .000 indicates that the difference in education levels is statistically significant. These findings may reflect variations in patients' educational attainment at this facility, potentially related to access to services or the social determinants of healthcare influenced by educational background. More than half of the respondents (51.3%) were employed, while 48.7% were unemployed, with a p-value of .000 also indicating a significant difference.

The median age is positioned at the center of the distribution, indicating a balanced central tendency among participants. The interquartile range (IQR) shows a wide span, reflecting moderate variability in participants' ages. Additionally, there are no extreme outliers, which suggests that the age distribution is relatively compact with minimal significant deviations. The data indicates a diverse age range, with the most frequent participants aged between 20 and 39 years. These two age groups collectively represent over 50% of the sample. (Figure 1).

FIGURE 1. THE BOX-AND-WHISKER DIAGRAM ILLUSTRATES THE AGE DISTRIBUTION ACROSS FIVE AGE CATEGORIES.



The boxes represent the interquartile range, the whiskers show data variability, and outliers are marked with red stars.

Females make up 55.4% of the participants, while males account for 44.6%. This means that the female category alone constitutes 55% of the population, and when males are added, the total reaches 100%. This near-balanced gender distribution provides a fairly equal representation of sexes in the sample, with a slight female predominance (Figure 2a). Basic Education: 43.4% of participants. Moderate Education: 40.1% of participants. High Education: 16.5% of participants. Cumulative: About 83.5% of participants have basic or moderate education, indicating that most of the sample comes from lower educational backgrounds. The data reflects limited educational advancement, which could impact health literacy or access to healthcare resources (Figure 2b). Employed: 51.3% of participants. Unemployed: 48.7% of participants. Cumulative: Including both categories brings the cumulative count to 100%. The distribution of employed and unemployed participants is nearly equal. This highlights the socioeconomic diversity of the sample and potential implications for healthcare affordability or access (Figure 2c).

FIGURE 2. GENDER AND SOCIOECONOMIC INFLUENCES ON HEALTH LITERACY.

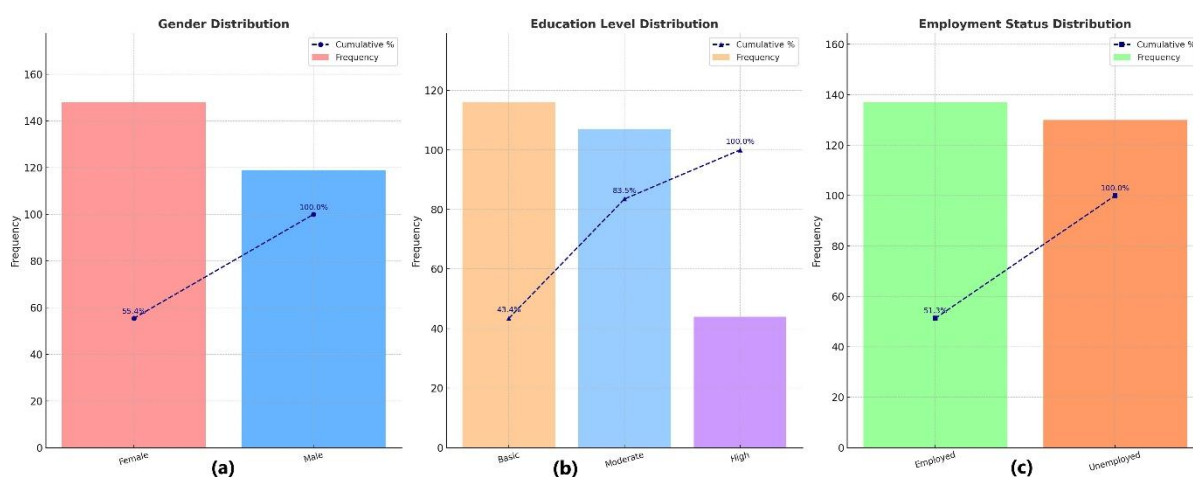


Figure 2. Gender and Socioeconomic Influences on Health Literacy. (2a) This near-balanced gender distribution provides a fairly equal representation of sexes in the sample, with a slight female predominance. (2b) The data reflects limited educational advancement, which could impact health literacy or access to healthcare resources. (2c) The distribution of employed and unemployed participants is nearly equal. This highlights the socioeconomic diversity of the sample and potential implications for healthcare affordability or access.

RELIABILITY AND VALIDITY TESTING

Prior to hypothesis testing, instrument reliability and construct validity were assessed. Content validity was established through expert review involving two healthcare management academics and one senior hospital administrator to ensure item relevance and contextual appropriateness.

Internal consistency reliability was evaluated using Cronbach's alpha coefficients for each SERVQUAL dimension based on the current dataset ($n = 267$). The results demonstrated acceptable to high reliability: 1) Reliability: $\alpha = 0.88$; 2) Tangibles: $\alpha = 0.85$; 3) Responsiveness: $\alpha = 0.90$; 4) Assurance: $\alpha = 0.91$; 5) Empathy: $\alpha = 0.89$; 6) Overall scale: $\alpha = 0.93$. All coefficients exceeded the recommended threshold of 0.70, indicating strong internal consistency among items within each dimension. Construct validity was assessed through corrected item-total correlation, with all items exceeding 0.30, confirming adequate internal structure of the instrument.

SERVQUAL APPROACH MODEL

Table 2 contains detailed item-level data for all 22 SERVQUAL items, categorized under the five service quality dimensions: Reliability, Tangibility, Responsiveness, Assurance, and Empathy.

Each item is labeled numerically (Items 1–22), with corresponding mean scores for both expectations (Y) and perceptions (X), allowing for calculation of the service quality gap ($Y - X$) at the item level. The items with the largest negative gaps, indicating the greatest participants dissatisfaction, are clearly identifiable in the table. For instance, Item 10 under the Responsiveness dimension showed a perception score of 2.72 versus an expectation score of 4.46, resulting in a gap of -1.74 . Similarly, Item 12 under Assurance and Item 16 under Empathy both showed perception scores of 2.70, with corresponding expectation scores of 4.43 and 3.97, respectively, indicating key areas of participants dissatisfaction. These item-specific insights are essential for generating targeted recommendations and ensuring actionable improvements in hospital service delivery. The discussion section of the manuscript has also been revised to reflect this more granular interpretation, directly linking item-level dissatisfaction to priority areas for service enhancement.

TABLE 2. MEASUREMENTS OR OBSERVATIONS RELATED TO PARTICIPANTS SATISFACTION IN HEALTH CARE SETTINGS

		Answer of belief							Answer of belief							
dim	Item	STS	TS	N	S	SS	Σ	X	STS	TS	N	S	SS	Σ	Y	Gap
Reliability	1	0	102	87	68	10	787	2,95	0	0	5	145	117	1180	4,42	-1,23
	2	1	111	61	76	18	800	3,00	0	0	4	134	129	1193	4,47	
	3	0	2	97	155	13	980	3,67	0	0	6	149	112	1174	4,40	
	4	0	86	78	86	17	835	3,13	0	0	9	600	570	1179	4,42	
	total average : 856 or grand mean 3, 20								total average : 1.182 or grand mean 4,43							
Tangibility	4	1	13	152	82	19	906	3,39	0	0	6	147	114	1176	4,40	-1,04
	5	0	25	139	86	17	896	3,36	0	0	5	142	120	1183	4,43	
	6	0	27	110	114	16	920	3,45	0	0	4	140	123	1187	4,45	
	7	0	31	107	114	15	914	3,42	0	0	5	134	128	1191	4,46	
	total average : 909 or grand mean 3,40								total average : 1.184 or grand mean 4,44							
Responsibility	8	1	119	100	28	19	746	2,79	0	0	6	132	129	1191	4,46	-1,55
	9	1	26	124	102	14	903	3,38	0	0	5	131	131	1194	4,47	
	10	1	121	110	23	12	725	2,72	0	0	4	137	126	1190	4,46	
	11	0	127	98	23	19	735	2,75	0	0	5	136	126	1189	4,45	
	total average : 777 or grand mean 2,91								total average : 1.191 or grand mean 4,46							
Assurance	12	1	119	115	22	10	722	2,70	0		7	138	122	1183	4,43	
	13	2	109	122	21	13	735	2,75	0	0	6	142	119	1181	4,42	
	14	1	129	102	20	15	720	2,70	0	0	8	134	125	1185	4,44	
	15	0	102	126	27	12	750	2,81	0	0	4	136	127	1191	4,46	

	total average : 732 or grand mean 2,74								total average : 1.185 or grand mean 4,44						-1,7	
Empathy	16	1	127	102	25	12	721	2,70	0	0	5	132	130	1061	3,97	
	17	2	128	100	22	15	721	2,70	0	0	4	137	126	1190	4,46	
	18	1	123	102	26	15	732	2,74	0	0	3	133	131	1196	4,48	
	19	0	94	132	27	14	762	2,85	0	0	9	129	129	1188	4,45	
		total average : 734 or grand mean 2,75								total average : 1.159 or grand mean 4,34						-1,59
	total average : 802 or grand mean 3,00								total average : 1.159 or grand mean 4,34						-1,42	

1. Reliability model (Corrected)

The Reliability dimension showed a positive and statistically significant association with participants satisfaction ($\beta = 0.315$, $t = 3.323$, $p = 0.01$). This indicates that for every one-unit increase in the reliability score, participants satisfaction increases by 0.315 units, holding other variables constant.

2. Tangible Model (Corrected)

Tangibles demonstrated a significant positive relationship with satisfaction ($\beta = 0.305$, $t = 2.827$, $p = 0.04$), suggesting that improved physical facilities and appearance are associated with higher satisfaction levels.

3. Responsiveness Model (Corrected)

Responsiveness had a significant positive effect on participants satisfaction ($\beta = 0.479$, $t = 3.866$, $p < 0.001$), indicating that timely and prompt service delivery is a strong predictor of satisfaction.

4. Assurance Model (Corrected)

Assurance exhibited a significant positive association with participants satisfaction ($\beta = 0.502$, $t = 5.247$, $p < 0.001$), suggesting that participants trust in staff competence and safety significantly enhances satisfaction.

5. Empathy Model (Corrected)

Empathy emerged as the strongest predictor of participants satisfaction ($\beta = 0.629$, $t = 6.787$, $p < 0.001$), indicating that personalized attention and emotional support are the most influential determinants of satisfaction in this study.

6. Simultaneous Regression Model

The simultaneous effect of the five SERVQUAL dimensions—Reliability (X1), Tangibles (X2), Responsiveness (X3), Assurance (X4), and Empathy (X5)—on participants satisfaction was assessed using multiple linear regression analysis.

The model demonstrated strong explanatory power, with an R^2 value of 0.677, indicating that 67.7% of the variance in participants satisfaction is explained collectively by the five service quality dimensions. The remaining 32.3% of the variance may be attributed to other factors not included in this model, such as individual participants characteristics, hospital system factors, or contextual influences.

The overall regression model was statistically significant, as indicated by the F-test ($p < 0.001$). This confirms that the five SERVQUAL dimensions jointly provide a meaningful contribution to predicting participants satisfaction.

DISCUSSION

This study aimed to evaluate the quality of inpatient services at Batara Siang General Hospital, Pangkep, Indonesia using the SERVQUAL model, focusing on identifying the gaps between participants expectations and perceptions across the five dimensions of service quality: tangibles, reliability, responsiveness, assurance, and empathy.

THE SERVQUAL MODEL AND ITS APPLICATION IN HEALTHCARE

The findings demonstrated that all five dimensions exhibited negative service quality gaps, indicating that participants expectations were consistently higher than their perceived experiences of care.

The SERVQUAL model is widely used to measure healthcare service quality and participants satisfaction [18,19]. Originally comprising five dimensions (reliability, assurance, tangibles, responsiveness, and empathy), studies have found variations in its applicability across different contexts. Lam (1997) reported that SERVQUAL is reliable for measuring healthcare quality

in Hong Kong, although the five-dimension structure was not confirmed. Similarly, Kansra and Jha (2016) identified only four factors in their Indian hospital study. Pekkaya et al. (2019) found that tangibles scored highest among the dimensions in a Turkish hospital, with reliability being the most determinant for outpatient satisfaction. Demographic factors such as age, income, and service type were found to influence perceived service quality [18]. Despite some criticisms, SERVQUAL remains a valuable tool for healthcare providers to assess and improve service quality [20]. The SERVQUAL model is a widely recognized framework for assessing service quality in various sectors, including healthcare. Its application in healthcare settings aims to bridge the gap between participants expectations and actual service delivery, ultimately enhancing participants satisfaction and care quality. The model evaluates five key dimensions: reliability, assurance, tangibles, empathy, and responsiveness. While the SERVQUAL model provides a structured approach to evaluating service quality, its implementation can be challenging due to cultural diversity and the complexity of participants-provider interactions. Nonetheless, it remains a valuable tool for healthcare organizations aiming to enhance service quality and participants satisfaction.

SERVQUAL has gained popularity in healthcare settings due to its ability to effectively measure and assess service quality from the participants perspective. The instrument allows healthcare providers to identify gaps between participants expectations and perceptions of service quality, enabling targeted improvements in care delivery[21]. The versatility of SERVQUAL is evident in its application across various healthcare contexts, including colposcopy clinics [22], physiotherapy and rehabilitation hospitals [23], and outpatient services [18]. Its adaptability to different healthcare settings makes it a valuable tool for managers and researchers seeking to evaluate and enhance service quality [18,24]. The SERVQUAL has proven to be a consistent and reliable scale for measuring healthcare service quality, some studies have found that the proposed five dimensions of SERVQUAL are not always confirmed in healthcare settings [25]. This suggests that the instrument may require adaptation to fully capture the unique aspects of healthcare service quality. Nevertheless, SERVQUAL remains a widely used and trusted method for assessing participants satisfaction and identifying areas for improvement in healthcare services. Despite its strengths, some studies indicate mixed results regarding SERVQUAL's effectiveness in various healthcare contexts, suggesting that while it is a valuable tool, its application may require careful consideration of specific settings and participants demographics.

The SERVQUAL model, widely used for measuring service quality, has been criticized for several limitations. These include its inability to fully capture customer experience [26], overlap between process and outcome measures, and scaling issues [27]. The model's dimensions are considered too limited to comprehensively assess service quality [28]. Cognitive differences among customers, stemming from personality disorders or cultural variations, can lead to irrational perceptions, further weakening SERVQUAL's reliability [29]. Additionally, the model's applicability across diverse service settings, countries, and ethnicities has been questioned [28]. While modified versions have been developed to address these shortcomings, they too have fallen short in reflecting the true dimensions of service quality impacting customer satisfaction.

The SERVQUAL model, while widely utilized for measuring service quality, has several notable limitations that hinder its effectiveness in capturing the complexities of customer experience. These limitations stem from its narrow focus and methodological constraints, which can lead to an incomplete understanding of service quality in various contexts. Despite these limitations, SERVQUAL remains a foundational tool in service quality measurement. However, the evolving landscape of customer experience necessitates the development of more comprehensive models that can address these shortcomings and better reflect the nuances of service quality. Researchers suggest the need for developing more comprehensive and universally accepted scales to measure service quality and customer experience.

THE DIMENSIONS OF SERVICE QUALITY IN SERVQUAL.

Reliability Model

Reliability in the implementation of the inpatient service quality dimension at the hospital with a p_value of 0.01, which is less than 0.05, in other words, significant. It can be said that respondents' feedback regarding reliability, such as: straightforward inpatient service procedures, quick and accurate examination, treatment, and care services, orderly and systematic administrative activities, as well as medical staff and employees, on average, participants expressed that they

were still lacking or unsatisfactory. The reason is that incoming participants experience service procedures that take too long, especially in terms of examination and treatment services. However, even though satisfaction is consumer-oriented, it does not mean that in determining the quality of service, the service provider must follow the desires of all consumers. In determining the quality of service, the Pangkep District Hospital must consider not only meeting customer expectations but also the availability of the resources they possess.

The reliability analysis of the inpatient service quality dimension in hospitals consistently shows high internal consistency across various studies. Several papers report strong Cronbach's alpha values for the service quality dimensions. Chu et al. (2018) noted a Cronbach's alpha value ranging from 0.794 to 0.958 for the SERVQUAL dimensions and technical quality [30]. Similarly, Younquoi et al. (2023) conducted a reliability analysis using Cronbach's alpha on the SERVQUAL dimensions [31]. Budiharto (2020) also used reliability analysis in the path analysis of their service quality dimensions [32]. While most studies use the standard SERVQUAL dimensions, some researchers have proposed modifications. Chu et al. (2018) combined the original SERVQUAL instrument with additional technical quality measures [30]. Budiharto (2020) used a modified SERVQUAL scale that includes dimensions such as trust and communication [32]. This indicates that although the core SERVQUAL framework is widely accepted, researchers see value in adapting it to specific healthcare contexts. The reliability analysis of the inpatient service quality dimensions consistently yields high internal consistency across studies. The SERVQUAL framework provides a reliable foundation, although some researchers propose context-specific modifications. This reliability supports the validity of using these dimensions to assess and improve the quality of inpatient services in hospitals.

The evaluation of reliability in inpatient service quality at hospitals has been extensively studied using various approaches and instruments. Several studies have developed and validated questionnaires to measure participants satisfaction and assess service quality in inpatient settings [33,34]. These instruments typically include several dimensions such as physician care, nursing care, hospital environment, and communication [34,35]. Various methodologies have been used to evaluate reliability. While some studies focus on traditional psychometric properties such as internal consistency and test-retest reliability [36], others have explored new approaches. For example, one study used data envelopment analysis to evaluate service reliability by comparing performance over time and identifying factors that affect unreliable phases [37]. Another study compared frequentist models, empirical Bayes, and Bayesian hierarchy to estimate the reliability of healthcare service quality measures [37]. The reliability of inpatient service quality measures is crucial for accurate assessment and improvement of care in hospitals. Although various instruments and methods have been developed, it is important to note that high reliability estimates may not always ensure accurate differentiation among service providers [37]. Future research should focus on refining existing tools and exploring innovative approaches to enhance the reliability and validity of inpatient service quality evaluations across various healthcare settings.

Tangible Model

The physical evidence in this study is the comfort in the inpatient room, the medical staff and employees appearing neat and polite, as well as having adequate physical facilities. On average, respondents provided fairly satisfactory answers with a p_value test result of 0.04, which is less than 0.05, in other words, significant.

Physical evidence plays an important role in assessing the dimensions of inpatient service quality in hospitals. Several studies have highlighted the importance of physical evidence: The SERVPERF model, which measures customer perceptions of service quality, includes "tangible" as one of its five main dimensions [38]. This dimension includes the physical aspects of the hospital environment that can be observed and evaluated by participants. Similarly, the SERVQUAL instrument, used in several studies, also includes tangible as an important component of service quality assessment [24,39]. Some studies have found that physical evidence may have varying impacts on different participants groups. For example, Trivedi and Jagani (2018) reported that the physical environment was significantly associated with satisfaction only among female inpatients [40]. This indicates that the importance of physical evidence may vary based on demographic factors. In conclusion, although physical evidence is consistently recognized as an important dimension of inpatient service quality, its relative importance may vary. The HospitalQual model, for example, includes "hospital infrastructure" as one of its seven dimensions for measuring inpatient service quality [41]. However, it should be noted that

in some studies, such as Budiharto (2020), the quality of infrastructure does not have a significant impact on participants loyalty, indicating that other factors may sometimes take precedence in overall participants satisfaction and loyalty [32].

Responsiveness Model

The dimension of responsiveness (quick response) is the customer's perception of the level of service felt, received by the customer regarding the customer service's ability to resolve issues, meet desires, and be responsive and agile in addressing the problems faced by the customer [42].

Quick responsiveness in service, especially for inpatients, is related to the ability of the staff to meet participants needs, provide prompt and accurate responses to participants complaints, and convey clear and easily understandable information to patients. From the data analysis on responsiveness, it was found that the p_value was 0.00, which is less than 0.05, meaning it is significant or has an impact on the satisfaction of inpatients at Batara Siang Hospital Pangkep. Guarantee is related to feelings of safety, skillfulness, friendliness, honesty, and the ability to provide services to inpatients in the hospital [43]. Quality assurance in healthcare is very important to foster trust and ensure that participants receive the highest standard of care while being treated in the hospital. An effective quality assurance program involves the continuous monitoring, evaluation, and improvement of healthcare services to meet established standards and participants expectations [44].

The research results indicate that assurance is generally in the insufficient category, which illustrates the absence of guarantees in case of errors in the performance of the staff, and the cost rates do not match the quality of the received service. Meanwhile, the knowledge and skills of the staff in carrying out their duties are quite good, as evidenced by the medical personnel and employees having the ability, extensive knowledge, and competence in performing their tasks. Therefore, with a p_value of 0.00, which is less than 0.05, it is significant.

The dimension of responsiveness is indeed a crucial aspect of service quality, reflecting customers' perceptions of how quickly and effectively service providers respond to their needs and concerns. Several studies have examined this dimension in various contexts, revealing its significance in shaping overall customer satisfaction and loyalty. Research findings indicate that responsiveness plays a crucial role in the quality of customer service across various industries. In the context of e-commerce, a study on Tokopedia, one of the major e-commerce platforms in Indonesia, found that responsiveness has a sentiment balanced between positive and negative, indicating room for improvement [45]. Similarly, in the telecommunications sector, a study on Nepal Telecom Company (NTC) revealed that responsiveness, along with other dimensions of service quality, has a significant positive impact on customer satisfaction and loyalty [46]. The importance of responsiveness is not only limited to external customer service but also extends to internal service quality. A study on customer-facing employees in full-service hotels shows that the responsiveness dimension of internal service quality significantly affects employee commitment to customer service beyond their roles [47]. These findings highlight the interconnection between internal and external service quality, emphasizing the need for organizations to cultivate a responsive culture at all levels. In conclusion, the dimension of responsiveness is an important factor in determining customers' perceptions of service quality. Organizations in various sectors should prioritize improving their responsiveness to customer needs and issues to enhance overall service quality, customer satisfaction, and loyalty. Further research could explore specific aspects of responsiveness that have the most significant impact on customer perception and how this may vary across different industries and cultural contexts.

Assurance Model

Assurance relates to security, skill, friendliness, honesty, and the ability to provide services to hospital inpatients. The study found that assurance is generally lacking, indicating no guarantee in case of errors in officer performance and a mismatch between cost and service quality. However, medical personnel and employees demonstrate good knowledge and skills in their duties.

Assurance is a critical dimension of healthcare service quality that significantly impacts participants satisfaction in hospital settings. Numerous studies have underscored its importance and influence on the overall participants experience. This

dimension encompasses a sense of security, skill, friendliness, honesty, and the ability to provide effective services to inpatients. According to Negari et al. (2021), assurance has the most substantial influence on inpatient satisfaction. Participants feel assured and satisfied when healthcare workers effectively communicate their expertise and competencies before performing their duties [48]. This finding is supported by Setianto et al. (2022), which report that participants are satisfied with friendly and polite healthcare services, safe healthcare services, and overall quality care all of which fall under the assurance dimension [49].

While most studies identify assurance as a significant factor, some contradictions exist. Perera and Dabney (2020) revealed that gaps in assurance significantly impact overall quality and satisfaction. This suggests that when participants' expectations of assurance are not met, it can negatively affect their perception of service quality and satisfaction [50]. Additionally, Al-Neyadi et al. (2016) rated the assurance dimension as the highest among the five SERVQUAL dimensions in both public and private hospitals in the UAE [51].

The assurance dimension plays a crucial role in shaping participants' satisfaction and perceived quality of healthcare services. It encompasses various aspects, such as the competence and communication skills of healthcare providers, the safety of services, and the overall trustworthiness of the hospital environment. Healthcare institutions should prioritize enhancing this dimension to improve participants' satisfaction and overall service quality [52,53].

Empathy Model

Based on the survey results, data analysis shows that the empathy factor has a significant influence on participants' satisfaction. The t-value of 6.787, which is greater than the t-table (1.96) with 266 degrees of freedom at a significance level of 0.05, indicates statistical significance. This means that the hypothesis stating a significant influence between empathy and participants' satisfaction can be accepted. In addition, the significance is also supported by the probability analysis (p-value) which shows a p-value of 0.00, which is smaller than the established significance level of 0.05. Thus, these results reinforce the conclusion that empathy is an important factor significantly affecting participants' satisfaction.

Empathy plays an important role in shaping customers' perceptions of the quality of healthcare services, particularly in the context of participants' experience. Several studies have identified empathy as one of the main dimensions in the framework for measuring service quality in healthcare settings [38,54,55]. The SERVQUAL and SERVPERF models, which are widely used to assess service quality in healthcare, consistently include empathy as a core dimension alongside reliability, responsiveness, assurance, and tangibles [38,54]. Empathy in healthcare refers to the ability of service providers to understand participants' needs and offer personalized attention. This includes aspects such as individual care, understanding specific participants' requirements, and showing genuine concern for the participants' well-being [55,56]. Although empathy is consistently recognized as important, its relative [38]. This shows that although empathy is very important, its significance may depend on the context and be influenced by other aspects of the healthcare experience. Empathy remains an important component in participants' perception of the quality of healthcare services. Empathy represents the human touch in medical care, fostering understanding and closeness between service providers and participants. Healthcare organizations must prioritize empathy alongside other dimensions of service quality to enhance participants' satisfaction and loyalty [57]. However, a holistic approach that addresses various dimensions of quality is necessary for an optimal participants' experience in healthcare settings [57].

The key findings of this study indicate that the reliability dimension is the most significant factor influencing participants' satisfaction at Batara Siang Pangkep Hospital. Many participants perceive that inpatient service procedures, particularly regarding examination and treatment services, are excessively prolonged. Reliability analysis demonstrates high internal consistency across the studies, although certain studies recommend specific modifications to the SERVQUAL framework. The application of SERVQUAL dimensions is valid for assessing and enhancing the quality of inpatient services in hospitals.

COMPARATIVE ANALYSIS OF STUDY RESULTS AT BATARA SIANG GENERAL HOSPITAL, PANGKEP, AND VARIOUS HOSPITALS IN INDONESIA.

To strengthen the discussion, a comparative analysis was conducted to position our findings within the context of similar studies across Indonesia. In our study at the hospital the largest negative gaps between participants expectations and perceptions were observed in the dimensions of Responsiveness (-1.47), Assurance (-1.44), and Empathy (-1.36). This pattern is consistent with findings from Novita et al. [58], who conducted a SERVQUAL-based study at RSUD Pirngadi Medan, Indonesia and identified significant gaps in Responsiveness and Empathy, attributing them to delays in staff responses and lack of effective communication during inpatient care.

Similarly, Notobroto [59], in their assessment of service quality at RSUD Dr. Soetomo Surabaya, Indonesia also found that Responsiveness had the widest gap, particularly due to long waiting times and slow nursing responses to participants needs. This aligns closely with our study, where Item 10, related to the promptness of service, showed the largest individual gap (-1.74).

In contrast, a study by Noviyani et al. [60] conducted in a Type A hospital in Palembang, Indonesia found that Tangibility had the highest gap, reflecting dissatisfaction with physical facilities and infrastructure, which differs from our findings where Tangibility showed the smallest negative gap (-0.91). This variation underscores how the dimension of dissatisfaction may differ depending on hospital type, geographic location, and service capacity.

Collectively, these studies reinforce the broader trend of service quality gaps in Indonesian hospitals, particularly in interpersonal and response-related aspects of care. However, the variation in dimension severity highlights the importance of localized interventions and targeted staff training tailored to the institutional context.

EXPANDED IMPLICATIONS FOR MANAGERS AND LEADERS AT BATARA SIANG HOSPITAL

The findings of this study emphasize the importance of targeted managerial interventions within the five SERVQUAL dimensions tangibles, reliability, responsiveness, assurance, and empathy to enhance participants satisfaction in inpatient care at Batara Siang Hospital.

1. Reliability as the Primary Driver of Satisfaction

Since reliability emerged as the dimension with the highest performance and strongest influence on satisfaction, hospital managers should institutionalize practices that ensure consistent, error-free service delivery. This includes standardizing care procedures, enhancing staff competence through routine training, and reinforcing accountability systems to reduce variability in care outcomes.

2. Responsiveness and Assurance: Enhancing Staff- participants Interaction

The relatively lower scores in responsiveness and assurance point to a need for strengthening communication skills and attentiveness among hospital staff. Managers should implement structured training programs in effective communication, active listening, and timely service delivery to increase participants confidence and satisfaction. In addition, empowering staff to make quick decisions within their scope of practice can enhance perceived responsiveness.

3. Tangibles: Improving the Physical Environment

Although tangibles scored moderately, the physical environment remains an essential component of perceived service quality. Leaders should prioritize regular maintenance, modern medical equipment upgrades, and a clean, welcoming inpatient setting to align participants perceptions with quality expectations.

4. Empathy: Personalizing Patient Care

The relatively lower empathy dimension suggests that participants may feel a lack of individualized attention. Hospital leadership should consider implementing participants-centered care models that emphasize emotional support and personalized communication. Encouraging staff to recognize and respond to participants unique needs can foster a more compassionate environment.

5. Data-Driven Quality Improvement

This study's SERVQUAL assessment can serve as a baseline for continuous quality improvement. Managers are encouraged to adopt regular participants satisfaction surveys using the SERVQUAL framework to monitor trends, identify new gaps, and adapt service delivery accordingly.

By focusing on these targeted strategies—particularly reinforcing reliability, enhancing staff responsiveness and assurance, and fostering empathetic care—managers at Batara Siang Hospital can more effectively elevate inpatient satisfaction and strengthen overall service quality.

STRENGTHS AND WEAKNESSES

The study employs the SERVQUAL model, a well-established framework for assessing service quality, which allows for a structured analysis of participants satisfaction across multiple dimensions. The research provides statistically significant results, such as the p-values indicating strong correlations between service dimensions and participants satisfaction, which enhances the credibility of the findings. A varied demographic of respondents, which helps in understanding different participants perspectives and needs, thereby enriching the analysis of service quality. The implications of the findings for hospital management, suggesting areas for improvement that can directly enhance participants satisfaction and service quality. The combination of descriptive analysis and multiple linear regression provides a robust approach to understanding the relationships between different service quality dimensions and participants satisfaction.

While the SERVQUAL model is widely used, it may not fully capture the nuances of participants satisfaction in different cultural contexts, which could limit the generalizability of the findings. The study uses purposive sampling, which may introduce bias as it does not randomly select participants. This could affect the representativeness of the sample and the overall findings. The research is limited to inpatient services, which may overlook important aspects of participants satisfaction related to outpatient services or other healthcare settings. The study primarily relies on quantitative measures, which may not capture the full depth of participants' experiences and perceptions. Qualitative insights could provide a more nuanced understanding of participants' satisfaction. The cross-sectional design captures participants' satisfaction at a single point in time, which may not reflect changes in perceptions over time or the impact of specific interventions.

MEANING OF THE STUDY

The meaning of this study is to provide valuable information and insights into the dimensions of participants satisfaction in inpatient services at Batara Siang Hospital Pangkep. The study utilizes the SERVQUAL model as the analytical framework to measure reliability, tangibility, responsiveness, assurance, and empathy dimensions of service quality. This study can be useful for healthcare providers and policymakers to understand the key factors that influence participants' satisfaction and improve the quality of inpatient services at the hospital.

UNANSWERED QUESTIONS AND FUTURE RESEARCH

Based on the study's findings and limitations, some potential avenues for future research could investigate specific aspects of responsiveness and assurance dimensions that have the most significant impact on participants perceptions and how this may vary across different cultures and countries. Additionally, future research could explore the impact of participants satisfaction on participants loyalty, hospital reputation, and financial performance.

CONCLUSION

This study concludes that the quality of inpatient services at Haji Hospital Makassar, assessed using the SERVQUAL model, reveals a consistent gap between participants expectations and their perceptions across all five dimensions tangibles, reliability, responsiveness, assurance, and empathy indicating that service delivery has not fully met participants expectations. The largest gap was observed in the empathy dimension, underscoring a critical need to enhance participants-centered care and personalized interactions. These findings highlight the importance of targeted improvements in human resource management, communication, and responsiveness to participants needs to elevate the overall quality of inpatient services and participants satisfaction in hospital settings.

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EVALUATING EHEALTH ACCESS AMONG ELDERLY POPULATIONS: A MULTI-METHOD ANALYSIS USING DGRA, TOPSIS, AND KRUSKAL-WALLIS TEST

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ABSTRACT

OBJECTIVE:

The purpose of this study was to identify and rank barriers to obtaining eHealth services among Pakistan's elderly. Older people contributed primary data on technological, individual, relational, environmental, and organizational factors.

DESIGN:

Dynamic Grey Relational Analysis (DGRA) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) were utilized on 450 elderly persons to examine and rank the most significant eHealth barriers.

RESULTS:

The most significant barrier was found as "aging limitation (reduction in hearing, sight, memory, and fine motor control)" using both the DGRA and TOPSIS techniques. The Kruskal-Wallis (KW) test was used to assess the significance of this barrier among three age groups of elderly persons. There were no significant differences when the age exceeded 60.

ORIGINALITY:

This study is the first to apply the DGRA, TOPSIS, and KW test to determine the barriers that older people in Pakistan's urban and rural areas face while trying to use eHealth services.

KEYWORDS

eHealth; grey relational analysis; technique for order preference by similarity to ideal solution; kruskal-wallis test; elderly

INTRODUCTION

By 2050, the elderly population in Pakistan (defined as individuals aged 60 years and above) is projected to reach 42.8 million, making up 12.4% of the country's demographic, and showing a growth rate significantly outpacing other age

groups [1,2]. As of 2019, rural areas reported that older adults comprised 6.77% of the population, while in urban settings, they accounted for 6.38% [3]. Current estimates by the Bureau of Statistics indicate that individuals aged 60 and above make up 7-8% of the national population, equivalent to 15-17 million people, with approximately 25-30% experiencing disabilities [4]. This translates to 4–5 million elderly facing challenges related to physical, sensory, or cognitive impairments [5]. Moreover, the Supreme Court of Pakistan's 2017 census interventions showed severe loopholes in counting disabled people [6]. The expanding older population, many of whom have health conditions that limit mobility and healthcare access, challenges the healthcare system, especially in undeveloped areas. Given these restrictions there is dire need to highlight the importance of research on elderly populations and barriers to access eHealth services.

The data indicate a clear need for ongoing medical assistance, which is hindered by inadequate healthcare facilities and the underdeveloped eHealth system [7]. eHealth, defined as the utilization of digital and telecommunication technologies in healthcare delivery, presents innovative opportunities for providing age-friendly care to elderly individuals with chronic conditions. In addition to remote management of social and health services through innovative medical delivery methods reduces the necessity for infrequent patient visits, especially in rural areas where health services may be limited [8]. Conversely, it is beneficial in managing conditions such as diabetes, cardiovascular diseases, and hypertension, often termed silent killers, that require constant control [9]. Digital health services can alleviate issues by reducing patient wait times for check-ups and minimizing costs associated with long-distance transportation through tele-help [10]. Despite the numerous advantages of eHealth technology for the elderly, significant barriers persist, complicating its implementation for many individuals in this demographic.

Analysing and discouraging the barriers faced by the elderly in accessing eHealth services is important in addressing the inequalities in health care as well as promoting appropriate healthcare policies. This population is more likely than average to have limited access to normal health care services especially for the elderly who are located in remote geographical regions where the infrastructure is underdeveloped. Understanding these barriers will help to focus the resources where they are highly required, improve the effectiveness of the healthcare sector, and inclusively equip old people with the ability to engage eHealth services. In addition, considerations of eHealth services accessibility can play a huge role in improving the overall life satisfaction levels of elderly patients with chronic illnesses by reducing the need for risky interventions in the case of medical treatment delays and providing constant monitoring as patients' health deteriorates.

Analyzing the challenges faced by the least economically developed countries, such as Pakistan, is essential also due to social issues, the digital divide, and inefficiencies in the healthcare system. A significant portion of the elderly population in society faces challenges in utilizing modern technology, including smartphones and computers, due to limited exposure to these media. This population, residing in rural areas where eHealth is implemented, has limited access to ICT services [7]. Moreover, the disrespect linked to aging or health limitations further isolates elderly patients from the community, diminishing their willingness or capacity to engage with innovations [14]. Furthermore, concerns regarding the protection of individuals' health data online and the utilization of digital health tools contribute to the decision of many individuals to opt out of eHealth services, thereby reinforcing the non-usage of these services and creating an additional barrier [8].

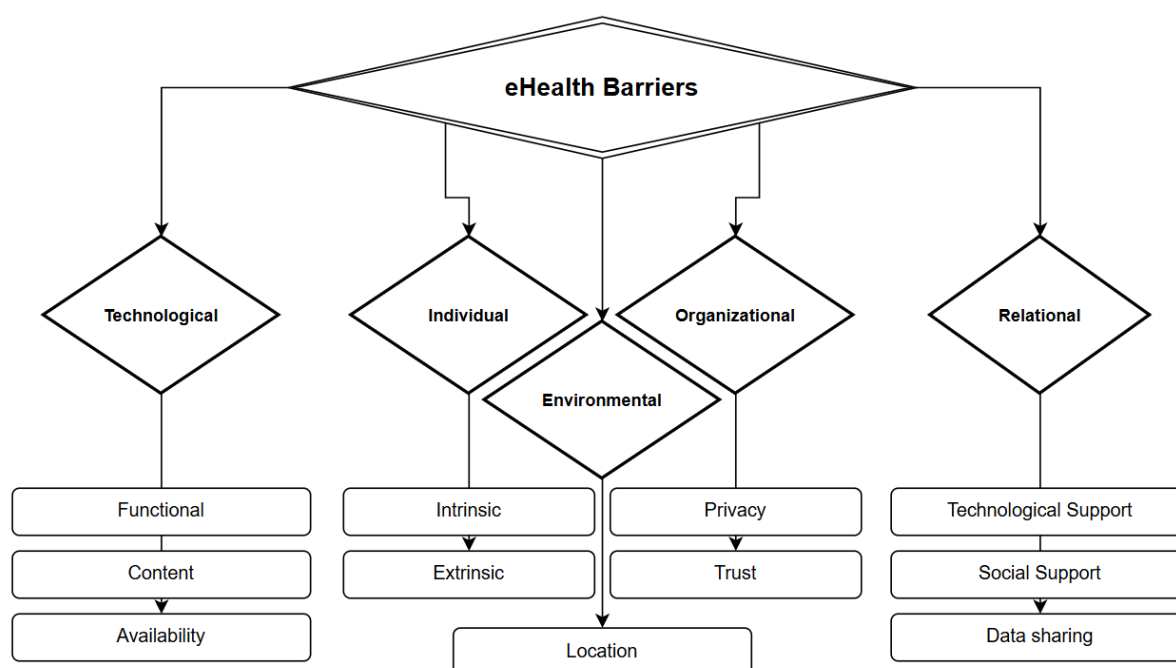
To address these challenges, extensive analysis is essential to identify barriers to eHealth adoption. While numerous studies examine eHealth access barriers among the elderly globally, there remains a distinct gap in understanding these obstacles in the Pakistani context, with age-specific analysis largely unexplored. This study addresses these gaps by employing Dynamic Grey Relational Analysis (DGRA) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), well-established multi-criteria decision-making methods [20, 39]—to systematically identify and rank the relative significance of 40 previously validated eHealth barriers. These methods enable objective ranking based on respondent perceptions without requiring assumptions about data distribution, providing policymakers with a clear prioritization of barriers to target. The Kruskal-Wallis (KW) test is subsequently applied to examine whether these barriers vary significantly across age groups within the elderly population. *Table 1* presents the barrier items with criteria and sub-criteria given by [20].

TABLE 1: THE BARRIERS IN ACCESSING EHEALTH SERVICES (SOURCE: AUTHOR'S OWN WORK)

Criteria	Sub-criteria	eHealth Barrier Item
C1: Technological	C1a: Functional	Small screen and text
		Small icons, lack of colour contrast
		Complex functionality
		Poor functionality
		Lack of alerts
	C1b: Content	Alert fatigue: reminders/emails/texts
		Condescending and impersonalized communication, inability to respond to reminders
		Overwhelming and difficult to understand content
		Too much content on one page
		Lack of access to electronic equipment
C2: Individual	C1c: Availability	Cost of electronic equipment and internet service
		Ageing limitations: reduction of hearing, sight, memory, and fine motor control
		Perceived self-efficacy
		Lacking confidence in e-health
		Fear and dislike of technology
	C2a: Intrinsic	No interest in learning
		Lack of experience/skills with e-health or technology
		Lack of knowledge of e-health
		Previous negative experience
		Unmet expectations
C3: Relational	C2b: Extrinsic	Lack of need to change
		Fear that traditional services may perish
		Disbelief in efficacy of e-health
		Lack of external accountability
		Inability to incorporate into routine
	C3a: Technological Support	Required effort
		Cultural limitations such as language barriers and e-health detracting from time with family
		No training/support to learn
		No one to help troubleshoot issues
		Reliance on family for guidance, and lack of family's patience and understanding while learning
C4: Environmental	C3b: Social Support	Lack of social interaction
		Absence of interpersonal communication
		Communication through technology considered an 'inauthentic experience'
	C3c: Data sharing	Lack of communication between health platforms
	C4a: Location	Poor/unreliable internet
C5: Organizational	C5a: Privacy	Health information concerns
		Unknown accuracy of information
	C5b: Trust	Not knowing who people are communicating with
		Concern over management of emergency situations

Figure 1 and Table 1 present the five validated constructs of eHealth barriers, each representing a category of barriers. The "organizational" identifies 5 barriers, which include the necessity to deliver services or establish infrastructure within the medical sector. The "environmental" construct comprises 1 barrier, which pertain to small yet irrefutable geographical and social environmental challenge, such as geographical distances. The "relational" construct, conversely, comprises 7 barriers that presumably signify a disruption in the communication and interaction processes among elderly users, their caregivers, and medical personnel. The "individual" construct presents the most significant barriers totalling 16, including individuals' abilities, computer literacy, health, and motivation, which contribute to the non-evidence-based utilization of eHealth tools. Finally, the subsequent component is "technological," which encompasses over 11 barriers, indicating concerns related to screen complexity, among others.

FIGURE 1: CRITERIA AND SUB-CRITERIA OF EHEALTH BARRIERS (SOURCE: AUTHOR'S OWN WORK)



METHODOLOGY

This study utilized a cross-sectional research design to investigate the challenges encountered by elderly individuals (aged 60 and above) in accessing eHealth services in Pakistan. This design is well-suited for exploratory studies aiming to identify and rank barriers at a single point in time, particularly when employing multi-criteria decision-making techniques such as DGRA and TOPSIS, which do not require longitudinal data to establish relative rankings. Out of one thousand individuals approached, 450 responded to the survey, with all completing all sections and included in the final analysis. The sample included male and female participants from both urban and rural areas across Pakistan to ensure diverse geographic and socioeconomic representation. The sample was stratified by geographic location, and purposive sampling was employed to capture diverse socioeconomic backgrounds and varying levels of familiarity with digital technologies. The 1,000 potential participants were approached in person at outpatient departments of public hospitals, rural basic health units, elderly day-care centers, and community gathering places (including mosques and senior citizen clubs) across four districts of Punjab and Sindh provinces.

This approach was deliberately chosen for two reasons: first, elderly populations in Pakistan, particularly those in rural areas or with mobility limitations, constitute a hard-to-reach demographic for which comprehensive sampling frames are not

publicly accessible; second, the objective was to capture the breadth of perceived barriers across diverse subgroups rather than to produce statistically generalizable prevalence estimates. Similar methodological approaches have been widely adopted in eHealth barrier research among elderly populations in low- and middle-income country contexts [10, 13, 15]. Given Pakistan's linguistic diversity, the survey was designed in both Urdu and relevant local languages to ensure accurate understanding. A structured questionnaire captured demographic information (gender, age, education level, geographic location) and addressed 40 previously validated eHealth barriers [15], adapted to Pakistan's context. Where necessary, questionnaires were read and explained to participants to accommodate visual impairments or limited literacy. To enhance data accuracy, four attention checks were embedded in the survey. This study received ethical approval from the Institutional Review Board of the University of the Punjab, Pakistan (Approval No. PU/IRB/2025-43, dated 15 September 2025), and all procedures were in accordance with institutional ethical standards. All participants provided verbal informed consent after a full explanation of the study objectives and their right to withdraw at any time without consequence.

Table 2 presents the demographic characteristics of the 450 elderly participants included in this study. The sample comprised 58.9% males (n=265) and 41.1% females (n=185), reflecting the relatively greater accessibility of male respondents in the Pakistani cultural context. A key strength of this study is the balanced distribution across age groups, with 34.4% aged 60-69 years (n=154), 34.23% aged 70-79 years (n=150), and 32.2% aged 80 years and above (n=145), allowing for robust comparative analysis across the entire elderly spectrum. Geographic representation was reasonably balanced between urban (53.3%, n=240) and rural (46.7%, n=210) areas, capturing diverse experiences of eHealth accessibility across different settings. Regarding educational attainment, nearly half of the participants (46.7%, n=210) had no formal education or only junior schooling, while 26.7% (n=120) had completed intermediate education. Higher education levels were less common, with 12.2% (n=55) holding bachelor's degrees and only 7.8% (n=35) having master's degrees. This educational profile aligns with the national literacy trends among older adults in Pakistan and has important implications for eHealth service design, particularly regarding digital literacy requirements and user interface accessibility.

TABLE 2: DEMOGRAPHIC PROFILE OF THE STUDY SAMPLE (N=450) (SOURCE: AUTHOR'S OWN WORK)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	265	58.90%
	Female	185	41.10%
Age Group	60 - 69 years	154	34.23%
	70 - 79 years	151	33.55%
	80 years and above	145	32.22%
Geographic Location	Urban	240	53.30%
	Rural	210	46.70%
Education Level	No Formal / Junior Schooling	210	46.70%
	Intermediate (High School)	120	26.70%
	Bachelor's Degree	55	12.20%
	Master's Degree	35	7.80%

To clarify the study's logical structure, the research data was organized and summarized. The analysis was divided into three main sections: GRA and TOPSIS, and the KW test, with results and interpretations presented for each. The manuscript structure is as follows: The introduction establishes the relevance of assessing eHealth barriers for elderly individuals in Pakistan, while the next section provides the theoretical foundation and application of Grey Systems Theory (GST) and GRA. The research approach follows, detailing the identification of 40 barriers and the analytical methods, GRA, TOPSIS and KW test, used to evaluate them. Subsequent sections discuss findings from the barrier rankings, supported by graphical representations. The manuscript concludes with an overview of the study's contributions and final remarks.

ANALYTICAL FRAMEWORK

The methodology relied on the application of DGRA and TOPSIS techniques. The choice of methods simplified the controlled evaluation of the barriers that were recognised, including classification of these barriers in terms of their severity

and usefulness towards promoting effective eHealth services. Through application of both DGRA and TOPSIS approaches, it provided a more detailed analysis of the key factors that serve to impede the elderly in effective adoption of eHealth facilities, which accounts for contextual relevance in different age cohorts. Descriptive statistics also facilitated the description and organization of the data used in the analysis, which is the demographic attribute of the sample. Particularly, the data were analysed through the groups of age difference in order to observe the variation of barriers to eHealth adoption. This approach also allowed providing a clear picture of the challenges experienced by elderly individuals in Pakistan and plans for interventions were formulated.

RESEARCH INSTRUMENT

The identification of barriers to using eHealth services was carried out in accordance with [20] and the opinions of experts. They found five different constructs, each of which contained various factors and forty different barriers. These barriers were originally identified by Wilson et al. [20] through a comprehensive scoping review of 3536 papers published in Scopus, Medline, Psychology and Behavioral Sciences, Embase, PsycINFO, and CINAHL, establishing a validated framework of eHealth barriers for elderly individuals all over the world. This framework was subsequently adapted and validated for the Pakistani context through expert opinions and pilot testing, following the approach employed in previous eHealth research [10, 11, 12, 13]. In order to assess the extent to which users perceive the negative implications of those barriers, the respondents were provided an instrument including five-points Likert scale that included strongly disagree, disagree, neutral, agree and strongly agree. The questionnaire tool was divided into 2 parts. In the first section, the respondents provided their demographics information whereas in the second section, they provided the data on 40 barriers they are facing in accessing eHealth services.

DATA ANALYSIS

DYNAMIC GREY RELATIONAL ANALYSIS

Deng's GRA is a prominent method within Grey System Research Analysis (GSRA) [16]. A critical parameter of Deng's GRA is the distinguishing coefficient (ξ), which scholars typically assign a value of 0.5. However, some studies have contested this convention, as demonstrated by Xie and Liu [17], while others have verified these objections [18]. Subsequently, Angela and Angelina [19] introduced a generalized version of this model, termed the Dynamic Grey Relational Analysis (DGRA), which has been well received by contemporary scholars [20]. Following this, Delcea and Coffas [21] and Ouali [22] validated the DGRA's validity. The DGRA is predicated on the dynamic Grey Relational Grade (GRG; Γ_{0k}). Let us assume that n respondents rated m barriers (or factors) using 5-point Likert scale. Then, the GRG will be given by Angela and Angelina [19],

$$\Gamma_{0k} = \frac{1}{n} \sum_{j=1}^n \gamma_{0k}(j) \quad (1)$$

where, the dynamic Grey Relational Coefficient (GRC; $\gamma_{0k}(j)$) is,

$$\gamma_{0k}(j) = \frac{\Delta_{min} + \xi(j)\Delta_{max}}{|\Delta_{0k}(j)| + \xi(j)\Delta_{max}}, k = 1, 2, \dots, m \quad (2)$$

Here,

$$|\Delta_{0k}(j)| = |x_0(j) - x_k(j)| \quad (3)$$

$$\Delta_{min} = \min_k \min_j |x_0(j) - x_k(j)| \quad (4)$$

$$\Delta_{max} = \max_k \max_j |x_0(j) - x_k(j)| \quad (5)$$

$$\xi(j) = \{\xi(1), \xi(2), \dots, \xi(n)\}, \xi(j) \in (0, 1] \quad (6)$$

The procedure to obtained $\xi(j)$ is reported in [19]. In this study, a dynamic GRA model was built and executed using Microsoft Excel. Because the sample size was small, it is important to report the Grey Relational Standard Deviation (GRSD); therefore, uncertainty analysis can also be performed, and one can see the range in which the GRG values can vary. The GRSD between the ideal data set X_0 and comparative data sets X_k is calculated as per Angela and Angelina [19],

$$\sigma_{\Gamma_{ok}} = \sqrt{\frac{\sum_{j=1}^n (\Gamma_{ok} - \gamma_{ok}(j))^2}{n-1}} \quad (7)$$

Subsequently, by multiplying the ranks associated with GRG and GRSD, one can obtain the Rank Product Score (RPS), which is a convenient way to cluster the barriers.

Table 3 presents the Grey Relational Grades (GRG) and corresponding rankings for all 40 eHealth barriers evaluated in this study. The results reveal that barriers within the individual construct dominate the highest rankings, with aging limitations (C2a.I1), perceived self-efficacy (C2a.I2), and lacking confidence in e-health (C2a.I3) occupying the top three positions. Other individual barriers, including fear and dislike of technology (C2a.I4), no interest in learning (C2a.I5), lack of experience (C2b.E1), and lack of knowledge (C2b.E2), also feature prominently within the top ten, underscoring the critical role of personal factors in eHealth access. Privacy concerns (C5a.P1) and alert fatigue (C1b.C2) represent the highest-ranked organizational and technological barriers, respectively, indicating that systemic and design-related issues also warrant attention. Conversely, environmental barriers such as poor internet connectivity (C4a.L1) and relational barriers including lack of social interaction (C3b.S1) and absence of interpersonal communication (C3b.S2) occupy the lowest ranks, suggesting these are perceived as less impedimental. The upper and lower bound values (GRG-U and GRG-L) demonstrate the range of uncertainty in the GRG estimates, with narrower bounds indicating greater consensus among respondents. The Rank Product Score (RPS) further refines the ordering by combining GRG and GRSD ranks, with lower RPS values indicating more consistently rated barriers, as seen for C5b.T4 (RPS=17) and C1b.C5 (RPS=33).

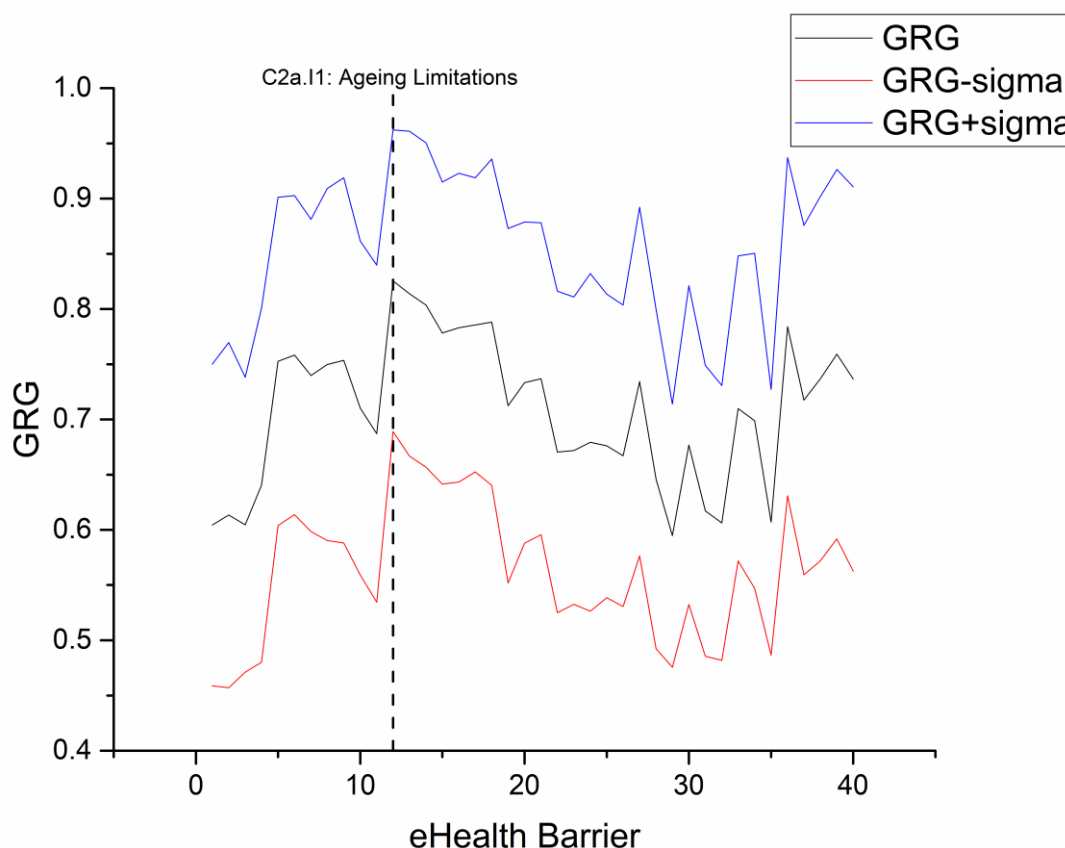
TABLE 3: GREY RELATIONAL EVALUATION OF EHEALTH BARRIERS (SOURCE: AUTHOR'S OWN WORK)

Code of Barriers	GRG	Rank (GRG)	GRSD	Rank (GRSD)	GRG (L)	GRG (U)	RPS
C1a.F1	0.604342	39	0.145674	21	0.458668	0.750015	819
C1a.F2	0.613371	35	0.156261	10	0.457109	0.769632	350
C1a.F3	0.604626	38	0.133535	35	0.471091	0.738161	1330
C1a.F4	0.640499	33	0.160393	6	0.480106	0.800891	198
C1b.C1	0.752558	12	0.148712	17	0.603846	0.90127	204
C1b.C2	0.758203	10	0.144534	24	0.613669	0.902737	240
C1b.C3	0.739796	14	0.141385	26	0.598411	0.88118	364
C1b.C4	0.749747	13	0.159401	7	0.590346	0.909147	91
C1b.C5	0.753481	11	0.165365	3	0.588116	0.918846	33
C1c.A1	0.71023	22	0.151173	16	0.559056	0.861403	352
C1c.A2	0.687091	25	0.152582	14	0.53451	0.839673	350
C2a.I1	0.825486	1	0.136569	33	0.688917	0.962056	33
C2a.I2	0.813795	2	0.147075	19	0.66672	0.96087	38
C2a.I3	0.803502	3	0.146854	20	0.656648	0.950356	60
C2a.I4	0.778219	8	0.136758	32	0.641461	0.914976	256
C2a.I5	0.783106	7	0.139773	28	0.643333	0.922879	196
C2b.E1	0.785652	5	0.133124	36	0.652529	0.918776	180
C2b.E2	0.788048	4	0.147769	18	0.64028	0.935817	72
C2b.E3	0.712397	21	0.160483	5	0.551914	0.87288	105
C2b.E4	0.733347	19	0.145424	23	0.587923	0.878771	437
C2b.E5	0.736853	16	0.141284	27	0.595568	0.878137	432
C2b.E6	0.670533	30	0.145612	22	0.524921	0.816145	660
C2b.E7	0.671752	29	0.139087	29	0.532665	0.81084	841
C2b.E8	0.679205	26	0.152835	13	0.52637	0.83204	338
C2b.E9	0.675984	28	0.137469	31	0.538515	0.813453	868
C2b.E10	0.667127	31	0.136514	34	0.530613	0.803641	1054

C2b.E11	0.734341	18	0.157915	9	0.576426	0.892256	162
C3a.T1	0.64592	32	0.153568	11	0.492352	0.799488	352
C3a.T2	0.594786	40	0.119192	40	0.475594	0.713978	1600
C3a.T3	0.676742	27	0.144381	25	0.532361	0.821123	675
C3b.S1	0.617178	34	0.131672	37	0.485506	0.74885	1258
C3b.S2	0.606308	37	0.124485	38	0.481823	0.730792	1406
C3b.S3	0.709922	23	0.138081	30	0.57184	0.848003	690
C3c.D1	0.698768	24	0.15167	15	0.547099	0.850438	360
C4a.L1	0.606881	36	0.120259	39	0.486622	0.72714	1404
C5a.P1	0.784028	6	0.153123	12	0.630905	0.937152	72
C5b.T1	0.717429	20	0.15823	8	0.5592	0.875659	160
C5b.T2	0.73688	15	0.164952	4	0.571928	0.901832	60
C5b.T3	0.759081	9	0.167295	2	0.591786	0.926375	18
C5b.T4	0.736731	17	0.174035	1	0.562696	0.910766	17

Figure 2 presents the Dynamic Grey Relational Grades (GRG) with upper (GRG + sigma) and lower bounds (GRG - sigma) for key eHealth barriers, where higher GRG values indicate greater significance. Individual construct barriers, particularly aging limitations (C2-a1/2, GRG=0.82) and perceived self-efficacy (C2-a1/4, GRG=0.80), demonstrate the highest values with relatively narrow confidence intervals, reflecting strong respondent consensus on their primary importance. Technological barriers such as alert fatigue (C1b-C5, GRG=0.74) and condescending communication (C1b-C3, GRG=0.75) occupy mid-range positions with wider bounds, indicating greater perceptual variability. Environmental (C4-a1, GRG=0.62) and functional barriers (C1a-F1, GRG=0.60) rank lowest, suggesting they are perceived as less critical obstacles to eHealth access among elderly individuals.

FIGURE 2: DGRA BASED RANKING OF EHEALTH BARRIERS (SOURCE: AUTHOR'S OWN WORK)



TECHNIQUE FOR ORDER PREFERENCE BY SIMILARITY TO IDEAL SOLUTION

TOPSIS is a domain of operations research dedicated to creating computational and mathematical tools to aid decision-makers in evaluating performance criteria subjectively. Numerous challenges in decision-making in the actual world can be addressed. Ranking of alternatives based on TOPSIS, developed by Hwang and Yoon [39], aimed at identifying an object with the maximum score, referred to as the positive ideal solution (PIS), and the minimum score, termed the negative ideal solution (NIS). Recently, numerous methodologies have been introduced for addressing DGRA and TOPSIS methods; for instance, Matambo [23] evaluate e-commerce barriers through DGRA, and Yoon and Hwang [24] applied TOPSIS. Li et al. [25] developed Grey Multiple Attribute Decision Making (GMADM), while Ma [26] and, Yang and Hu [27] explored novel approaches utilizing fuzzy \$\beta\$ covering techniques. Additionally, Atef and Liu [28] proposed Multiple Attribute Grey Decision Making (MAGDM) inspired by the concepts of Yoon and Hwang [24], among others Mardani et al. [29], Sun et al. [30], Zhang et al. [31], and Derici and Dogan [32]. Therefore, the subsequent procedure is executed: STEP 1. The normalized matrix was calculated as:

$$N(x_{ij}) = \frac{x_{ij}}{\sqrt{\sum_{j=1}^n x_{ij}^2}} \quad (8)$$

STEP 2. Calculate the weighted normalized matrix.

$$K_{ij} = N(x_{ij}) * W_j, \quad (9)$$

where W is the weight vector such that $\sum_{j=1}^n W_j = 1$.

STEP 3. Calculate the ideal best $K_j^+ = \max(K_{ij})$ and worst $K_j^- = \min(K_{ij})$ value.

STEP 4. The distance from the ideal best was calculated using the following formula:

$$D_i^+ = \sqrt{\sum_{j=1}^n (K_{ij} - K_j^+)^2} \quad (10)$$

STEP 5. Hence, the distance for the ideal worst case was computed as follows:

$$D_i^- = \sqrt{\sum_{j=1}^n (K_{ij} - K_j^-)^2} \quad (11)$$

STEP 6. Calculate the score, and then rank the alternatives.

$$S_i = \frac{D_i^-}{D_i^+ + D_i^-} \quad (12)$$

Table 4 presents the TOPSIS rankings of eHealth barriers, showing remarkable consistency with the DGRA findings. Individual construct barriers dominate the top positions, with aging limitations (C2a.I1), perceived self-efficacy (C2a.I2), and lacking confidence in e-health (C2a.I3) ranked first, second, and third, respectively. Lack of experience (C2b.E1) and no interest in learning (C2a.I5) complete the top five, underscoring the primacy of personal factors in hindering eHealth access. Privacy concerns (C5a.P1) emerged as the highest-ranked organizational barrier at eighth position, while alert fatigue (C1b.C2) and lack of alerts (C1b.C1) were the top technological barriers at ninth and tenth, respectively. At the lower end, functional barriers (C1a.F1-F3), lack of social interaction (C3b.S1), and absence of interpersonal communication (C3b.S2) ranked among the lowest, suggesting these are perceived as less critical.

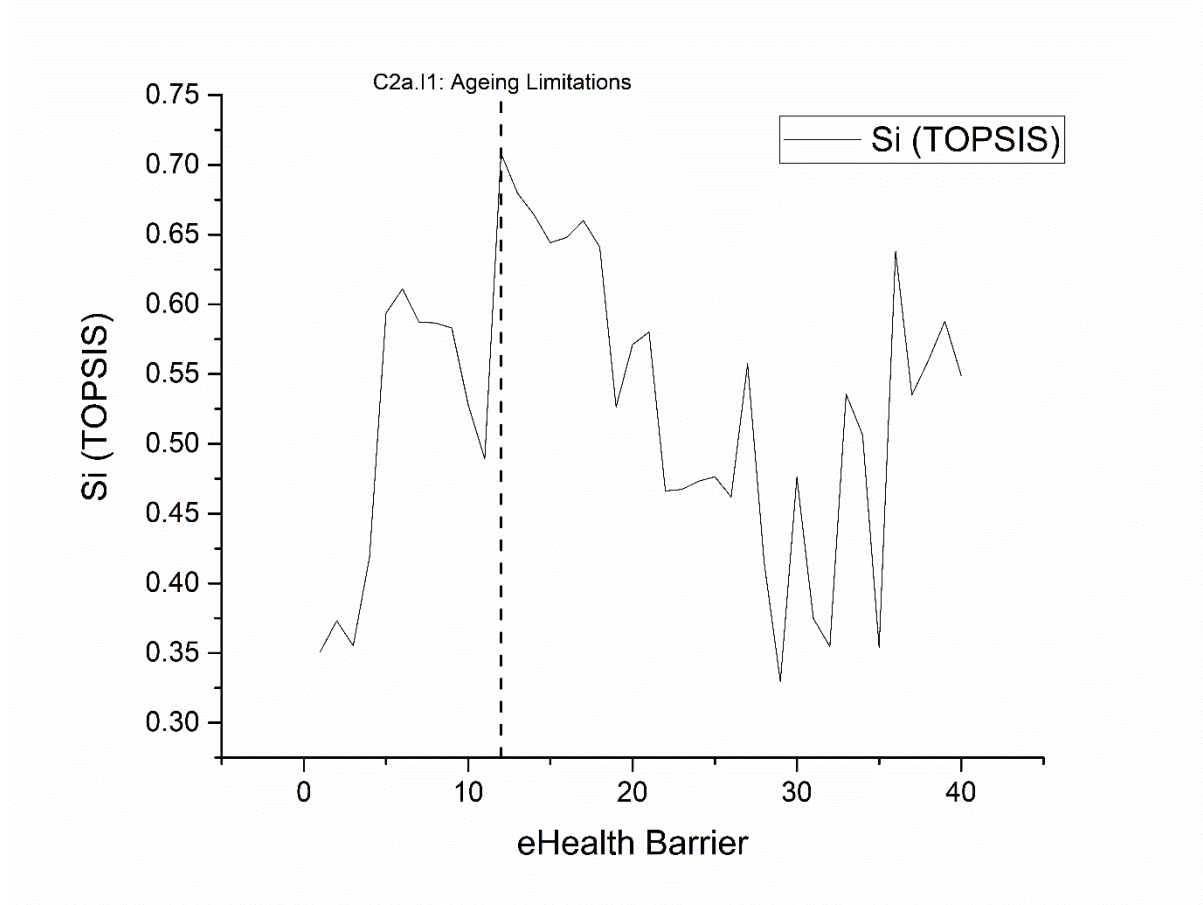
TABLE 4: ORDERING ALTERNATIVES THROUGH TOPSIS (SOURCE: AUTHOR'S OWN WORK)

Coding of Barriers	D_i^+	D_i^-	S_i	Rank
C1a.F1	0.662163	0.357984	0.350914	39
C1a.F2	0.660505	0.393024	0.373055	35
C1a.F3	0.649519	0.357792	0.355195	36
C1a.F4	0.611476	0.440544	0.41876	32
C1b.C1	0.394417	0.576281	0.593677	10
C1b.C2	0.371512	0.583842	0.611127	9
C1b.C3	0.391277	0.556683	0.587243	12
C1b.C4	0.40403	0.57342	0.586649	13

C1b.C5	0.409254	0.572343	0.583073	14
C1c.A1	0.463143	0.517908	0.527912	22
C1c.A2	0.503959	0.482847	0.489303	25
C2a.I1	0.27331	0.663197	0.70816	1
C2a.I2	0.305962	0.649202	0.679676	2
C2a.I3	0.322961	0.638774	0.664189	3
C2a.I4	0.334018	0.604941	0.644268	6
C2a.I5	0.332579	0.612261	0.648005	5
C2b.E1	0.315229	0.612037	0.660044	4
C2b.E2	0.3469	0.619272	0.640954	7
C2b.E3	0.462402	0.514057	0.52645	23
C2b.E4	0.406735	0.541962	0.57127	16
C2b.E5	0.397532	0.549247	0.580122	15
C2b.E6	0.518305	0.452818	0.466283	30
C2b.E7	0.521337	0.457485	0.467383	29
C2b.E8	0.521469	0.468293	0.473137	28
C2b.E9	0.505453	0.460025	0.476474	26
C2b.E10	0.525136	0.450998	0.462025	31
C2b.E11	0.437108	0.550369	0.557348	18
C3a.T1	0.586185	0.416721	0.415514	33
C3a.T2	0.655296	0.322111	0.329557	40
C3a.T3	0.507482	0.461066	0.476038	27
C3b.S1	0.617832	0.370403	0.374813	34
C3b.S2	0.634144	0.348477	0.354641	37
C3b.S3	0.441321	0.509369	0.535789	20
C3c.D1	0.481141	0.493516	0.506348	24
C4a.L1	0.624671	0.342327	0.35401	38
C5a.P1	0.350047	0.617499	0.638211	8
C5b.T1	0.462847	0.532265	0.53488	21
C5b.T2	0.439765	0.559385	0.55986	17
C5b.T3	0.413088	0.589217	0.587862	11
C5b.T4	0.462106	0.562683	0.549072	19

Figure 3 illustrates the TOPSIS performance scores for selected eHealth barriers, where higher values indicate greater significance. Consistent with the DGRA findings, individual construct barriers dominate the upper range, with aging limitations (C2-a12, score=0.71) and perceived self-efficacy (C2-a14, score=0.67) achieving the highest scores, followed closely by lack of experience (C2-b1-E1, score=0.66). Technological content barriers, including condescending communication (C1b-C3, score=0.60) and alert fatigue (C1b-C5, score=0.59), occupy the mid-range, indicating moderate importance. Notably, environmental factors (C4-a1, score=0.64) show relatively higher scores in this visualization, suggesting some regional variation in perceived barriers. Functional barriers (C1a-F1, score=0.35; C1a-F3, score=0.37) and relational barriers (C3-b1, score=0.32; C3-b3, score=0.36) cluster at the lower end, reinforcing that technical complexities and social support concerns, while relevant, are secondary to individual capacity and health-related limitations in explaining eHealth access challenges among elderly populations.

FIGURE 3: TOPSIS BASED RANKING OF EHEALTH BARRIERS (SOURCE: AUTHOR'S OWN WORK)



KRUSKAL-WALLIS TEST

The KW test is a nonparametric alternative to ANOVA Wissing and Timm [33] and can be viewed as a generalized form of the Mann-Whitney test Du Prel et al. [34]. This test evaluates whether distributions differ across three or more independent groups by comparing their mean ranks. In this study, the KW test was applied to examine differences across three age groups of elderly participants, 60-69 years ($n = 155$), 70-79 years ($n = 150$), and 80+ years ($n = 145$), using IBM® SPSS® 24 software for statistical analysis. The null hypothesis tested was that the mean ranks across these groups are equivalent. Elderly individuals over the age of 60 face comparable challenges in performing daily activities, primarily due to physical and cognitive limitations associated with aging. Differences between the age groups, 60-69, 70-79, and 80+, were expected to be minimal. To explore this, we applied the KW test to assess any significant differences across these age groups within the elderly population. Below given are the steps to apply KW test:

STEP 1: Rank all of the scores, regardless of which group they belong to; the lowest score receives the lowest ranking.

STEP 2: Calculate T_g , the sum of the ranks in each group. Simply add up all of the ranks for each category in turn.

STEP 3: Find H as

$$H = \left[\frac{12}{N(N+1)} * \sum \frac{T_g^2}{n_g} \right] - 3 * (N + 1) \quad (13)$$

Where N is the total number of respondents, T_g is the rank sum of each demographic group, and n_g is the number of respondents in each group. The current study employed IBM SPSS software to administer this test to four groups (age, gender, education, marital status, and participant category).

STEP 4: The degrees of freedom (df) equal the number of groups minus one. We have four groups with three degrees of freedom.

STEP 5: The number of groups and participants determines how significant H is.

In accordance with the assumptions of the KW test and the focus of our study, we formulated the following null (H_0) and alternative (H_1) hypotheses.

H_0 : There is no significant difference in barrier to access eHealth services across different age groups of the elderly.

H_1 : There is a significant difference in barrier to access eHealth services across different age groups of the elderly.

Evaluation of eHealth service barriers across the three age groups using the KW test revealed no significant differences, as indicated by an asymptotic significance level of 0.487 ($p > 0.05$) (see Table 5). This result supports the acceptance of the null hypothesis, confirming that barriers to eHealth access are comparable across the age groups studied, and there is no significant difference found among age groups.

TABLE 5: KRUSKAL-WALLIS TEST RESULTS FOR BARRIERS ACROSS AGE GROUPS (SOURCE: AUTHOR'S OWN WORK)

Mean Barriers	Age Group	Sample (n)	Mean Rank
	60-69 years	154	226.34
	70-79 years	151	231.78
	80 years and above	145	218.62
Chi-Square	1.452		
Degree of Freedom	2		
Asymp. Sig.	0.487		

DISCUSSION

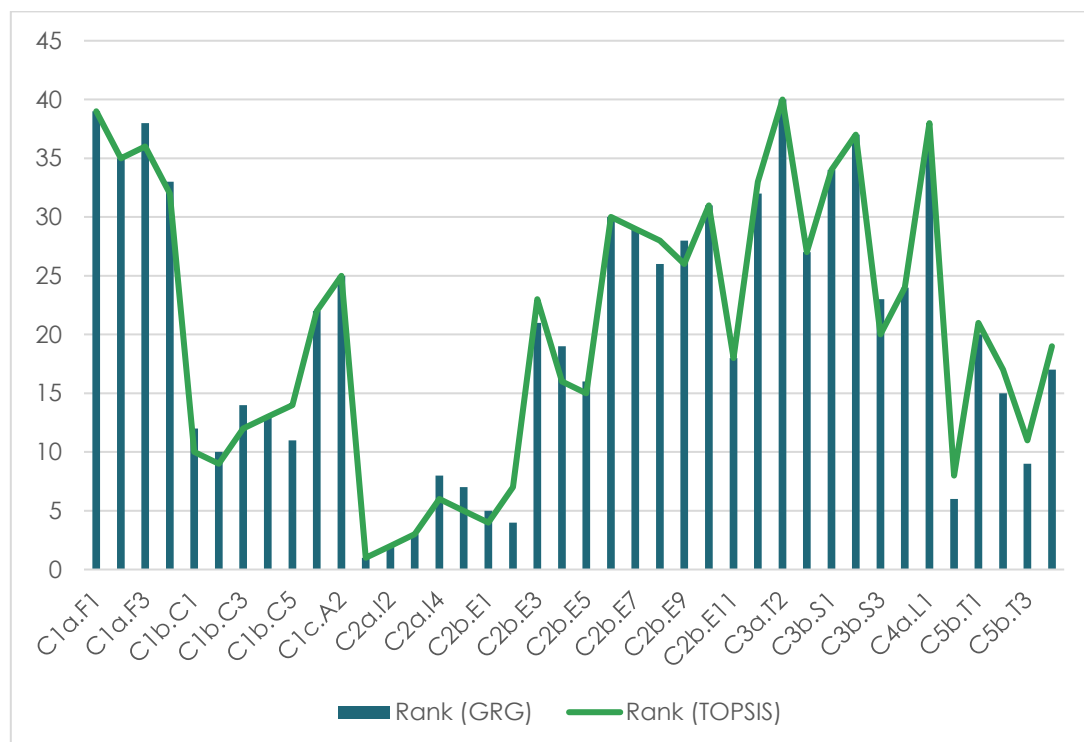
The findings from this study provide critical insights into the barriers affecting eHealth access among elderly individuals in Pakistan, with important implications for healthcare policy and digital health infrastructure development. The application of both DGRA and TOPSIS methods consistently identified "aging limitations" including reductions in hearing, sight, memory, and fine motor control, as the most significant barrier across all analyses, underscoring the fundamental role of age-related physiological changes in shaping digital health engagement. Notably, most of the top ten barriers belonged to the "individual" construct, suggesting that personal factors such as perceived self-efficacy, lack of confidence in eHealth, and fear of technology, collectively represent the most formidable obstacles to eHealth adoption among older adults. The organizational construct emerged as the second most impactful category, highlighting systemic issues related to privacy concerns, trust in digital platforms, and emergency management that require coordinated responses from healthcare institutions.

Importantly, the KW test results ($\chi^2 = 1.452$, $p = 0.487$) confirmed that these barriers are experienced uniformly across all age groups (60-69, 70-79, and 80+ years), suggesting that interventions should adopt a universal design approach rather than targeting specific age cohorts. The balanced sample distribution achieved in this study ($n=450$ with 145-155 respondents per age group) strengthens the validity of these findings and addresses methodological concerns regarding underrepresentation of the oldest-old population. From a policy perspective, these results underscore the urgent need for age-sensitive eHealth solutions that accommodate age-related impairments through features such as voice-activated interfaces, adjustable text sizes, simplified navigation, and AI-driven assistance, while simultaneously addressing organizational barriers through transparent data governance and digital literacy programs tailored to Pakistan's diverse elderly population.

A comparison of the rankings obtained from DGRA and TOPSIS reveals notable consistency in the identification of critical barriers to eHealth access among elderly individuals, presented in Figure 4. Barriers within the individual construct, particularly those related to intrinsic aging limitations (C2.a1.1) and extrinsic factors such as lack of experience (C2.b1.E1), consistently ranked among the highest in both methods, reinforcing their prominence as primary obstacles. Technological barriers related to content complexity (C1b.C3) and alert fatigue (C1b.C5) also showed strong alignment across both

ranking techniques. Conversely, environmental (C4a.L1) and relational barriers (C3b.S1, C3b.S3) were consistently ranked lower by both methods, suggesting they are perceived as less impedimental. This convergence between DGRA and TOPSIS rankings enhances the reliability of the findings and provides robust evidence base for prioritizing interventions targeting the most impactful barriers.

FIGURE 4: COMPARATIVE ANALYSIS OF EHEALTH BARRIERS (SOURCE: AUTHOR'S OWN WORK)



CONTRIBUTION OF THE STUDY

This study adds to the body of knowledge of GST in the following ways. First, this is the first study to use DGRA, TOPSIS, and KW test focusing on the elderly population of Pakistan. Previous research has shown that policies need to be specific to the needs of older adults in the perspective of telehealth services. Second, we used a Likert scale to collect data to learn more about elderly individuals' perceptions, which provides richer insights compared to other studies. Third, the study highlights the importance of considering different age groups among the elderly, which provides valuable insight to healthcare policy makers to formulate strategies. This helps them set goals and address eHealth barriers effectively. It is important to pay attention to both the top barrier and the top set of barriers. eHealth segments such as eHealth apps, online doctor consultations, online pharmacies, and eHealth gadgets are associated with the evaluated eHealth barriers. Considering the growing rate of the elderly population in Pakistan, healthcare policy makers need to offer a wide range of services in home, community, and institutional settings that are well-balanced and specifically designed to meet the wants and needs of older adults.

The findings highlight the importance of continuing to work on projects and actions that make eHealth primary care services easier to access, as also suggested by Bardhan and Ashraf [35]. For the elderly in Pakistan, building long-term eHealth primary care infrastructure is very important because it is linked to the work of hospitals and the government. Studies have shown the effectiveness of comprehensive long-term care systems in other regions, highlighting the possible benefits of similar approaches in Pakistan [8]. Furthermore, research indicates that when elderly individuals perceive ICT as useful and relevant to their daily tasks, they are increasingly likely to adopt and engage with these technologies.

IMPLICATIONS AND RECOMMENDATIONS

The findings carry significant implications for healthcare policy and practice in Pakistan. The consistent ranking of "aging limitations" (reductions in hearing, sight, memory, and fine motor control) as the most critical barrier underscores the need for age-sensitive eHealth design, including voice-activated interfaces, adjustable text sizes, and simplified navigation.

Healthcare policymakers should mandate accessibility standards for digital health platforms and integrate digital literacy programs into primary healthcare services, leveraging community health workers to provide hands-on training for elderly individuals in both urban and rural settings. The prominence of privacy and trust-related barriers further indicates that healthcare institutions must develop transparent data governance policies tailored to elderly users. For practitioners, eHealth interventions should be introduced gradually, beginning with simple task-specific applications such as medication reminders, to build self-efficacy and reduce technology-related anxiety. Finally, as the KW test confirmed no significant differences across age groups ($p = 0.487$), a universal design approach rather than age-segmented interventions represents the most efficient and equitable strategy for improving eHealth access among Pakistan's elderly population.

CONCLUSION

This research utilized a mixed-method approach that incorporated both DGRA and TOPSIS, in addition to the KW test. DGRA and TOPSIS techniques were employed to identify and rank the barriers encountered by elderly individuals in accessing eHealth services. The KW test was employed to examine the significant difference in top ranked barrier to access eHealth services among various age groups of the elderly. Together, these methods provide a robust foundation for targeted policy interventions and the development of age-sensitive eHealth strategies aimed at reducing healthcare disparities among older adults in Pakistan.

Using the constructs of technology, individual, relational, environmental, and organizational factors, the DGRA and TOPSIS analyses identified the 'Individual' construct as the most impactful barrier to eHealth access among elderly individuals. The primary barrier, 'aging limitations', including reductions in hearing, sight, memory, and fine motor skills, was consistently recognized as the most significant obstacle across analyses. The KW test further confirmed that this barrier affects all elderly age groups similarly, with no statistically significant differences observed between age groups over 60. This finding suggests that policymakers should prioritize addressing aging-related limitations uniformly across the elderly population in eHealth policy planning. To mitigate these barriers effectively, enhancements in the eHealth sector should incorporate user-friendly technologies, such as thumbprint authentication, AI-driven assistance, and eye-tracking features, designed to accommodate age-related impairments and improve accessibility for all elderly users.

This study has limitations, notably the reliance on cross-sectional data, which restricts the ability to establish causal relationships. Subsequent investigations employing longitudinal data may broaden the applicability of this study. Second, our study encompasses elderly individuals who indicated insufficient access to ICT. The implementation of eHealth services is dependent on the accessibility of the eHealth segment, which constrains their utilization. The implementation of internet of things (IoT) systems and digital health technologies has the potential to improve healthcare accessibility and autonomy for the elderly. Third, the study did not address the aspirations of older adults; therefore, eHealth service providers should foster an interest in technology among this demographic. The findings suggest that individuals with a natural curiosity and interest in technology are more likely to adopt eHealth services and engage with various eHealth primary care platforms. Four, the current study did not consider the potential impact of additional factors that may act as facilitators, including individuals' ambitions and tendencies to embrace a new lifestyle, as well as their aspirations to contribute to scientific progress by participating in eHealth program research trials. Future studies should concentrate on the facilitating factors. International health organizations, including the WHO, underscore the necessity of incorporating digital health into healthcare policies to enhance health systems. Five, GRA, TOPSIS, and KW test are the non-parametric statistical techniques applied in this study. To enhance the generalizability of the findings in future studies, non-parametric methods can also be integrated with parametric techniques such as regression analysis and structural equation modelling, as demonstrated in prior studies Khan et al. [36], Jiang et al. [37], and Nawaz et al. [38]. Six, the study employed purposive sampling rather than a probability-based sampling framework derived from official census data (e.g., Pakistan Bureau of Statistics). While this approach was appropriate for capturing diverse perspectives across hard-to-reach elderly subgroups and for the exploratory ranking objectives of this study, the findings may not be statistically representative of Pakistan's entire elderly population. Future research should consider probability sampling methods where feasible to enhance generalizability.

Seven, considering the advancement of methodology, future studies may also incorporate additional multi-criteria decision-making methods, such as the Analytical Ordinal Priority Approach (AOPA), to further validate and extend the ranking results presented here. Finally, the questionnaire tool lacked identification checks concerning health or functional limitations. The study was thus constrained in assessing the ranking of barriers according to the level of physical or cognitive impairment. In light of this research gap, subsequent studies may assess the ranking of barriers according to the severity of age-related limitations through MCDM methodologies and further explore significant differences among impairment levels by utilizing the KW test.

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CONFLICT OF INTEREST

Authors declared no conflict of interest.

DATA AVAILABILITY

The data underlying this article will be shared on reasonable request to the corresponding author.

DECLARATION OF COMPETING INTEREST

Authors have no conflicts of interest to disclose.

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HOW DOES POOR MENTAL AND PHYSICAL HEALTH AFFECT PRODUCTIVITY?

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ABSTRACT

This research paper aims to study how poor mental and physical health could impact the productivity of employees. A person's overall health is of utmost importance as it has a serious contribution towards contentment in their lives and it can have an impact on the economic development of the country. Poor physical health and mental health could lead to a decrease in productivity, as well as increasing healthcare costs. The various health issues are fatigue, obesity, chronic illness, depression and many more. These has a negative impact on the financial outcomes of the businesses and stress on the medical system.

It is also found from the study that the cases of OUD are rising, along with a rising problem in the workplace environment. This could have a significant impact on the workplace efficiency and the well-being of the staff members of a company. This issue could be treated with prescribed drugs, but prolonged use of opioids to treat this disorder can lead to dependency and tolerance towards it. There have also been incidences of abuse of these opioids by employees to reduce and alleviate their pain, which could lead to a habit towards [1].

A survey was conducted among 200 respondents, which is aimed at studying the impact on productivity of employees who have mental or physical health disorders. The respondents of the survey were from a wide range of industrial backgrounds and educational experiences. This survey is also conducted to emphasize the importance of maintaining the physical and mental well-being of employees by an organization, as it can have direct consequences on organizational outcomes. The respondents agreed that encouraging social activities or exercises can lead to improvement in the productivity of employees as it improves the physical and mental health conditions at the workplace.

KEYWORDS

Mental health, physical health, workplace productivity, health conditions, anxiety.

INTRODUCTION

BACKGROUND

Mental health issues such as depression and anxiety have been a growing concern in the working environment in most nations. Organizations that assist employees with psychological disorders and encourage mental wellness are far more inclined to minimize presenteeism—a term used to describe employees who are less productive at their job—and boost employee efficiency by lowering absenteeism [2]. Several studies have investigated that there is a significant correlation between the occurrence of episodes of mental health as well as absenteeism. The investigators also concluded that depression-related conditions constituted the most prevalent form of mental illness across most personnel. But our study and its originality contribution relative to prior work appears from A comprehensive examination is necessary to fully understand the consequences of the financial system. Considering chronic illness generally results in a decline in the standard of living and social withdrawal, it may be quite debilitating. Consequently, examining this matter might lead to solutions for enhancing communications and attaining pleasure. Alongside the physical settings, there are other additional significant factors that affect the well-being of the employees. For instance, organizational challenges like taking responsibility as a leader and lacking personal assistance and diverse job-specific variables such as workload and imbalance amongst the requirements of employment and the assets that are accessible. These factors have an adverse impact on the health and mental well-being of individuals as they have been found to struggle with the key triggers for sleep disruption, exhaustion, mood swings, headaches and irritable gastrointestinal problems.

PROBLEM STATEMENT

Mental and physical health problems are becoming more prevalent today. The cornerstone of an individual's happiness as a human being is their psychological and physical wellness. The health issues involve anxiety, depression, stress, fatigue, overweight and persistent illness. Given that these challenges impact a considerable segment of the community, concerns exist over the possible consequences for overall productivity. There might be detrimental financial effects from having poor physical and mental health. Reduced efficiency, rising absenteeism, and increasing costs for healthcare are having an impact on companies as well as medical systems [3].

SIGNIFICANCE OF THE RESEARCH

Well-being concerns like migraines, weariness, and tense muscles may originate from psychological problems that reduce efficiency. Furthermore, those with inadequate psychological conditions might take longer breaks or find it challenging to regularly attend up for employment, which at first may adversely affect both their own and other people's performance [4]. Additionally, a person's drive, inventiveness, and capacity for teamwork could all be impacted by their psychological well-being. Businesses must, thus, establish a culture that delivers encouragement at their jobs that encourages healthy psychological well-being as well as offers help and amenities to staff members who might be experiencing mental well-being problems. The research will further investigate the topic of the way poor mental and physical health might affect productivity.

AIM AND OBJECTIVE OF THE RESEARCH

The achievement of the company is significantly influenced by the worker's efficiency. Maintaining the physical and emotional well-being of staff members is critical to their effectiveness. Thus, the research will aim to investigate the way poor mental and physical health affects productivity. Hence, to accomplish the aim, the research will address the following objectives which are as follows:

- To analyse the impact of mental and physical health on employee productivity.
- To evaluate the factors resulting in mental and physical health issues of employees.
- To recommend ways to enhance employee mental and physical health to ensure productivity.

RESEARCH QUESTIONS

The research will attempt to answer the following questions on the particular research topic which are as follows:
RQ1: How do poor mental health and physical health affect employee productivity?

RESEARCH HYPOTHESIS

Therefore, based on the above research questions, the following hypothesis have been framed which are as follows:

H1: Poor mental and physical health significantly impacts employee productivity.

REVIEW OF LITERATURE

IMPACT OF MENTAL AND PHYSICAL HEALTH ON EMPLOYEE PRODUCTIVITY.

As per the statement of WHO, being healthy is a condition of whole intellectual, bodily, and societal wellness rather than solely the lack of illness and disability. The intricate interplay amongst a person's emotional, mental, and institutional assets, as well as the pressure imposed by their human and societal surroundings at both places of labour, leads to their overall state of well-being. Anxiety and sadness are examples of mental well-being conditions that can lead a professional to become distracted, which makes it highly challenging to concentrate on multiple things and do daily tasks at the workplace [5]. It might be challenging for a staff member to fulfil commitments due to a lack of resilience. Paranoia can result from anxiousness or melancholy, which means the most positive remarks could be perceived negatively by the sufferer, forcing them to wonder about their talents and self-worth. This can undermine the sufferer's morale and productivity in the near term. Furthermore, the dynamics of the personnel, which make the workplace less of a collaborative environment and a greater degree of a competitive environment, could constitute the root reason for psychological problems rather than just physical working environments.

Individuals experiencing psychological problems might discover it difficult to engage alongside other individuals, leading these individuals to withdraw from society. This greatly obstructs interaction, particularly in professional contexts where inattentiveness frequently lowers productivity. Furthermore, the norms, environment, and overall vibrancy of any given workplace frequently have been shifting, which may be quite challenging for an individual who is having psychological disorders. It might seriously impede your company's inherent development procedure to be unable to adjust to an atmosphere that continually changes.

Opioid Use Disorder (OUD) is a syndrome that more personnel are experiencing, which is a rising problem in work environments. Both company efficiency and the well-being of staff members could be significantly impacted by OUD [6]. The excessive prescribing of opioids to alleviate pain constitutes several of the leading causes of OUD in the job sectors. Medications with a prescription are often used by employees with persistent discomfort to treat the signs they have, but gradually, this can result in tolerance and dependency. In addition, certain employees might purposefully abuse opioids towards an attempt to relieve strain or worry, which could potentially result in habits and dependency.

EVALUATING THE FACTORS RESULTING IN MENTAL AND PHYSICAL HEALTH ISSUES OF EMPLOYEES.

According to research, there are over 24,000 instances of psychological issues in the United Arab Emirates [7]. It notes that illicit drug misuse, depression, and stress were some of the most common disorders among the populace. A mental wellness problem also affects approximately fifty per cent of Americans at some point in their lives. Amongst the workers polled, 57.9% reported that their mental health was negatively impacted by their jobs in some way. There are several factors cited in the literature that demonstrate the cause of the mental and physical health issues of employees at their workplaces. One such factor has been the influence of the physical settings on the condition of individuals. Unfavourable interior environments, disturbances, and distractions negatively affect workers' health and well-being. Contrary to this, a positive work environment is enhanced by suitable chances for communication, concentration, and outdoor interaction. In many workplaces, the physical surroundings have been very poor, where there is an absence of natural sunlight, lush vegetation, noisy settings, disarray and rigid arenas. These poor physical settings at the workplace also affect the efficiency of the employees as most of them are found to be frequently complaining about the same to the top management, which in turn affects the productivity of the company.

The OUD disorder-affected workers may have fewer absences and be less on time. People might have to leave labour to attend therapy visits [8]. This may result in a decline in output and efficiency at their workplace, which might have serious repercussions for both the person as well as the company.

RECOMMENDING WAYS TO ENHANCE EMPLOYEE MENTAL AND PHYSICAL HEALTH TO ENSURE PRODUCTIVITY.

Worker's happiness, efficiency, expenses, business reputation, and vulnerability are just a few of the principles that might be impacted, either intentionally or inadvertently, by productive environments that promote workers' overall well-being. Conversely, ideals like conservation might improve well-being and happiness. Workplaces must prioritize the aspects of humanity, the environment, and revenue, and to achieve all three, the work settings must adhere to sustainable constructions, which are claimed to be cleaner than non-green structures. Research finding revealed that based on the regional temperature, wind-induced structure movement might result in workers' mental illness as well as a 30% drop in efficiency. Also, professionals working in green-certified structures have performed 26% higher on their psychological assessment, and 30% reported having fewer sick-enabled symptoms when operating in an unhealthy apartment than those functioning in non-certified structures. These effects are very varied nevertheless, are projected to be considerable over time[9]. Thus, the workplace must be flexible and should have enough space for the employees to move around, and their cabinets must be structured in the form of cell workplaces so that employees can maintain their privacy in their work settings and perform their work with fewer disturbances and with great efficiency. Moreover, there is a positive impact on the IAQ (interior-air quality) on well-being and productivity as the findings showed a higher realistic standard for the workplace's long-term viability, variety, natural surroundings, and opportunities for movement and relaxation. Enhanced physical exertion and interpersonal interaction, improved cooperation and production, and elevated perceptual experiences of motivation, warmth, and vitality.

Another recommendation for the employee's mental and physical well-being is that workplaces must allow their employees further freedom regarding the way they carry out their duties. According to the investigation, possessing zero influence over the way tasks are completed is linked to greater incidences of coronary artery ailment as well as a decline in psychological wellness. Furthermore, there is a substantial spike in the likelihood of Type 2 diabetes along with cardiac demise when work-related stresses and inadequate job management are combined. The health of employees can be affected by even little adjustments to staff member flexibility. Furthermore, organizations must maintain a sufficient staffing level for appropriate assignments inside their organization. Excessive job expectations, such as extended working periods or the need to function quickly or diligently, have been shown to have a negative impact on the health and wellness of workers. A number of findings indicated that a combination of elevated expectations and inadequate supervision leads to adverse well-being effects such as increased prevalence of depressive disorders, hypertension, and coronary artery diseases.

Programmes and activities are also being implemented within workplaces with the goal of enhancing staff efficiency and psychological well-being. EAP, also known as the Employee Assistance Programme, offers counselling and other amenities for staff members who might be dealing with psychological disorders is a perfect example. An analysis of forty-two research on worker assistance programmes revealed that these programmes were successful in lowering stress, nervousness, and unhappiness in workforces, which subsequently raised output.

Finally, to reduce mental and physical ailment, working professionals should follow certain precautionary measures to remain healthy and fit and, in turn, enhance productivity in their work settings. Presently, after the global epidemic, there has been a significant change in the pattern of work, and several employees have been experiencing a flexible pattern in performing their jobs. The effect of working from home has been found to be both positive as well as negative. However, recommendations for operating efficiently in positive work-from-home settings involve establishing a feeling of discipline and habit, which could assist in psychologically separating job duties while operating from home. Workers could establish frequent pauses during their commute to warm up, go for a little stroll, or practise mindfulness. They will feel refreshed and progress on their job if they follow the strategy while working from their homes.

METHODOLOGY

RESEARCH DESIGN

The methods that are required to be utilized in the research will be referred to as research design, and this study will employ a hybrid methodology that integrates qualitative and quantitative methods to investigate the association between low physical and psychological wellness and work output. To achieve its goals, the study would employ a mixed investigation technique, analysing data from both primary and secondary sources.

The secondary data used in the investigation's qualitative element will come from a study of the body of current literature. Sources would include formerly published books, journals, and research papers for conducting the research on the pertinent topic. Examining the body of current literature and coming to the right inferences would be the sole purpose of this research. Because of the strong theoretical foundation, the researcher established in the qualitative phase, evidence has also been gathered to address the research questions and hypotheses for the quantitative phase.

DATA COLLECTION INSTRUMENTS

The primary data was collected through administering a survey of 200 respondents belonging to a wide range of industries and educational backgrounds. The primary technique for gathering information to estimate the financial impact of psychological and physical disease on performance will be a survey. By means of the survey, significant information will be gathered, including population size, expressed psychological and physical wellness, efficiency, coping mechanisms, as well as access to resources and assistance at work. To provide quantitative data appropriate for thorough statistical assessment, the inquiries for the survey will be carefully crafted to guarantee precision and pertinence.

ETHICAL CLEARANCE APPROVAL

This paper involve human and all the procedures covered were in accordance with National Health and Medical Research Council ethical standards. After taking the research panel approval for this paper with number AY 2/2024. liwa university UAE

DATA ANALYSIS

The analysis of the survey will include various quantitative tools such as data visualization, inferential statistics, and descriptive statistics. With the utilization of descriptive statistics, emphasis will be given to the important characteristics of the data, which will be the main emphasis of the preliminary study. The median of central tendency will be computed through the means, medians, and standard deviations for several additional metrics, which will include indicators of productivity, physical fitness, and emotional health. Finally, a sense of the entire dataset could be rapidly obtained and could be seen whether there are any obvious inclinations or outlines that require more research by utilizing descriptive statistics.

Further, the study will also use inferential statistics to hunt for associations that could point to casualty. The degree of connections among the parameters will be evaluated using statistical methods like a correlation investigation. Attendance patterns along with wellness (for instance, detecting the level of stress) might be examined to determine if there is a relationship. Additionally, regression investigation may be utilized to look at possible consequences that could result from a change in the worth of one variable in relation to another.

The material acquired for this portion of the investigation will be subjected to a thematic examination as one of the qualitative data examination approaches to assist the researcher in identifying recurring themes. The additional background and intricacy that this qualitative research provides will help the quantitative conclusions. The study will require the use of these techniques to examine the survey data in a manner that is convincing and comprehensive. Also, these theories will be tested and insightful results of how low psychological and physical health affect efficiency using this multifaceted approach.

Data Analysis

the analysis of data collected through an online survey to investigate the impact of poor mental and physical health conditions on employee productivity at an organisation. The study aims to evaluate how important it is to maintain the mental and physical well-being of a company's staff to enhance their productivity and contribute to the company's success effectively. For this, an online survey was conducted surveying 200 professionals and workers from a wide range of industry and education backgrounds. The justifications of the sample size were to provide sufficient adequate sample from many educators from selected schools in the Capitale of Amman city The survey responses were organised and analysed by using various analytical tools to understand the impact of mental and physical health conditions on workers' productivity. This presents the results of the data analysis by presenting the percentage distribution of respondents' demographic details along with a descriptive analysis of the data. also presents and discusses the results of the correlation and regression analysis done to meet the research objectives.

DEMOGRAPHIC ANALYSIS

TABLE 1: GENDER DISTRIBUTION OF THE PARTICIPANTS

Gender	Number (N)	Percentage (%)
Female	96	48.00%
Male	104	52.00%
Grand Total	200	100.00%

Table 4.0.1: Gender distribution of the participants

The table above shows the gender distribution of participants, where 52% of the respondents are male and 48% of the participants are female. Though the number of male participants is higher than that of females, there is not a larger difference between the two.

TABLE 2: AGE DISTRIBUTION OF THE PARTICIPANTS

Age	Number (N)	Percentage (%)
20-30 years	64	32.00%
31-40 years	118	59.00%
Above 40 years	18	9.00%
Grand Total	200	100.00%

Table 4.0.2: Age distribution of the participants

The table above shows the age distribution of the participants. The majority of the participants (59%) belong to the 31-40 years group, following 32% of the participants belonging to the 20-30 years age group, and only 9% were above 40 years.

TABLE 3: ORGANISATIONAL DISTRIBUTION OF THE PARTICIPANTS

Type of organisation you are associated with	Number (N)	Percentage (%)
Others	16	8.00%
Private	105	52.50%
Public	79	39.50%
Grand Total	200	100.00%

Table 4.0.3: Organisational distribution of the participants

The table above shows that the majority of the respondents (52.5%) work in private organisations, and 39.5% of the respondents work in public organisations. Only 8% work in other sectors.

Descriptive Statistics

How Does Poor Mental and Physical Health Affect Productivity?

The results of the descriptive statistics displaying the mean, mode and standard deviation of responses under each question help in understanding the characteristics of responses. The table below shows the variable categorisation along with descriptive statistics.

TABLE 4: DESCRIPTIVE STATISTICS

Variables		Mean	Mode	Standard Deviation
Work productivity	How far do you agree that mental health condition impacts your workplace performance?	3.91	4	0.98
	How far do you agree that your physical health status has a significant impact on your workplace productivity?	3.96	4	0.93
	Do you think anxiety and depression reduce your workplace productivity?	4.02	4	0.97
Mental health	How far do you agree that the level of stress regarding workload and nature is manageable and acceptable by you in your workplace?	3.88	4	1.06
	How far do you agree that your supervisor motivates you to discuss ideas and listen to suggestions?	3.94	4	0.98
	How far do you agree that you are satisfied with your benefits and salary package provided to you?	3.93	4	0.95
	Do you think poor mental health makes it difficult for you to multi-task in your workplace?	4.02	4	0.95
	Do you think promoting collaborative opportunities to interact and share experiences among employees can boost mental health and well-being in the workplace?	3.98	4	0.91
Physical health	How far do you agree that chronic sickness can damage your concentration towards your work?	3.94	4	0.95
	How far do you agree that physical health issues like obesity, pain, and chronic diseases decrease your workplace performance and productivity?	3.97	4	0.95
	Do you think encouraging regular social events and exercise can enhance employees' physical health and well-being?	3.96	4	0.94

Table 4.0.4: Descriptive statistics

The average responses to questions under the variable 'Work productivity' show an average response inclined towards agreeing to the statements by employees, with less standard deviation. The mode value of 4 indicates that most of the respondents agreed with the statements mentioned in each question under 'work productivity'. The average responses to questions under variable 'mental health' show an average response inclined towards agreeing the statements by employees, with less standard deviation except the statement "the level of stress regarding workload and nature is manageable and acceptable by you in your workplace" having comparatively high standard deviation. The mode value is 4 in this case, also indicating that most of the respondents agreed with the statements mentioned in each question under 'mental health'. The questions under physical health also show an average value close to 4, indicating employees' agreement on the statements mentioned in each question. The mode value of 4 obtained for each question supports the result of mean responses by indicating that most of the respondents agreed with the statements under the 'physical health' categorisation.

HYPOTHESIS TESTING

For the hypothesis testing formulated in the study, correlation and regression analysis have been followed. The correlation analysis was done to understand how the dependent and independent variables are associated with each other and how strong is the association between the two. The regression analysis was done to understand the impact of poor mental and physical health conditions of employees on their productivity.

CORRELATION ANALYSIS

The table below presents the results of the correlation analysis with the dependent variable, employee productivity and independent variables, mental and physical health.

TABLE 5: CORRELATION ANALYSIS

	employee productivity	mental health	physical health
employee productivity	1		
mental health	0.83871	1	
physical health	0.814047	0.882872	1

Table 4.0.5: Correlation analysis

The table shows that there is a strong and positive association between mental health and employee productivity, with a correlation value of 0.83871, implying a direct relationship between the two. It is also seen that there is a strong and positive association between physical health and employee productivity as well, with a correlation value of 0.814. Therefore, these two are also directly related to each other.

TABLE 6: REGRESSION ANALYSIS

Regression Statistics	
Multiple R	0.853217
R Square	0.72798
Adjusted R Square	0.725218
Standard Error	0.436017
Observations	20 to 0

ANOVA

	df	SS	MS	F	Significance F
Regression	2	100.2282	50.11411	263.6051	2.03E-56
Residual	197	37.45178	0.190111		
Total	199	137.68			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%

Intercept	0.534299	0.152433	3.505129	0.000565	0.233688	0.8349	0.2336	0.8349
						1	88	1
mental health	0.540538	0.078598	6.877212	7.89E-11	0.385536	0.6955	0.3855	0.6955
						41	36	41
physical health	0.326864	0.077527	4.216111	3.79E-05	0.173974	0.4797	0.1739	0.4797
						54	74	54

Table 4.6: Regression analysis

DISCUSSIONS AND FINDINGS

The table above presents the result of the regression analysis between the dependent and independent variables. The result shows that the regression model is overall significant ($F_{2,197} = 263.61$, $p < .01$). The independent variables can explain 72.8% variations in the dependent variable ($R\text{-square} = 0.728$). Mental health has a significant positive impact on employee productivity ($\beta = 0.5405$, $p < .01$). Physical health also has a significant positive impact on employee productivity ($\beta = 0.3269$, $p < .01$). Therefore, mental and physical health conditions of employees have significant impact on employee productivity.

The results of the analysis obtained by analysing the survey responses provide some clear findings. From the demographic analysis, we obtained most of the participants were male, with a close percentage of female participants. Most of the participants were 31-40 years old, which increases the result's authenticity because the responses were obtained mostly from experienced employees. Most of the respondents work in private organisations, giving a scenario of mental and physical stress of employees in private organisational culture. A significant proportion of employees work in public organisations, also depicting the picture of public organisations with no less importance than those of private ones.

Moreover, most of the respondents agreed that the mental and physical health status of employees has a significant impact on their productivity. This has been greatly supported by the results of the regression analysis. The research question of the study can be answered by explaining the results of the correlation and regression analysis. The correlation analysis showed that there is a positive association between the mental and physical health conditions of employees and their workplace productivity. It means that better mental and physical health conditions will increase their productivity, and poor mental and physical health conditions will decrease their productivity at the workplace. The regression analysis showed the significance of this positive association between the two. From the results of the analysis, we evaluated that both mental and physical health conditions of employees have a significant positive impact on their workplace productivity. Poor mental and physical health conditions of employees will cause significant damage to their productivity levels at the workplace. Thus, the alternative hypothesis of the study 'Poor mental and physical health significantly impacts employee productivity' is accepted.

It is thus essential for organisations to keep their staff stress-free so that they don't feel obesity, stress and burnout. The employees also need to be physically healthy to enhance their productivity at the workplace. Organisations should take initiatives towards keeping their staff mentally and physically healthy. The organization could also provide an employee assistance program. There should be appropriate communication about these issues as many employees avoid it in apprehension of the stigma attached to them; there needs to be clear communication regarding the confidentiality of the programs to the employees. The employees of an organization must be informed about the benefits and the availability of community resources for supporting mental well-being, and there should be mention of emotional well-being at every organizational discussion, especially in the case of organizations which recruit diverse talents. This will help the employees come to work in a confident manner and remain productive. The organizations must also focus on the appropriate staffing practices to carry out the assignments they need to complete. This could help in reducing the unwanted pressure on the employees, which has been associated with various ailments like cardiac diseases and coronary blockages. The pressure of too much expectation and the need to work fast and in a diligent manner with inadequate availability of resources has led to various health disorders like hypertension, diabetes and many more.

CONCLUSION:

The physical fitness of an individual is important as this can indicate the frequency of absenteeism and could impact the performance of other people. The psychological well-being of a person is also important as it could impact teamwork of a person, the level of concentration as well as the innovativeness of a person. As per WHO it is found that when a person is healthy, it indicates that the person is in an optimal state physically, intellectually, and socially. A person who is sick in a chronic manner runs the risk of becoming socially isolated and distracted. This makes it difficult to multi-task at the place of work [10]. A lack of resilience could impact the work outcomes and result in paranoia. Paranoia that arises from melancholy could impact the self-esteem of the person and impact his outlook on life. This whole system could impact the productivity of the person at his job; again, this attitude can make the workplace have a less collaborative and more of competitive environment. Psychological illness can impact the social interactions of people and can have significant impacts on productivity in the case of professions which demand a high level of attention [11].

Individuals who have experience with high levels of stress and of anxiety can have the tendency to withdraw from social interactions. Again, the dynamic nature of the workplace could also have a significant impact on the already stressed individual. The workplace vibrations, the norms, and the environment can make it difficult for an individual to adjust if he is suffering from psychological illness.

Alongside the setting, there are other organizational challenges like lack of support to carry out a specific job role, which could also give rise to job stress. The imbalance between the resources for a job role and their availability could also impact the stress level of an employee and productivity. These factors have been associated with health disorders like sleep issues, headaches, irritability, gastrointestinal disorders and many more. These health disorders could be potential sources to impact business outcomes in a negative manner. Employees who suffer from mental health disorders may have to leave their workplace for therapy sessions, which could reduce the productivity of the organization.

Some of the factors which have the potential to impact the mental health of employees because of consequences of their jobs, which lead to illicit use of drugs, stress and high levels of depression, are some of the disorders faced by the population. A significant contributor to a deteriorating and negative impact on physical and mental health is the physical environment of the workplace [12]. The internal environment, the workplace norms, and the distractions could have serious negative effects on the employees of an organization, while a positive environment will reinforce positive outcomes. The aspects of effective communication, outdoor interaction and the issues of concentration could be significantly impacted by the physical environment of the workplace. The absence of natural light and workstations with limited space have negative impacts on the productivity of the employees [13].

IMPLICATION OF THE STUDY

IMPLICATIONS FOR ORGANIZATION MANAGERS

1. Recognition of Health as a Productivity Driver

- Managers should recognize that poor mental and physical health significantly affects absenteeism, presenteeism, errors, and turnover.
- Employee wellbeing should be viewed as a strategic investment, not a cost.

2. Development of Supportive Workplace Policies

- Implement Employee Assistance Programs (EAPs).
- Offer flexible work arrangements and reasonable adjustments for employees with chronic health conditions.
- Establish clear mental health support policies.

3. Training for Leaders and Supervisors

- Train managers to recognize early signs of burnout, stress, and declining performance.
- Encourage psychologically safe environments where employees feel comfortable disclosing health concerns.

4. Workload and Job Design Review

- Assess workload distribution and unrealistic performance expectations.
- Reduce chronic stressors that contribute to burnout and physical strain.

LIMITATIONS

This research paper focuses on how physical and mental health could impact the productivity of employees at the workplace. This could have been extended to interviewing some experts on this matter, which would have proven costly. Thus, the cost factor poses a limitation to this survey owing to the lack of sufficient funds.

RECOMMENDATIONS

The organizations can promote certain organizational practices like social interactions and sessions for physical activity. This could lead to an improvement in worker's happiness, improved efficiency and a positive business reputation.

- It is important that the workplace promotes various practices that are conducive to the wellness of the employees, which can help to improve productivity. Factors like environmental impacts need to be focused on, and humanity, as well as revenue, are important for the long-term success of an organization. These three perspectives for a successful business could be achieved by using "green constructions", which are sustainable in nature and have a clean outcome with no adverse environmental impact [14].
- The other important area which needs to be focused on by the organization is the internal layout of their office spaces. The spaces need to be spacious, with enough space for the employees to facilitate their movement. It would also be beneficial for the employees if they have their work cabins designed in such a manner that can alleviate any distractions. This could lead to better efficiency.
- The internal air quality of an organization can also impact the productivity of employees, it has been found that internal qualities like natural surroundings and the space for moving around have considerable influences on the mental well-being and physical health of employees. It reduces the turnover rate and improves the viability of the employees to work in an organization for the long term.

The well-being of employees could be further improved through the integration of health coverage plans and also providing support services to promote the well-being of employees mentally. The organization can also provide the benefit of a health savings account, which can support the costs that can go out of pocket.

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WORKPLACE SPIRITUALITY AND WORKPLACE HAPPINESS: MEDIATING ROLE OF ORGANIZATIONAL CITIZENSHIP BEHAVIOR IN HEALTHCARE SECTOR

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ABSTRACT

BACKGROUND

Medical professionals are working in challenging working conditions in health care sector, especially in post-covid era, which impact their happiness at workplace. Therefore, to encourage them to perform their tasks more effectively in such challenging conditions, spirituality at workplace is required.

OBJECTIVE

The present research attempts to examine the relation between spirituality at workplace, organizational citizenship behavior (OCB) as well as workplace happiness in the healthcare sector of Haryana (India), with OCB as a mediator between spirituality and happiness at workplace.

METHODS

To achieve the objectives of the study, this study utilized a causal research design. Data were collected using a structured questionnaire and analyzed using smart PLS.

RESULTS

The study confirms that a significant association is found between spirituality and OCB, and spirituality and happiness at workplace, while OCB is also associated significantly with workplace happiness. Further, OCB is also mediating the relation between spirituality and happiness at workplace.

CONCLUSION

The study indicates a significant relation between spirituality at workplace, OCB as well as workplace happiness, and also offer valuable insights about the significance of applying spiritual values at work to enhance happiness amongst healthcare professionals, i.e., doctors and nurses. Hence, the administrators should create a congenial environment to support spirituality at workplace, and strengthen healthcare personnel's OCB, which eventually lead to workplace happiness.

KEYWORDS

healthcare, happiness at workplace, workplace spirituality, organizational citizenship behavior

INTRODUCTION

Happiness has been regarded as an important aspect of individual's lives, and plays a substantial role in building a resilient workforce [1]. In contemporary organizations, employees are viewed as valuable capital, and improving their capabilities has become crucial. Consequently, many organizations have begun investing in appointing chief happiness officers to improve the morale of the workers and monitor their happiness level at workplace [2]. The happiness of healthcare workers has become a global concern amid rising mental health challenges, burnout, high level of distress, as well as suicidal ideation [3]. Healthcare professionals form the core of any health system. They are consistently encouraged to stay neutral when offering medical assistance, but their satisfaction and happiness are often overlooked [4]. Maintaining their mental balance is crucial for their productivity at work as well as well-being in personal life. Work stress arises when healthcare professionals face realities that conflict with their professional expectations [5]. Only a small proportion of employees report truly thriving at work, while a majority are struggling or suffering in terms of their overall well-being [6]. The report from World Economic Forum (2021) reveals that 43% of the workers in over 100 countries face work related stress daily, an increase from 38% in 2019[7]. A survey by WHO on World Mental Health Day in 2021 showed that over half (55%) of employed professionals in India are experiencing stress at workplace, as access to well-being measures becomes more challenging to them [8]. Further, WHO projects a deficit of 11 million health workers by 2030, highlights the increasing pressure on healthcare systems and underscores the critical importance of maintaining workplace happiness. The existing studies on mental health often emphasize weaknesses as well as pathologies instead of focusing on positive elements such as happiness, particularly in low as well as middle-income nation [9]. Happy workers are more likely to provide OCB to their colleagues [10].

Nowadays, staff are expected to be more dedicated, productive, and efficient, and also to care for their well-being [11]. Many employees remain spiritually detached from their roles despite being physically present at work. Hence, to evaluate organizational success as well as performance, a new perspective has been proposed, namely workplace spirituality. When workers see meaning in their job, experience sense of community, as well as practice human values, then they are more inclined to experience greater happiness, perform exceptionally, as well as achieve higher satisfaction at work [12]. When people are happy from the inside, they will think more innovatively, care for others, grow with others and have a team spirit. In the light of post-Covid-19 shift, workplaces are increasingly integrating spirituality into work to improve worker's health, motivation, as well as performance [13]. In Indian healthcare sector, workplace happiness has emerged as a serious concern. India has a complex as well as multi-tiered healthcare system comprising public and private providers delivering services at primary, secondary, and tertiary levels. The Indian healthcare system has witnessed significant expansion in recent decades; however, it continues to face persistent challenges such as inadequate healthcare workforce, uneven distribution of medical infrastructure, and increasing demand for healthcare services (14). These challenges are particularly evident in multispecialty hospitals that manage large number of patients as well as specialized treatment (15, 16, 17). These systemic limitations have placed considerable pressure on healthcare institutions and professionals, particularly those working in multispecialty hospitals. Consequently, healthcare workers experience heavy workloads, time pressure, emotional exhaustion, as well as limited organizational support, which adversely affect their workplace well-being and happiness [8, 18].

The healthcare system in Haryana has expanded through the development of healthcare facilities to meet the growing healthcare needs of its population (19). Despite this expansion, the state continues to face challenges related to workforce shortages, high patient inflow, overburdened hospitals, inadequate mental health as well as psychosocial support for healthcare employees [20]. Multispecialty hospitals in Haryana are characterized by complex clinical demands and intensive work environments, where increasing care requirements and performance pressures further intensify occupational stress among healthcare professionals (21, 22). Despite these contextual challenges, limited empirical research has examined the constructs like workplace spirituality, OCB, and workplace happiness in multispecialty hospitals of Haryana, thereby provided a clear research gap that the present study seeks to address.

REVIEW OF LITERATURE

Workplace spirituality has attracted significant interest over the past few years as organizations seek to address the changing demands of the workforce [23]. Mental health of healthcare employees is influenced by various factors like pandemics [24], economic instability and financial hardships [25]. Various studies highlighted the increased level of stress, emotional fatigue, and burnout among the health professionals [26, 27]. In the Indian healthcare sector, the burden on healthcare workers has increased substantially due to rising patient loads, resource limitations, and shortage of workforce. The persistent challenges such as emotional exhaustion, workplace stress, and lack of organizational support have been highlighted among Indian health professionals [8, 18]. Rapid urbanization, increased demand for healthcare services, inadequate mental health support, and staffing constraints have created additional pressures for healthcare workers in Haryana. Despite the expansion of health facilities, issues such as overburdened hospitals and limited psychosocial support continue to affect employees' well-being [20]. However, stress and dissatisfaction, are unique not only in India, but also in the western countries, where work-related stress, depression, emotional fatigue, burnout as well as anxiety remain significant challenges in health professionals [28, 29]. But nowadays the employees are looking for a work atmosphere that promotes personal development, social connections and sense of purpose, in addition to financial rewards [30].

In the light of these shifting requirements, organizations are embracing new management practices to foster a more productive as well as positive workplace. They are progressively adopting spirituality to enhance the employee's performance with a growing body of research showing its potential positive consequences [31]. Healthcare employees, who not only treat their patients, but also engage with them on a profound level, identifying meaning in reducing suffering as well as enhancing wellbeing. This represents the true impact of spirituality at workplace in practice.

Spirituality at workplace refers to the acknowledgment that the staff possesses an internal life that is cultivated and supplemented by the purposeful work carried out in a community [32]. It empowers workforce with internal strength, communication abilities as well as intrinsic motivation required for managing the challenges of healthcare. Spirituality at work serves as a valuable tool for enhancing employees' well-being by cultivating a sense of connection as well as purpose [33], improving patient care, fostering innovation as well as engagement by cultivating an environment that supports spiritual beliefs [34]. Although spirituality at workplace involves several dimensions, but three of them are: meaningful work, sense of community, as well as alignment with organization values [35]. Meaningful work is considered as the essence of spirituality at workplace, which lies in experiencing a thoughtful sense of commitment in one's tasks. Sense of community reflects the belief that spiritually inclined individuals are deeply connected with others as well as with community. Lastly, the alignment with organization values is the perceived congruence amid the individual values as well as the mission and values of the workplace.

Spirituality emerges when workers experience a sense of bond, closeness as well as mutual attraction with both their peers as well as firm as a whole [36]. However, it is extremely challenging to establish an environment that allows workers to prosper beyond their designated roles. However, several management setups focus on organizational citizen behavior for this purpose.

ORGANIZATIONAL CITIZENSHIP BEHAVIOR (OCB)

"Organizational citizenship behavior refers to the actions that contribute to continuance and facilitation of the social as well as psychological environment, which, in turn, directly impacts task performance [37]. Individuals in organizations at times display behavior that extends beyond their assigned duties, which is referred to as OCB. It is a multifaceted concept, made up of five key constructs: altruism (being helpful), courtesy (being courteous and polite), conscientiousness (attention to detail to prevent error), sportsmanship (accept changes and perform without any complaints) and civic virtue (demonstrate interest and involvement). OCB remains a big challenge for organizations but serves as a powerful tool to boost workers' morale, enhance happiness, as the workers, who are happy, are more likely to help other people, demonstrate empathy as well as respect and engage in OCB [10].

WORKPLACE HAPPINESS (WH)

Happiness at workplace reflects the degree to which individuals feel positive as well as satisfaction at work. Employee happiness at workplace is a crucial factor in driving motivation and improving employee retention within any organization [38]. The concept of work happiness is broadly defined by three components: work engagement, job satisfaction, as well as affective organization commitment [39]. Firstly, work engagement indicates various factors that encourage the workers to actively contribute to their workplace. Whereas job satisfaction indicates a positive emotional response arising from the employees' assessment of job characteristics as well as experience. Lastly, affective commitment inclined to workers' emotional bond towards their workplace.

Despite extensive research on workplace spirituality, organizational citizenship behavior, and workplace happiness in various contexts, no prior study has specifically examined these constructs within multispecialty hospitals in Haryana, India. Furthermore, limited research has investigated the mediating role of OCB in the relationship between workplace spirituality and workplace happiness in this specific setting. This gap underscores the need for an empirical study to explore these relationships in multispecialty hospitals of Haryana, thereby contributing to the understanding and application of workplace spirituality in improving employee well-being.

WORKPLACE SPIRITUALITY AND OCB

Spirituality, which emphasizes meaning, purpose, community, as well as aligning with personal values at work, can motivate the employees to go beyond their formal responsibilities. Moreover, supportive workplace fosters discretionary behavior that benefits colleagues and the organization [40]. Employees, who perceive wisdom of belonging as well as meaning at job, tend to help others, display courtesy, and contribute beyond their roles [12].

OCB AND WORKPLACE HAPPINESS

Happy employees are more inclined to be helpful, empathetic, and respectful, making them more likely to exhibit organization citizenship behavior [10]. Employees who practice OCB, are also more tolerant of workplace difficulties, more flexible in solving problems, and more willing to help their organization adapt and thrive. It also enhances the worker's sense of purpose as well as well-being, contributing to greater workplace happiness [39].

WORKPLACE SPIRITUALITY AND HAPPINESS AT WORKPLACE

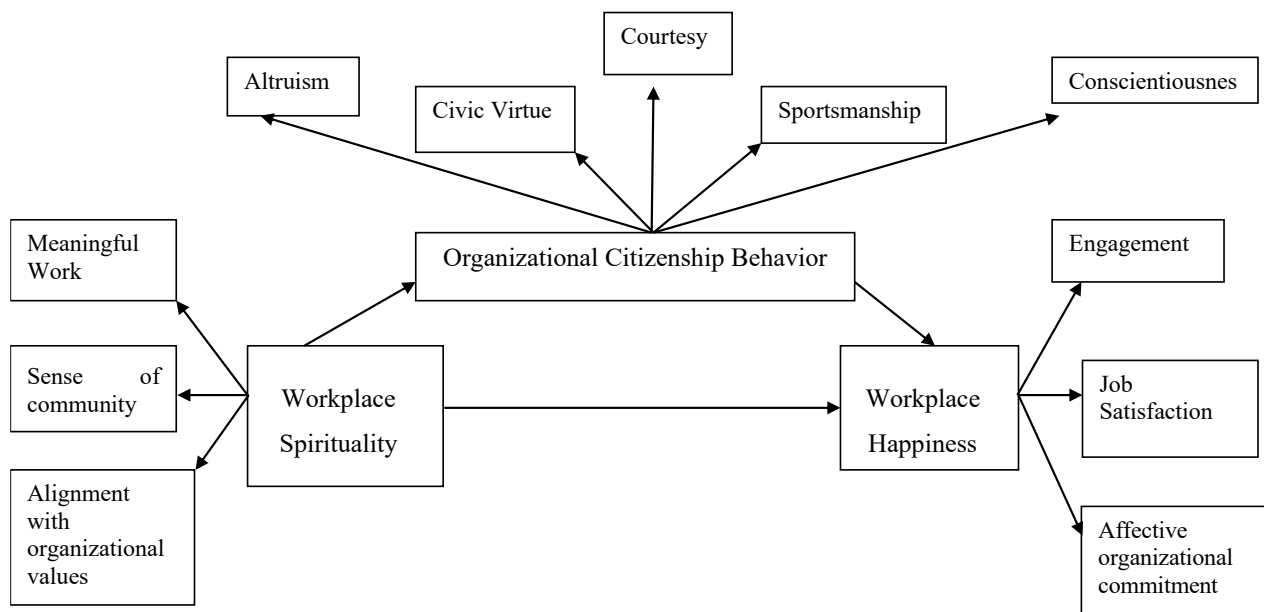
Spirituality at workplace is really contributing to happiness by fostering meaningful work, nurturing positive relations, as well as a sense of commitment [41]. Happiness at work, often considered synonymous with subjective well-being, involves positive experiences such as enthusiasm, energy, as well as a sense of purpose [39]. A spiritual work environment enhances positive emotions and resilience, supporting workplace happiness and organizational performance.

WORKPLACE SPIRITUALITY, OCB AND WORKPLACE HAPPINESS

A significant association between spirituality at workplace as well as OCB is identified [42] and also emphasizing the role of spirituality in encouraging the workers to go beyond their job roles. Such experiences at work often contribute to a deeper sense of happiness, which in turn strengthens discretionary behavior [10]. Cultivating spirituality and happiness at workplace enhances affectivity within the organization by fostering patience, tolerance, and serenity during challenging times. Therefore, integrating workplace spirituality with positive emotions and discretionary behavior is expected to create a virtuous cycle of happiness as well as performance.

CONCEPTUAL MODEL

Based on the literature, the researcher proposes the following model to be tested empirically, involving three key constructs, i.e., workplace spirituality (WS), organizational citizenship behavior (OCB), and workplace happiness (WH), with organizational citizenship behavior as a mediator between workplace spirituality and workplace happiness among the healthcare professionals.



METHODOLOGY

RESEARCH OBJECTIVES:

1. To assess the relation between spirituality, OCB, and happiness at workplace.
2. To examine whether OCB is mediating the relation between spirituality and happiness at workplace.

RESEARCH HYPOTHESES:

- H1: Spirituality at workplace is significantly associated with OCB.
 H2: OCB is significantly associated with happiness at workplace.
 H3: Spirituality at workplace has significant association with workplace happiness.
 H4: OCB is mediating the relation between spirituality and happiness at workplace.

RESEARCH DESIGN AND SAMPLE

A causal research design is employed in this study to test how workplace spirituality influences workplace happiness through the mediating role of OCB. The study focuses on healthcare professionals i.e., doctors, nurses working in the selected multi-specialty hospitals in the state of Haryana (India). Using G*Power software, a required minimum sample size of 68 was calculated; however, researcher collected 258 usable responses, which exceeded the minimum required threshold [43]. Multi-stage sampling technique was employed for selecting the sample. First, a list of hospitals in Haryana was prepared. Next, multi-specialty hospitals of Haryana were classified based on divisions and districts. Six districts, namely Panchkula, Faridabad, Gurugram, Hisar, Rohtak, and Panipat, with the highest number of multi-specialty hospitals, were selected. These districts collectively had 44 multi-specialty hospitals, including Panchkula (7), Gurugram (9), Faridabad (8), Hisar (8), Rohtak (6), and Panipat (6). Primary data were collected with the help of a structured questionnaire through offline mode using snowball sampling.

ETHICAL CONSIDERATIONS

Ethical Clearance was obtained from MM Institute of Management, Maharishi Markandeshwar deemed to be University (Ref. No: 2026/139). The study was conducted in accordance with standard ethical guidelines. Participation was voluntary, and informed consent was obtained from all participants. Anonymity and Confidentiality of all responses were strictly maintained.

MEASUREMENTS

A Likert-scale (5-point) was employed; where meaningful work as well as sense of community contains 7 items each, alignment with organisation value contains 8 items. To measure the work spirituality, scales developed by Ashmos et al., (2000) as well as Milliman et al., (2003) were adapted. Organizational Citizenship Behavior involves 19 items scale developed by Smith et al., (1983) as well as Podsakoff et al., (1990). Happiness at Work Scale was used from the study of Salas-Vallina and Alegre, (2020) that include three aspects, i.e., job satisfaction, job engagement as well as affective organizational commitment (each contains 03 items).

DATA ANALYSIS

To analyze the data, the researcher adopted PLS method, a variant of SEM. Sample profile shows that employees aged up to 35 years are 95.7%, 66.7% are graduates, 51.6% are males, 77.5% are single, 96.1% have experience below 10 years, and 69.4% are doctors (Table 1).

TABLE 1: DEMOGRAPHIC PROFILE OF THE RESPONDENTS

Demographic variables	Categories	Frequency	Percentage
Age (years)	Upto35	247	95.7
	Above35	11	4.3
Highest Qualification	Graduation	172	66.7
	Post Graduation	86	33.3
Gender	Male	133	51.6
	Female	125	48.4
Marital Status	Unmarried	200	77.5
	Married	58	22.5
Experience (Years)	0-10 years	248	96.1
	Above10	10	3.9
Designation	Doctor	179	69.4
	Nurse	79	30.6
Total		258	100.0

Source: Authors' Calculations

MEASUREMENT MODEL EVALUATION

The results indicate that factor loadings of all the variables surpass the standard threshold value of 0.7 [47], except one construct, i.e., SC1 (0.669) and that too was also retained because the Average Variance Extracted(AVE) value of that construct is surpassing the standard limit, which validates the model (Table 2). Further, the values of Average Variance Extracted (AVE) of the dimensions also exceed 0.5, providing further evidence of their validity. Values of Cronbach alpha as well as composite reliability, which evaluate the internal consistency of variables, surpass the required limit of 0.7, thus affirming their reliability [48].

TABLE 2-RESULTS OF MEASUREMENT MODEL

Construct		Items Code	Factor Loadings	Cronbach's alpha	rhoA	CR	AVE
Workplace Spirituality	Meaningful Work	MW1	0.807	0.886	0.892	0.912	0.597
		MW2	0.763				
		MW3	0.862				
		MW4	0.707				
		MW5	0.806				
		MW6	0.737				

		MW7	0.713				
	Sense of Community	SC1	0.669	0.881	0.886	0.908	0.586
		SC2	0.773				
		SC3	0.795				
		SC4	0.815				
		SC5	0.708				
		SC6	0.785				
		SC7	0.804				
	Alignment with organizational values	AV1	0.865	0.944	0.945	0.954	0.721
		AV2	0.885				
		AV3	0.778				
		AV4	0.880				
		AV5	0.856				
		AV6	0.868				
		AV7	0.840				
		AV8	0.816				
OCB	Altruism	ALT1	0.799	0.841	0.845	0.894	0.679
		ALT2	0.890				
		ALT3	0.838				
		ALT4	0.764				
	Courtesy	COUR1	0.813	0.811	0.814	0.877	0.641
		COUR2	0.872				
		COUR3	0.780				
		COUR4	0.730				
	Civic Virtue	CIV1	0.745	0.818	0.821	0.880	0.648
		CIV2	0.862				
		CIV3	0.808				
		CIV4	0.800				
	Sportsmanship	SPORT1	0.804	0.810	0.816	0.875	0.637
		SPORT2	0.839				
		SPORT3	0.751				
		SPORT4	0.794				
	Conscientiousness	CONS1	0.807	0.753	0.761	0.859	0.670
		CONS2	0.871				
		CONS3	0.775				
Workplace Happiness	Engagement	ENG1	0.820	0.709	0.720	0.835	0.628
		ENG2	0.769				
		ENG3	0.787				
	Job Satisfaction	JS1	0.746	0.740	0.749	0.853	0.660
		JS2	0.814				
		JS3	0.872				
	Affective organizational	AOC1	0.892	0.905	0.905	0.941	0.841

	commitment						
		AOC2	0.928				
		AOC3	0.930				

Source: Authors' Calculations

The Heterotrait- Monotrait Ratio (HTMT) is used for evaluating the validity as well as multicollinearity of the variables. The value of HTMT should not be above 0.9; else there will be lack of discriminant validity [49]. Table 3 indicates that the ratios of all the variables are well below the threshold limit and is affirming the good discriminant validity.

TABLE 3: DISCRIMINANT VALIDITY

	ALT	AOC	AV	CIV	CONS	COUR	ENG	JS	MW	SC
AOC	0.333									
AV	0.318	0.687								
CIV	0.612	0.650	0.595							
CONS	0.597	0.270	0.354	0.666						
COUR	0.799	0.253	0.403	0.596	0.590					
ENG	0.136	0.194	0.090	0.212	0.100	0.161				
JS	0.365	0.864	0.716	0.663	0.313	0.428	0.190			
MW	0.471	0.406	0.802	0.449	0.358	0.515	0.089	0.531		
SC	0.422	0.450	0.820	0.473	0.336	0.460	0.102	0.693	0.867	
SPORT	0.241	0.352	0.216	0.455	0.303	0.205	0.135	0.301	0.110	0.150

Source: Authors' Calculations

STRUCTURAL MODEL EVALUATION

The researcher determined the value of r-square [48], which indicates the proportion of variance in the dependent variable explained by the independent variable. A higher score reflects greater predictive accuracy, and vice-versa. Table 4 exhibits that R² value of OCB is 0.253, which means 25.3% variance in OCB is explained by WS. R-squared scores of 0.75, 0.50, 0.25 explain strong, moderate, and weak predictive accuracy, respectively, thus it indicates a weak effect of WS on OCB. This R² is consistent with behavioural and healthcare research where multiple unobserved factors influence employee behavior [48]. In the same way, R² of WH (0.422) explained 42.2% variance, indicating that 42.2% of the variance in WH is explained by WS and OCB, which also reflects a moderate explanatory power.

TABLE 4: COEFFICIENT OF DETERMINATION

Construct(s)	R ²	ADJR
OCB	0.253	0.250
WH	0.422	0.417

Source: Authors' Calculations

TESTS OF DIRECT AND INDIRECT EFFECT (HYPOTHESES TESTING)

To assess the relations, the formulated hypotheses were tested (Table 5). There is a significant relation between workplace spirituality as well as OCB, hence the first hypothesis (H₁) is supported ($p = 0.000$). Further, OCB is significantly related with workplace happiness, hence the second hypothesis (H₂) is supported ($p = 0.003$). Likewise, spirituality is significantly related to happiness at workplace, hence the third hypothesis (H₃) is also supported ($p = 0.000$). Further, to test the mediating effect, the researcher used the 10,000-bootstrap method. The specific indirect effect is found significant as t-value (2.975) is greater than 1.96 and p = value (0.003) is less than 0.05. Hence, the fourth hypothesis (H₄), i.e., OCB is mediating the relation between spirituality and happiness at workplace, is also supported.

TABLE 5: ACCEPTANCE/REJECTION OF HYPOTHESES

Relationship effect	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	t-statistics (O/STDEV)	P values	Accept/Reject
WS->OCB	0.503	0.504	0.074	6.797	0.000	Accepted
OCB->WH	0.250	0.252	0.085	2.945	0.003	Accepted
WS->WH	0.487	0.494	0.074	6.618	0.000	Accepted
WS->OCB->WH	0.126	0.125	0.042	3.013	0.003	Accepted

Source: Authors' Calculations

DISCUSSION

The research indicates a positive relation between spirituality and happiness at workplace. Greater level of happiness is found in hospitals in which spirituality is rehearsed at high level. These correspond with the previous study which shows a significant relation between them [41]. This reveals that if health professionals see meaning in their work, experience a great sense of community, as well as align with workplace values, then they are more inclined to experience happiness at workplace. The finding also shows a significant relation between work spirituality and OCB and is supported by previous study [50]. A significant relationship of OCB with workplace happiness is also revealed, aligning with previous research showing happy employees are more likely to show OCB [10]. Thus, spirituality at workplace is acknowledged as a key factor in increasing the employees' happiness. Further, OCB also mediates the relation between spirituality as well as happiness at workplace. The research also highlights the relevance of workplace spirituality in health sector as well as indicates that spirituality at workplace not only enhances the happiness but also helps in maintaining the organizational citizenship behavior by fostering a supporting environment that promotes personal well-being as well as job satisfaction.

IMPLICATIONS OF THE STUDY

The outcomes hold real-world relevance for hospital administration, as it contributes to efficiency of healthcare professionals. Workplace spirituality is believed to influence the staff performance and care delivered to both patients as well as to their relatives positively by connecting with the hearts of healthcare workers. Recognizing and promoting this at work will significantly help healthcare professionals by fostering a productive, pleasant as well as supportive environment. Integrating spirituality into personal as well as professional development methods can strengthen the performance of healthcare professionals. Interventions like meetings as well as workshops can be carried out to promote stronger connection between the health managers and health staff, enabling the latter to contribute insights into enhancing meaningful work and awareness of community, in alignment with hospital values from their own perspectives.

In the face of a constantly changing environment and increasing external pressures, addressing areas like spiritual competence and workplace happiness can serve as a valuable buffer, helping employees and the organization to meet future challenges more effectively. Amid the ongoing paradigm shift in the 21st century, organizations are continually exploring and testing new strategies to support workers in balancing work as well as family responsibilities. These efforts include the introduction of flexible work arrangements. Allowing flexible job hours as well as encouraging frequent intervals of rest also supports workers in maintaining a balanced work-life. The health managers can cultivate a positive work atmosphere and guide workers to promote effective work-life management. The organization can introduce well-being programs; include incentives, promote teamwork to enhance the employees' performance. Reinforcing spirituality at work further contributes to employee well being, which can be achieved through initiatives such as offering prayer in the morning or yoga classes, creating multi-spiritual prayer areas, introducing workplace chaplain, launching spiritual wellness programs, etc. for the employees [51, 52].

CONCLUSION AND RECOMMENDATIONS

Spirituality not only contributes to enhance happiness at workplace but also helps in maintaining the OCB by fostering a supportive environment that promotes personal well-being as well as job satisfaction. Hospital managers should take into consideration the impact of workplace spirituality in enhancing OCB, as well as work happiness, and improving the service quality in health care system. This could offer a better understanding of how healthcare professionals perceive their duties, strength of collegial relationships in the hospital, and the extent to which health staff are aligned with the healthcare values. By accomplishing this, health managers can better assess workplace happiness and the degree of healthcare professionals' OCB. This insight could enable earlier interventions, either by meetings or with the help of workshops, or other actions to mitigate the rising resignation rates. Workplace spirituality could also serve as a solution to rising turnover rate, thereby making it essential for ensuring the quality of patient care. Health administrators need to prioritize creating an environment that supports work spirituality and strengthen health care personnels' OCB, which eventually leads to happiness at workplace.

LIMITATIONS AND FUTURE DIRECTIONS

The present research creates the avenues for future researchers. Firstly, it focuses mainly on health sector, which limits the applicability of its results to other domains. Secondly, researchers in future could investigate the effect of other moderating variables on the relation between spirituality as well as happiness at workplace, such as physical environment, structural and situational dimensions, organizational culture, leadership style, and job characteristics, etc. Thirdly, this study is confined to doctors and nurses of healthcare sector of Haryana only. Future studies could broaden its scope by involving nurses and doctors across different regions with larger and more diverse samples to analyze whether demographics (such as age, gender, or experience) moderate these relationships to offer a more comprehensive understanding.

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PERCEPTION OF PATIENTS TOWARDS OUTPATIENT SERVICE OF GYNECOLOGY DEPARTMENT IN PRIVATE AND PUBLIC HOSPITALS IN KATHMANDU, NEPAL

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ABSTRACT

BACKGROUND:

Patient satisfaction is an essential indicator of healthcare quality, significantly impacting patient outcomes.

OBJECTIVE:

This study aimed to evaluate patient's perceptions and satisfaction with gynecology services at a private and a government hospital in Kathmandu, Nepal.

DESIGN:

A descriptive, cross-sectional research design was employed, involving 330 patients (165 from each hospital) who were selected using purposive and non-probability convenience sampling.

SETTING:

The study was conducted in one private and one public tertiary level hospital. Data were collected using the patient's satisfaction questionnaire (PSQ-18) on a five-point Likert scale and analyzed with SPSS. Scores from each of the seven domains of the PSQ were identified and summed to calculate mean and standard deviation. To compare the satisfaction levels between two hospitals, the Mann-Whitney U-test was applied and Bonferroni correction was used to reduce the Type I error due to multiple comparisons.

RESULTS:

Our study revealed that, 42.53% of female attending the gynecology OPD were satisfied in public hospital and 47.85% from private hospital. Public hospital scored better in terms of financial aspects, indicating a lower financial burden for patients. Overall, patients visiting private hospital expressed greater satisfaction with the services provided. The findings revealed significant differences in patient's satisfaction between the two hospitals. Private hospital outperformed public hospital in general satisfaction, technical quality, communication, and accessibility ($p < 0.001$).

CONCLUSION:

Satisfaction was found to be better in the private hospital. These results suggest that improving the quality of care in government hospital, particularly in communication and interpersonal interactions, while maintaining affordability, could enhance overall patient satisfaction.

KEYWORDS

Perception, satisfaction, patient oriented care, service, gynecology OPD.

INTRODUCTION

Hospitals are central to the healthcare system, providing essential services to improve the health and well-being of patients. The effectiveness of hospital management is critical, as it directly influences the quality of care provided[1]. Hospital managers play an essential role in translating policies into practice, ensuring the efficient delivery of services, and overseeing the management of healthcare resources[2]. Inadequate managerial competencies and poor human resource management can negatively impact the quality of healthcare services and lead to inefficiencies in patient care[3].

In developing countries like Nepal, the perception of patients regarding healthcare services is often overlooked, which may affect the quality of care and patient outcomes[4]. Patients' satisfaction has therefore emerged as a crucial indicator of healthcare quality and plays an important role in shaping the overall patient experience[5]. Previous studies in Nepal have reported high satisfaction levels in private hospitals[6], while research in Northern India has found satisfaction rates as high as 87.8% across the health[7].

Patient satisfaction is a multi-dimensional concept that includes factors such as the quality of medical care, the communication between patients and healthcare providers, accessibility to services, and the financial implications of treatment[8]. One of the key elements of patient-centered care, which considers the needs, preferences, and experiences of patients in the decision-making process[9]. These factors not only influence the quality of healthcare services but also affect patients' overall satisfaction and their likelihood of returning to or recommending a healthcare facility.

While government hospitals are generally more affordable than private hospitals, many patients still prefer private healthcare facilities due to the perceived higher quality of care, reduced waiting times, and greater comfort[10]. For example, Zhu, Heng, and Teow found that long waiting times in government hospitals often drive patients to private facilities, where quicker access to care is available[11]. The urgency for timely care, particularly in the maternity wards where immediate attention is required, plays a critical role in patients' satisfaction levels[12]. This preference is further supported by studies such as those by other study[13], which highlighted the faster service and personalized care often associated with private hospitals.

Despite these insights, earlier studies in Nepal have largely focused only on private hospitals. Our study makes a novel contribution by directly comparing patient perceptions of outpatient services between the country's first public women's hospital, historically significant, serving the largest number of gynecology patients at the lowest cost, and leading private hospitals with advanced facilities. By examining dimensions such as accessibility, affordability, waiting time, infrastructure, and doctor-patient interaction, the study highlights contrast in service delivery and patient perceptions across the public-private divide in gynecology care.

Accordingly, this study aimed to determine whether patient satisfaction differs between public and private hospitals in Kathmandu. We hypothesized that there would be no significant difference in satisfaction levels between public and private hospitals. The research aimed to answer the following question: *How do patient perceptions of gynecology services differ between government and private hospitals in Kathmandu?* Through this comparison, the study aimed to identify factors that influence patient's satisfaction and highlight potential areas for improvement in both public and private healthcare services in Nepal.

METHODS

STUDY DESIGN

This study utilized both descriptive and cross-sectional research designs. Descriptive research was aimed at accurately portraying phenomena as they naturally occur, providing a clear depiction of current conditions[14] whereas cross-sectional study design was used to measure the prevalence of disease, attitudes and knowledge among patients and health personnel[15] and also comparing in validation among them. .

The study was carried out in adherence to the ethical principles outlined in the Declaration of Helsinki throughout the research. Permission was taken from both hospitals, before the data collection. Written informed consent was taken from every respondent through an anonymous questionnaire after explaining the study's objectives and the importance of their participation. Approval was taken (Ref. No: 079/080/658) from the research committee of the National Open College Sanepa, Lalitpur, Nepal. Confidentiality was rigorously maintained throughout the research process, and all collected data were securely stored in a password protected computer.

STUDY SITE

The study was conducted at two hospitals in Kathmandu District: one is a prominent private hospital, Norvic Hospital and the other is the oldest government maternity hospital, Paropakar Maternity and Women's Hospital in Kathmandu, Nepal. These hospitals were selected due to their accessibility to the researcher and their significant contributions to obstetrics and gynecology, including services related to pregnancy, childbirth, postpartum care, and female reproductive health. These hospitals are tertiary-level facilities with a high patients flow, providing valuable insights into healthcare practices in Nepal, especially in the field of maternal health.

SOURCES OF DATA

The primary sources of data were collected from both public and private hospitals using a structured questionnaire.

DATA COLLECTION METHODS AND TOOLS

Primary data were collected through face-to-face interviews with patients in the gynecology department using a structured questionnaire. The questionnaire was designed to assess patient perceptions of gynecological services, with standardized, predetermined questions allowing respondents to choose from predefined answers[16].

Primary data were collected using a scheduled structure questionnaire. Patients perception-related questionnaires (PSQ-18) were used to measure their satisfaction/perception towards different factors[17]. The first part includes the questionnaire widely measures the patient's perception with 18 items which yields seven spheres of patient perception that are general satisfaction (2 questions i.e. QN 3 & 17), technical quality (4 questions i.e. QN 2, 4, 6 & 14), interpersonal manner (2 questions i.e. QN 10 & 11), communication (2 questions i.e. QN 1 & 13), financial aspect (2 questions i.e. QN 5 & 7), time spent with doctor (2 questions i.e. QN 12 & 15) and accessibility and convenience (4 questions i.e. QN 8, 9, 16 & 18). Respondents were asked to rate each statement on a five-point Likert scale, ranging from 'strongly disagree' (1) to 'strongly agree' (5). The second part of the questionnaire gathered socio-demographic details, including age, education, occupation, ethnicity, place of residence, and hospital type. The third part allowed patients to provide feedback on how

services could be improved. Table 1 outlines the categorization of the seven domains and the specific variables used during data collection.

TABLE 1: SEVEN DOMAINS OF PATIENT'S PERCEPTION

SN	Seven subscales of PSQ-18	Average of questions
1	General Satisfaction	3 + 17
2	Technical Quality	2 + 4 + 6 + 14
3	Interpersonal Manner	10 + 11
4	Communication	1 + 13
5	Financial Aspect	5 + 7
6	Time Spent with Doctor	12 + 15
7	Accessibility and Convenience	8 + 9 + 16 + 18
Overall perceptions		All 18 questions

STUDY POPULATION

The study population consisted of female patients attending the gynecology department of two selected hospitals who were willing to participate. Participation was voluntary, and respondents were not coerced into the study. Women of reproductive age attending the gynecology OPD were included in the study.

SAMPLE SIZE

The sample size for the study was determined by the number of patients visiting the gynaecology department of the selected hospitals in Kathmandu District. The sample size was calculated using the following formula:

$$\text{Sample Size } (n) = PQ \left(\frac{Z}{e} \right)^2$$

Where $Z = 1.96$ (the standard statistical value of Normal distribution)

P = Prevalence of satisfaction level from previous study = 0.3 [18]

$Q = 1 - P$ and e = permissible error (is taken as 0.05)

$$\text{Now, } n = PQ \left(\frac{Z}{e} \right)^2 = 0.3 \times 0.7 \left(\frac{1.96}{0.05} \right)^2 = 322.69 \approx 323.$$

But for the convenience of data collection procedure, researchers took sample size $(n) = 330$ (165 in each hospital) who was the outpatient of Gynaecology department.

SAMPLING PROCEDURE

This study employed a non-probability convenience sampling method, selecting two tertiary level hospitals: one government and one private. These hospitals were chosen for their complementary roles in the healthcare sector and because the researcher had worked as an employee at the private hospital for three years during the study period. The researcher spent one month in the outpatient departments (OPD) of each hospital, allocating 15 days to collect primary data using semi-structured questionnaires at each location.

DATA MANAGEMENT AND STATISTICAL ANALYSIS

The collected data were entered into IBM SPSS (version 25) for analysis. Descriptive statistics, including frequency percentages, means, and standard deviations, were calculated. The PSQ-18 questions, using a five-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree," were scored as follows: items 1, 2, 3, 5, 6, 8, 11, 15, and 18 were considered "satisfied" if rated as "Agree" or "Strongly Agree," while the remaining items were considered "satisfied" when rated as "Strongly Disagree" or "Disagree." Each item's score ranged from 1 (strongly dissatisfied) to 5 (strongly satisfied), following the PSQ-18 guidelines.

Satisfaction/perception scores were calculated by summing the scores as per the PSQ-18 questionnaire. The seven domains assessed were: General Satisfaction, Technical Quality, Interpersonal Manner, Communication, Financial Aspect, Time Spent with Doctor, and Accessibility and Convenience. Scores for each domain were calculated separately.

The distribution of the PSQ-18 scores was tested for normality. Since the data were not normally distributed, the Mann-Whitney U-test was used to compare patient satisfaction between the two hospitals. Separate Mann-Whitney tests were conducted for each of the seven domains to compare satisfaction levels between public and private hospitals. To control for Type I error due to multiple comparisons, the Bonferroni correction was applied. The level of significance was initially set at a p-value of 0.05 for the Mann-Whitney test, and after the Bonferroni correction (calculated as: $(\alpha - corrected) = 0.05/7 \approx 0.0071$), the adjusted significance level was set at $p < 0.0071$.

RESULTS

TABLE 2: SOCIO-DEMOGRAPHIC CHARACTERISTIC OF RESPONDENTS

Educational Status	Public Hospital (n = 165)		Private Hospital (n = 165)	
	Frequency	Percent (%)	Frequency	Percent (%)
Illiterate	15	9.1	13	7.9
Primary	23	13.9	25	15.2
Secondary	20	12.1	31	18.8
Higher secondary	55	33.3	36	21.8
Bachelor and above	52	31.5	59	35.8
Occupation				
House wife	34	20.6	58	35.2
Service	65	39.4	52	31.5
Business	11	6.7	12	7.3
Labour	6	3.6	4	2.4
Others	49	29.7	39	23.6
Ethnicity				
Brahmin/Chettri	80	48.5	84	50.9
Janajati	53	32.1	44	26.7
Dalit	12	7.3	11	6.7
Madhesi	19	11.5	26	15.8
Other	1	0.6	165	100
Place of Residence				
Rural	70	42.4	75	45.5
Urban	95	57.6	90	54.5

Among the 330 respondents, 15 (9.1%) in the public hospitals and 13 (7.9%) in the private hospitals were illiterate. Regarding higher secondary education, 55 (33.3%) were in the public hospital, compared to 36 (21.8%) in the private hospital and, 52 (31.5%) respondents in the public hospital and 59 (35.8%) in the private hospital had completed at least a bachelor's degree. Regarding the occupation, nearly one-third of patients from both private and public hospital were service holders. In terms of ethnicity, most of the patients were Brahmin/Chettri followed by Janajatis. Regarding patient residence, most of them were from urban areas (Table 2).

TABLE 3: SATISFACTION OF PATIENTS SEGREGATED BY EACH ITEM OF PATIENTS SATISFACTION QUESTIONNAIRE

PSQ Questions with Domains	Public Hospital				Private Hospital			
	Mean (SD)	No (SD+D), n(%)	Uncertain, n(%)	Yes (A+SA), n(%)	Mean (SD)	No (SD+D), n(%)	Uncertain, n(%)	Yes (A+SA), n(%)
General Satisfaction (3 + 17)								
QN 03. The medical care I have been receiving is just about perfect.	2.83 (0.74)	58 (35.2)	75 (45.5)	32 (19.4)	3.45 (0.91)	30 (18.2)	48 (29.1)	87 (52.7)
QN 17. I am dissatisfied with some things about the medical care I receive.	1.85 (0.80)	7 (4.2)	22 (13.3)	136 (82.4)	2.63 (1.001)	37 (22.)	53 (32.1)	75 (45.5)
Technical Quality (2 + 4 + 6 + 14)								
QN 02. I think my doctor's office has everything needed to provide complete care.	3.64 (0.68)	19 (11.5)	21 (12.7)	125 (75.8)	2.8 (1.06)	76 (46.1)	50. (30.3)	39 (23.6)
QN 04. Sometimes doctors make me wonder if their diagnosis is correct.	2.03 (0.84)	10 (6.1)	31 (18.8)	124 (75.2)	2.61 (1.12)	47 (28.5)	37 (22.4)	81 (49.1)
QN 06. When I go for medical care, they are careful to check everything when treating and examining me.	2.28 (0.74)	106 (64.2)	51 (30.9)	8 (4.8)	3.15 (1.04)	39 (23.6)	61 (37)	65 (39.4)
QN 14. I have some doubts about the ability of the doctors who treat me.	2.67 (1.08)	29 (17.6)	65 (39.4)	71 (43)	3.21 (1.15)	72 (43.3)	47 (28.5)	46 (27.9)
Interpersonal Manner (10 + 11)								
QN 10. Doctors act too business like and impersonal towards me.	3.98 (0.86)	120 (72.2)	36 (21.8)	9 (5.5)	3.38 (0.99)	87 (52.7)	38 (23)	40 (24.2)
QN 11. My doctors treat me in a friendly and courteous manner.	3.05 (0.99)	62 (37.6)	48 (29.2)	55 (33.3)	3.67 (0.92)	20 (12.2)	47 (28.5)	98 (59.4)
Communication (1 + 13)								
QN 01. Doctors are good about explaining the reason for medical tests.	3.03 (0.67)	35 (21.2)	90 (54.5)	40 (24.2)	3.55 (1.08)	17 (10.3)	62 (37.6)	86 (52.1)
QN 13. Doctors sometimes ignore what I tell them.	2.14 (1.05)	27 (16.4)	22 (13.3)	116 (70.3)	2.79 (1.06)	52 (31.5)	44 (26.7)	69 (41.8)
Financial Aspect (5 + 7)								
QN 05. I feel confident that I get the medical care I need without being set back financially.	4.29 (0.91)	12 (7.3)	16 (9.7)	137 (83)	3.06 (1.07)	61 (37)	47 (28.5)	57 (34.5)
QN 07. I have to pay for more of my medical care than I can afford.	4.09 (0.78)	139 (84.2)	17 (10.3)	9 (5.5)	2.92 (1.06)	48 (29.9)	43 (26.1)	74 (44.8)
Time Spent with Doctor (12 + 15)								
QN 12. Those who provide my medical care sometimes hurry too much when they treat me.	1.85 (0.82)	1 (0.6)	42 (25.5)	122 (73.9)	2.87 (1.02)	58 (35.2)	46 (27.9)	61 (37)
QN 15. Doctors usually spend plenty of time with me.	2.33 (0.8)	104 (63)	49 (29.7)	12 (7.3)	2.82 (1.09)	68 (41.2)	43 (26.1)	54 (32.7)
Accessibility and Convenience (8 + 9 + 16 + 18)								

QN 08. I have easy access to the medical specialists I need.	2.15 (1.05)	117 (70.9)	30 (18.2)	18 (10.9)	2.87 (1.12)	66 (40)	39 (23.6)	60 (36.4)
QN 09. Where I get medical care, people have to wait too long for emergency treatment.	2.07 (0.83)	11 (6.7)	27 (16.4)	127 (77)	2.83 (1.08)	57 (34.5)	44 (26.7)	64 (38.8)
QN 16. I find it hard to get an appointment for medical care right away.	1.68 (0.62)	0 (0)	14 (8.5)	151 (91.5)	2.84 (1.06)	59 (35.8)	37 (22.4)	69 (41.8)
QN 18. I am able to get medical care whenever I need it.	2.03 (0.82)	117 (70.9)	34 (26.1)	5 (3)	2.79 (0.97)	66 (40)	56 (33.9)	43 (26.1)

These results indicated that patients in the private hospital reported greater satisfaction with the medical care they received than those in the public hospital in general satisfaction. In technical quality, patients in the private hospital had more favorable perceptions regarding correct diagnosis, careful checking, treatment, and the doctors' ability to provide care. Interpersonal manner suggests a varied perception of interpersonal manner, with private hospital patients reporting better experiences in terms of friendliness and approachability, while public hospital patients perceived doctors as more businesslike. The result from communication suggested that doctors in the private hospital were better at explaining medical results and addressing patient concerns, as patients reported that doctors in the private hospital were more thorough in explaining the reasons for medical tests and less likely to ignore patient queries. The findings also suggested that patients in public hospital feel more confident about receiving care without financial hardship. Doctors from private hospital spent more time with patients and provided more attentive care than in the public hospital. Private hospital experienced better accessibility and convenience, including quicker access to medical care, shorter waiting times for emergency treatment, and easier access to specialist appointments compared to those in the public hospital (Table 3).

TABLE 4: AVERAGE MEAN ACCORDING TO SATISFACTION DOMAIN

Health Care Domains	Mean ($\pm$ SD) of each Domain		Average Mean ($\pm$ SD)		Satisfied %	
	Public	Private	Public	Private	Public	Private
General Satisfaction	4.68 (1.03)	6.08 (1.49)	2.34 (0.52)	3.04(0.75)	50.9	49.1
Technical Quality	10.62 (1.39)	11.77(2.13)	2.66 (0.35)	2.94 (0.53)	49.7	70.0
Interpersonal Manner	7.03 (1.76)	7.04 (1.5)	3.52 (0.88)	3.52 (0.75)	19.7	41.8
Communication	5.17 (1.07)	6.34 (1.55)	2.58 (0.53)	3.17 (0.78)	47.2	47.0
Financial Aspect	8.38 (1.28)	5.98 (1.79)	4.19 (0.64)	2.99 (0.89)	44.2	56.9
Time Spent with Doctor	4.18 (1.36)	5.69 (1.68)	2.09 (0.68)	2.85 (0.84)	40.6	34.5
Accessibility and Convenience	7.92 (1.95)	11.32 (2.7)	1.98 (0.49)	2.83 (0.67)	45.4	35.7
Overall			2.77(0.58)	3.05 (0.74)	42.53	47.85

Table 4 provides a comparative overview of patient satisfaction across various healthcare domains between public and private hospitals. In terms of general satisfaction, 50.9% of patients in the public hospital reported satisfaction, compared to 49.1% in the private hospital. For technical quality, satisfaction was lower in the public hospital (49.7%) compared to the private hospital (70%). Similarly, interpersonal manner satisfaction was lower in the public hospital (19.7%) than in the private hospital (41.8%). In the communication domain, satisfaction was nearly equal between the two hospitals.

Regarding financial aspects, patients in the private hospital reported a higher financial burden, with 56.9% indicating dissatisfaction, compared to 44.2% in the public hospital. For time spent with doctors, satisfaction was higher in the public hospital (40.6%) compared to the private hospital (34.5%). Lastly, in terms of accessibility and convenience, satisfaction was higher in the public hospital (45.4%) than in the private hospital (35.5%).

TABLE 5: ASSOCIATION BETWEEN SATISFACTION DOMAINS ACCORDING TO HOSPITAL TYPES

Mann Whitney U-test						Bonferroni Correction
PSQ Domain	Hospital type	N	Mean rank	U-test	p-value (0.05)	(α) correction (0.0071)
General satisfaction	Public	165	120.85	20980.5	<0.001	Significant
	Private	165	210.15			
Tech quality average	Public	165	137.95	18159.00	<0.001	Significant
	Private	165	193.05			
Interpersonal manner average	Public	165	164.04	13853.00	0.778	Not significant
	Private	165	166.96			
Communication average	Public	165	129.85	19494.50	<0.001	Significant
	Private	165	201.15			
Financial aspect average	Public	165	222.74	4168.00	<0.001	Significant
	Private	165	108.26			
Accessibility and convenience average	Public	165	124.56	20368.00	<0.001	Significant
	Private	165	206.44			
Overall score	Public	165	118.18	21420.50	<0.001	
	Private	165	212.82			

Table 5 presents the results from a Mann-Whitney U-test that analyzes patient satisfaction across various domains between public and private hospitals, with a Bonferroni correction ($\alpha = 0.0071$) applied to control for multiple comparisons. Significant differences were found in general satisfaction, technical quality, and accessibility and convenience between the two hospital types. However, no significant difference was observed in the interpersonal manner domain ($p = 0.778$), and there were no significant differences in the interpersonal average domain.

DISCUSSION

The socio-demographic characteristics of the respondents were analyzed in four domains: educational status, occupation, ethnicity, and place of residence. A study by Batbaatar et al.[19] Identified age as a significant predictor of patient satisfaction, showing a strong positive association with satisfaction levels. In this study, educational status was categorized into illiterate, primary, secondary, higher secondary, and bachelor and above. Among respondents, the highest proportion of patients in the public hospital (33.3%) had completed higher secondary education, while in the private hospital, 59% had completed at least a bachelor's degree. This data suggests that more educated individuals tend to be more engaged with their healthcare[20].

Occupation was sub-categorized into housewives, service holders, business owners, laborers, and others. The highest proportion of service holders was found in the public hospital (39.4%), while housewives made up the highest proportion in the private hospital (58%). Jafari et al.[21] found that patients with higher education were often less satisfied, possibly due to higher expectations. Ethnicity was divided into Brahmin/Chettri, Janajati, Dalit, Madhesi, and other categories. The majority of respondents in both hospitals were Brahmin/Chettri (48.5% in the public hospital and 50.9% in the private hospital), with lower participation from other ethnic groups, possibly due to lower health awareness[22]. Regarding place of residence, the majority of respondents were from urban areas, with 57.6% in the public hospital and 54.5% in the private hospital.

In terms of patient satisfaction, Table 4 shows that private hospitals generally had higher satisfaction scores across most domains, except for financial aspects, where public hospitals scored higher (8.38 vs. 5.98), reflecting a lower financial burden for patients. The average scores indicate a trend of higher satisfaction in private hospitals for general satisfaction, technical quality, communication, and accessibility. Private hospitals also scored significantly higher in technical quality (70% vs. 49.7%) and interpersonal manner (41.8% vs. 19.7%), although public hospitals scored better for accessibility and financial aspects. Overall, private hospitals had a slight edge in patient satisfaction (47.85% vs. 42.53%).

In the area of general satisfaction, the public hospital scored higher (50.9%) than the private hospital (49.1%)[23], although general satisfaction in our study was higher than reported in other study [24], where only 39% of patients expressed satisfaction. A study showed that general satisfaction ranged from 87% to 88%, indicating a higher level of satisfaction in other settings[25]. For technical quality, 49.7% of public hospital patients reported satisfaction, compared to 70% in private hospitals. In interpersonal manner, satisfaction was significantly lower in the public hospital (19.7%) compared to the private hospital (41.8%), which may be due to a lack of friendly and courteous behavior from doctors. In the communication domain, satisfaction was nearly equal between both hospitals.

Regarding financial aspects, patients in private hospitals reported a higher financial burden (56.9%) compared to public hospitals (44.2%), which aligns with study conducted in Nepal[24], where financial satisfaction was higher in public hospitals (87.4%). The lower financial satisfaction in our study may be due to patients' financial backgrounds. Similarly, a study from India found that satisfaction with time spent with doctors was higher in their study (71.4%) compared to our study, where 40.6% of public hospital patients and 34.5% of private hospital patients were satisfied[26].

In terms of accessibility and convenience, public hospitals scored higher (45.4%) than private hospitals (35.5%), which aligns with findings from study in Nepal[24].

Our study hypothesized that there would be no significant difference in satisfaction levels between public and private hospitals. However, significant differences were found in general satisfaction, technical quality, communication, accessibility, and overall satisfaction, with private hospitals generally scoring higher (all p-values < 0.001). Public hospitals scored better in the financial aspect, reflecting a lower financial burden for patients. No significant difference was found between hospital types in the interpersonal manner domain ($p = 0.778$).

In a study conducted in Morang district, Nepal, patients in public hospitals were more satisfied with the overall cost and services than those in private hospitals[27]. However, another study in Indonesia found that satisfaction was generally higher in private hospitals, where superior amenities, personalized care, and shorter wait times aligned with patient preferences[28]. While public hospitals provide more affordable essential services to vulnerable populations, private hospitals focus more on quality, offering better amenities and personalized care, which can lead to higher patient satisfaction.

CONCLUSIONS

The analysis of the data revealed that patients visiting private hospitals generally expressed higher levels of satisfaction compared to those visiting public hospitals. Despite potential financial drawbacks, patients preferred private hospitals for the quality of communication and the time doctors dedicated to each patient. In contrast, doctors in public hospitals were often perceived as being too occupied, leading to shorter interactions and, consequently, lower patient satisfaction.

To attract a broader patient base, private hospitals could consider reducing their service costs without compromising on quality. This approach would help them provide excellent care for a wider population. Meanwhile, public hospitals could improve their services, particularly in communication and interpersonal interactions, to enhance the patient experience while maintaining their affordability.

The study also found that individuals with higher education were more likely to visit private hospitals, while illiterate individuals tended to seek services at public hospitals. This may be due to the perception that private hospitals are more expensive than public ones. Addressing this misconception and providing clearer information about cost differences could help balance patient distribution between the two types of hospitals. Additionally, both hospitals should focus on catering to patients from diverse educational backgrounds to ensure equitable access to healthcare services.

LIMITATIONS

The findings obtained from this research may not be universally applicable to all hospitals in Kathmandu District or throughout Nepal. The results are specific to the two hospitals being investigated and may not fully represent the broader healthcare landscape. This study focused exclusively on understanding the perceptions of patients utilizing gynecology department services in the two sampled hospitals. Consequently, the results may not be generalizable to other departments within the same hospitals, as patient satisfaction might vary across different medical specialties and services.

CONFLICTS OF INTEREST:

The authors declared they have no conflicts of interest.

DATA AVAILABILITY STATEMENT:

The data used for preparing this manuscript will be available with reasoned request from corresponding author.

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EXPLORING FACTORS AFFECTING EMPLOYEES' ORGANIZATIONAL COMMITMENT AND PERFORMANCE IN A HOSPITAL LOCATED IN SOUTHERN IRAN: A MIXED-METHOD STUDY

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ABSTRACT

BACKGROUND:

Organizational commitment, as a significant motivator, plays a crucial role in delivering high-quality healthcare services. This study was conducted to investigate the factors affecting the organizational commitment of hospital staff in the southern region of Iran and to evaluate its impact on employees' performance in delivering quality healthcare services.

METHODS:

This is mixed methods study (quantitative and qualitative) conducted in 2023. In the quantitative phase, 103 personnel with using census method selected. The Allen and Meyer questionnaire was distributed among them and analyzed using the Smart PLS-3 software. In the qualitative phase, 11 hospital employees were purposefully interviewed to investigate the factors influencing their organizational commitments. Qualitative data analysis was performed using a content analysis.

RESULTS:

The results indicate that emotional commitment with a path coefficient of 0.61 and a t-value of 80.5, continuous commitment with a path coefficient of 0.68, a t-value of 75.6, normative commitment with a path coefficient of 0.66, and a t-value of 6.32, have a positive and significant relationship with employee performance. Finally, participants mentioned individual, emotional, job-related, social, and economic factors as the most significant reasons for organizational commitment.

CONCLUSION:

Organizational commitment has a significant positive relationship with employee performance. Hospitals need to implement organizational reforms to fulfill employees' organizational commitment. It is suggested that hospital managers take effective steps towards improving employees' organizational commitment by creating communication networks and using motivational methods.

KEYWORDS

emotional commitment, continuance commitment, normative commitment, employee performance, hospital.

Today, employees are recognized today as the most important stakeholders in organization. They can be the game-changers for the success or failure of their organizations [1]. Human resources play a crucial role in enhancing hospital performance to the extent that an organization cannot succeed without the efforts and commitments of its employees. Organizational commitment refers to employees' beliefs, values, and convictions regarding staying in an organization [2]. Any behavior that occurs in relation to others signifies an individual's commitment towards others. Without commitment, human behavior loses its meaning and significance. Therefore, commitment is a human characteristic that exists in everyone but not everyone adheres to it to the same extent [3]. Commitment is a fundamental characteristic of social life. They predict individuals' behaviors towards fluctuations in desires and interests, thereby facilitating the planning and coordination of joint actions with different factors [4]. Organizational commitment, as a global concept in human resource management and organizational development, has gained attention, and its enhancement is considered key to success and is a significant indicator of an organization's superiority [5]. They introduced organizational commitment into three dimensions: emotional, continuous, and normative commitment. Emotional commitment highlights an individual's emotional attachment to or sense of belonging to the organization. Continuous commitment emphasizes the costs imposed on employees of leaving the organization; in other words, individuals are compelled to stay in the organization because of personal benefits. Normative commitment refers to an individual's sense of obligation to remain in the organization or commitment to the investments made in them [6]. Organizational commitment leads to a significant enhancement in reducing turnover, absenteeism, and turnover intentions, which in turn results in a remarkable improvement in organizational performance, employee morale, better manifestation of organizational excellence goals, and the achievement of individual goals [7]. Ultimately, it enhances patient safety and improves quality of care [8]. Organizational commitment, as a major motivator, can play a significant role in providing quality health services, and motivated and committed employees can have a profound impact on service quality improvements [9-10]. While low organizational commitment weakens employees' creativity, growth opportunities, and innovation, it may impact on the organization's sustainability [11]. Organizational commitment is a key variable that influences employee performance, productivity, service delivery, and quality [12].

Employees in some organizations, such as hospitals, require a high level of job commitment due to the difficulty of their work to avoid leaving their jobs [13].

The hardship of personnel in hospitals for various reasons, such as direct and constant exposure to patients' pain and suffering, staff shortages, multiple duties, high workload, and rotating work shifts, has created concerns about employee turnover, posing a challenge for healthcare system managers in recent years [14-15]. In a review, results showed that 12% of the studies reported high levels of organizational commitment among nurses [2]. The investigations conducted indicate a direct relationship between organizational commitment and job performance [16]. Given that hospital employees provide services to save lives, healthcare institutions and governments must have a mutual commitment to ensure employee well-being [17]. Additionally, hospitals need employees who demonstrate commitment to achieving strategic goals [18]. The ultimate goal of all hospitals is to improve community health; therefore, without committed employees, problems arise in providing effective performance and quality services to patients [19]. The current study aims to connect employee performance with factors related to organizational commitment, which is a key challenge for providing quality care in hospitals. Since no study has been conducted in the southern Iran on employee commitment in providing medical care, the present study aims to investigate the impact of affective commitment, normative commitment, and continuance commitment on the performance of hospital employees in the southern region of the country. As a result, this study seeks to identify and evaluate the factors affecting employee organizational commitment.

METHODS

STUDY DESIGN:

Current study was conducted in two phases, quantitative and qualitative, this study started on 2023/06/27 and ended on 2023/12/25.

STUDY SAMPLE:

The first phase included all staff members of Fatemeh Zahra Hospital in Hajji Abad, Hormozgan, with 103 individuals evaluated using a census method. For the second phase, all staff members of Fatemeh Zahra Hospital in Hajji Abad, Hormozgan were considered, and 11 semi-structured interviews until data saturation were conducted with purposefully selected participants, including doctors, nurses, and administrative staff serving in the hospital.

Inclusion and Exclusion Criteria

- Participants were required to have at least one year of work experience,
- Participants have no history of neurological or psychiatric illnesses.

Exclusion Criteria:

- incomplete filling up of the questionnaire
- Unwillingness to participate in the study

DATA COLLECTION

For quantitative data collection, a 23-item questionnaire, based on a five-point Likert scale, was used. The questionnaire consisted of two parts: the first part included demographic questions (age, sex, marital status, and education), and the second part comprised the main questions of the questionnaire based on the research hypotheses, which were validated for reliability and validity. The questionnaire covered four dimensions (affective commitment, continuous commitment, normative commitment, and employee performance) and was reviewed by professors in the field of healthcare management. Smart-PLS 3 software was used to assess the validity and reliability of the measurement model. For qualitative data collection, interviews were conducted according to guidelines. Data were collected through individual interview sessions, audio recordings, and note taking. Interviews were conducted face-to-face at the participants' workplace based on their preferences and prior coordination. Initially, the participants were asked to answer demographic questions regarding age, job position, work experience, and educational background. Guided interview questions were then posed, starting with an open-ended question, such as "How is the organizational commitment status in the hospital?" The discussion continued to explore participants' perspectives on the reasons for organizational commitment among hospital staff. Each interview lasted between 25 to 50 minutes. Participants were asked for consent to record the conversations before the session, and a code was assigned to each interview to maintain confidentiality of participants' perspectives.

ETHICAL CONSIDERATION

Following approval of the project implementation permit from the Research Ethics Committee of the Hormozgan University of Medical Sciences, (Number: [IR.HUMS.REC.1402.116](#)). (Ethics committee of Hormozgan University of Medical Sciences has approved the research).

The researchers in Iran visited all staff members of Fatemeh Zahra Hospital in Hajji Abad, Hormozgan, with 103 individuals and. For the second phase, 11 staff members of that were considered for sampling and data collection. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/ or national research committee. The current study was carried out in accordance with the 2013 version of the Helsinki Convention (and its 2020 extensions).

All the participants received verbal explanation about the study objectives and procedures and then signed written informed consents for taking part in the study. The participants were also reassured about the anonymity and confidentiality of their information. All procedures performed in studies involving human participants were in

accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments including informed consent and confidentiality of all personal information.

DATA ANALYSIS

After collecting the data in the quantitative phase, they were analyzed using the Partial Least Squares (PLS) software version 3. PLS is used for structural equation modeling and allows users to visualize graphical indicators instead of writing complex commands. It is important to note that the second generation of structural equation modeling, known as Partial Least Squares Structural Equation Modeling (PLS-SEM) or the variance-based approach, was employed to analyze the gathered data. This approach shares similarities with, but is distinct from, the covariance-based approach, which emphasizes constraints based on covariance.

The capabilities of the PLS approach include working with small datasets, insensitivity to data normality, predictive abilities, support for highly complex models, the capability for composite and reflective measurement modeling. This approach has gained popularity among researchers because of its versatility.

The PLS software utilizes central statistical indicators to describe the sample data and generalize the results obtained from the sample to the hypothetical statistical population of the study. Cronbach's alpha coefficients for all constructs in the study were above (0.70), indicating good reliability and validity of the research measures.

TABLE 1. FINAL RESULTS AND SOURCES OF ASSESSMENT SCALES

Research Variables	Scale Source	Number of Questions	Cronbach's Alpha Coefficient
Emotional Commitment	Meyer, Allen & Smith (1993)	6	0.813
Continuous Commitment	Meyer, Allen & Smith (1993)	5	0.825
Normative Commitment	Meyer, Allen & Smith (1993)	5	0.818
Employee Performance	Koopmans et al (2015)	7	0.891

In the qualitative data analysis section, following each interview, the recorded data were transcribed on the same day. At the same time as the initial interview. The transcripts were first type and read line- by- line, and the important paragraphs were marked, and then independently coded the interviews by researchers, to address the primary reasons for organizational commitments. All themes were finalized and approved by all the researchers at the end of the analysis. Subsequently, coding was performed using MAXQDA 2020 software. Furthermore, after coding all data, codes that shared conceptual similarities were classified into unified categories with more precise meanings.

RESULTS

QUANTITATIVE PHASE

As shown in Table 2, 73.8% of the participants were female and 77.7% were married. The majority of participants (around 67%) held a bachelor's degree compared to other educational backgrounds. The highest occurrence was observed in the age group of 25 to 30 years.

TABLE 2: DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE POPULATION

Demographic Characteristics		Frequency	Percent (%) of frequency
Gender	Female	76	8/73
	Male	27	2/26
Age	18-24	2	09/1
	25-30	34	33
	31-36	26	2/25
	37-42	27	2/26
	+43	14	6/13
Marital Status	Married	23	3/22
	Single	80	7/77
Education	Diploma and Sub-diploma	16	5/15
	Post-diploma	13	06/12
	Bachelor's degree	69	67
	Master's degree	5	09/4

The evaluation of the external model fits in a two-stage Partial Least Squares (PLS) path modeling process involves two key steps. Initially, the measurement model (external model) was scrutinized through confirmatory factor analysis, validity and reliability assessments, and confirmatory factor analysis. Subsequently, the structural model (internal model) was analyzed by estimating the relationships between the variables. Two types of validity assessments were used to confirm the validity of the measurement tool: content validity and convergent validity. Content validity was established based on expert opinions. Additionally, two criteria, namely, Cronbach's alpha coefficient and composite reliability coefficient, were employed to ascertain the questionnaire's reliability. All variables in this study exhibited Cronbach's alpha coefficients that surpassed the minimum threshold of (0.70). Table 3 presents the comprehensive results and convergent validity of the measurement instrument in detail. The measurement tool demonstrated sound content validity, convergent validity, and reliability based on the information provided and the results outlined in Table 3. Factor loadings exceeding (0.40) indicate that the variance between constructs and their indicators surpasses the measurement error variance, implying acceptable reliability of the measurement model. In the current research model, as delineated in Table 3, all factor loading coefficients exceed (0.40), indicating that the variances of the indicators with their respective constructs are adequate, substantiating the appropriateness of this criterion.

TABLE 3. STATISTICAL COEFFICIENTS OF THE RESEARCH

Structure	Title in the model	Index	Cronbach's Alpha Coefficient (Alpha>0.7)	Composite reliability coefficient (Alpha>0.7)	Extracted average variance (AVE>0.5)	factor load (>0.4)	T -value (t>1.96)
affective commitment	affective commitment	A1	0.813	0.802	0.552	0.724	11.5
		A2				0.852	4.62
		A3				0.651	8.78
		A4				0.508	4.24
		A5				0.408	7.17
		A6				0.511	14.8
Continuance commitment	Continuance commitment	C1	0.825	0.811	0.614	0.619	7.10
		C2				0.588	18.2
		C3				0.704	7.19

		C4				0.713	9.09
		C5				0.682	5.51
normative commitment	normative commitment	N1	0.891	0.857	0.575	0.691	8.23
		N2				0.401	15.2
		N3				0.631	8.26
		N4				0.421	8.31
		N5				0.713	6.01
Personnel performance	Personnel performance	P1	0.818	0.806	0.543	0.741	6.95
		P2				0.606	10.4
		P3				0.887	14.5
		P4				0.437	4.06
		P5				0.851	8.36
		P6				0.571	5.73
		P7				0.927	8.16

Internal model fit assessment" refers to the evaluation of the relationship between the variables in a research study. Using an internal model, the research hypotheses can be investigated. The criterion for confirming the research hypotheses is for path coefficients to be positive and t-statistics greater than (1.96). The results of the hypothesis testing are presented in Table 4.

TABLE 4. INTERNAL MODEL FITTING RESULTS

H	Path	Path coefficient	Statistics T	Results
H1	Emotional commitment → personnel performance	0.612	5.801	Accept
H2	Continuous commitment → personnel performance	0.684	6.755	Accept
H3	Normative commitment → personnel performance	0.661	6.324	Accept

The validated conceptual model is shown in Figures 1 and 2. The numbers on the lines represent the beta coefficients resulting from the regression equation between variables, which are the path coefficients. The numbers within each circle indicate R-squared values corresponding to the latent variables within the model. For the path coefficient to be significant, the t-value for each path should exceed (1.96).

FIGURE 1: TESTED RESEARCH MODEL (PATH COEFFICIENTS AND FACTOR LOADING)

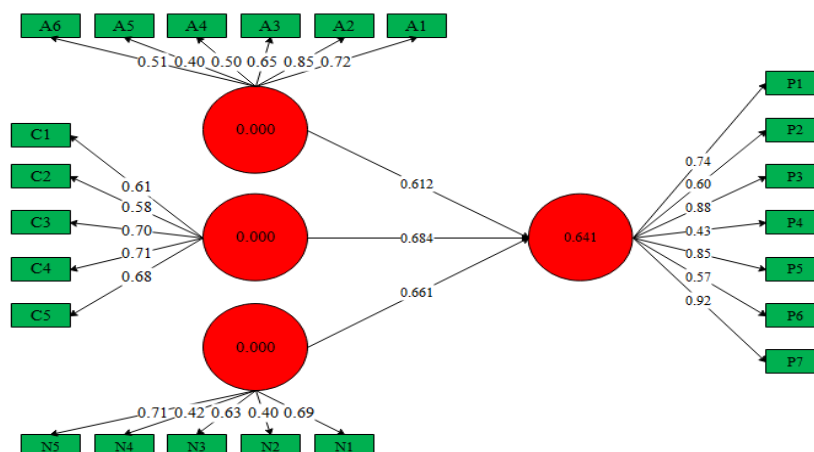
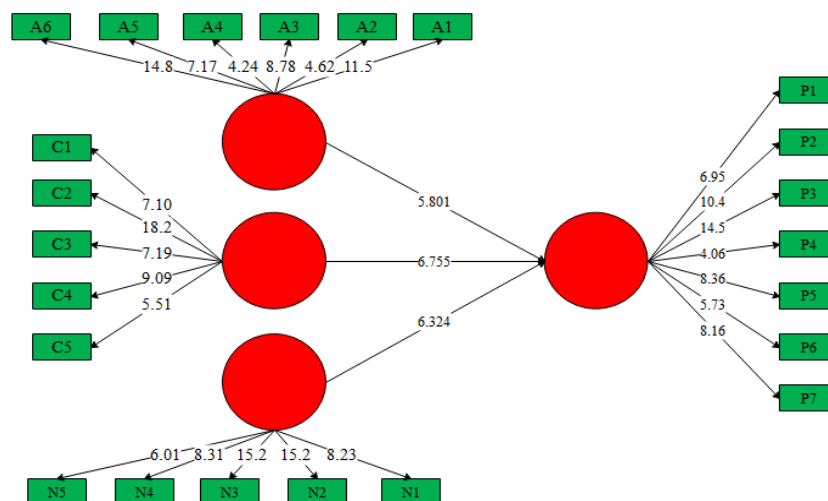


FIGURE 2: TESTED RESEARCH MODEL (T-VALUES)



QUALITATIVE PHASE

The findings of the research on identifying the reasons for organizational commitment from the perspective of hospital employees are in five main themes, including personal, emotional, occupational, social and economic factors as described in Table 5.

TABLE5: REASONS FOR HAVING ORGANIZATIONAL COMMITMENTS FROM THE PERSPECTIVE OF HOSPITAL EMPLOYEES

Main them	Sub them
Economic factors	1- Timely receipt of salary 2- Fair distribution of benefits 3- The possibility of receiving loans and facilities 4- Existence of welfare facilities
Social factors	5- The social position of the job 6- Good reputation of the organization 7- The family's interest in working 8- The desire to have independence
Occupational factors	9- Employing a worker according to the field of study 10- Job security 11- Existence of fair shift 12- Job promotion 13- Job burnout 14- High work experience 15- Empowering work environment and work environment
Emotional factors	16- Existence of effective relationships in the hospital 17- Good morals and character of colleagues 18- The respectful treatment of the management team of the organization 19- Management support 20- Respect 21- Personnel satisfaction
Individual factors	22- Being interested in the job 23- Sense of responsibility and commitment to work 24- Duties 25- sense of being useful 26- Quality of personal life 27- Increasing age

Individual Factors:

One of the reasons for organizational commitment among employees is related to individual factors, which increase with job interest, sense of responsibility and commitment to work, increased age and work experience, sense of duty and usefulness, and likelihood of staying in the organization. *"Due to my love and interest in my job, I tried to improve my skills so that I could be useful in the hospital."* (Participant 1) *"One of the reasons that make me committed to the hospital is that I consider it my human duty to do the work as best as possible and the satisfaction of patients is very valuable to me."* (Participant 6).

Emotional Factors:

The most influential factors affecting employees' organizational commitment are related to emotional factors, which create job satisfaction and commitment due to the presence of effective and intimate relationships, good ethics and attitudes of colleagues, respectful interactions with the hospital management team, and job satisfaction. *"In our department, one of our colleagues suffered from postpartum depression, we tried to make the atmosphere cheerful during our colleagues' presence and with guidance and counseling, we improved their condition."* (Participant 3)

Job Factors:

Job factors are another important factor in organizational commitment: employing a job that matches their field of study, job security, having programs to prevent job burnout, fair shift scheduling, and having a job promotion system increase employees' commitment to the hospital. *"One of our colleagues was a caregiver and was being used as a secretary in the department; they requested to resign several times which eventually led to their relocation."* (Participant 5) *"The head nurse of our department has lower educational qualifications and less work experience than me which sometimes makes me feel disillusioned in my job."* (Participant 2).

Social Factors:

Some participants stated that social factors play an important role in organizational commitment. The social status of the job, good reputation of the organization, and desire for personal independence are among the important factors in retaining the workforce in the organization. *"I take pride in being an employee of the hospital."* (Participant 6) *"Well, we receive monthly salaries and in terms of finances, I have almost financial independence, this is one of the reasons why I stay in the hospital."* (Participant 10)

Economic Factors:

One of the goals of working in an organization is to meet its material needs. Obtaining financial resources such as receiving fair wages and benefits, the possibility of obtaining facilities and welfare amenities are among the factors that retain the workforce in the organization. *"Our hospital has contracts with sports clubs and recreational places, well, this is comforting for me."* (Participant 1) *"In my opinion, dividing rewards based on the number of shifts and working hours and the individual's qualifications can be fairer."* (Participant 9).

DISCUSSION

Organizational commitment is considered an important factor in organizational behavior discussions and plays a significant role in guiding human resource management and professional health policies. If hospital staff lacks commitment to the organization, the organization will not achieve its goals. It is evident that all processes and investments in an organization are tools that require educated, interested, and committed employees dedicated to their work. This study aimed to investigate the relationship between organizational commitment in terms of emotional, continuous, and normative commitment on the performance of staff in the southern hospitals of the country and identify the factors that affect organizational commitment.

In the present study, it was shown that organizational commitment has a positive relationship with staff performance, as demonstrated by Moradi et.al, indicating that organizational commitment is at a moderate level among 67.3% of nurses [20]. Rafiee et.al highlighted that all three dimensions of organizational commitment - emotional, continuous, and

normative commitment have a positive and significant effect on job performance [21]. A study by Princy et al. showed that organizational commitment has a significant impact on a work system with high performance [22]. In 2018, Visanh et al. demonstrated in a study titled "Factors Affecting Organizational Commitment of Employees in Lao Development Bank" that the level of organizational commitment of employees in Lao Development Bank is high, with normative commitment and emotional commitment considered from the highest to the lowest level [23]. Estiningtyas and Darmanto showed in a study titled "Organizational Commitment in Improving the Performance of Employees in Indonesia" that control sources and self-efficacy have a positive and significant impact on organizational commitment [24]. Additionally, Aiwazi stated that there is a significant relationship between performance evaluation and organizational commitment among employees of the General Office of Sports and Youth in Alborz Province [25].

In this study, emotional commitment was found to have a positive and significant relationship with staff performance in the hospital, with an indicative path coefficient of 0.612 and a significant coefficient of 5.801. It is expected that employees will perform their job every day when their managers have guaranteed a valid commitment to pay them at the end of the month. Therefore, hospital staff's emotional commitment can be strengthened through strategies such as emotional attachment, identification, and participation in the organization. If the job at the hospital meets individuals' needs, fosters good relationships with colleagues, and increases job performance and productivity, managers will be able to make more professional decisions in critical situations. Ouyang et al. showed that job satisfaction in nurses has a positive and significant correlation with psychological empowerment and organizational commitment [26]. In a study by Aiwazi et.al, mentioned that employees who emotionally commit to their work integrate their identity with the organization and develop a sense of belonging and commitment, thus not leaving the organization [25].

In this study, continuous commitment was found to have a positive and significant relationship with staff performance, with a path coefficient of (0.684) and statistics of (6.755). Overall, employee output and performance are considered important factors for evaluation: thus, it is believed that with an increase in continuous commitment, hospital staff performance should increase. Therefore, considering the factors affecting continuous commitment in hospitals, employees feel that they should continue their service in the hospital and see the costs of leaving the workplace to be very high.

The results showed that normative commitment also has a positive and significant relationship with hospital staff performance, with a path coefficient of (0.661) and a significant coefficient of (6.324). By creating this type of commitment, a sense of interest and dedication is formed, guiding employees to remain loyal to the organization and continue their activities within it. Government hospital managers should teach their employees how to commit to their organization and job duties according to different commitment styles. In line with the results of this study, Fantahun mentioned that respectful team behavior and management support styles play an effective role in creating employee commitment [27]. It seems that when the management team deals respectfully with employees and supports them, employees establish a strong relationship with the management team and have internal motivation to fulfill organizational commitments.

Bigi et.al revealed that nursing staff have a desirable level of organizational commitment, with the highest level of commitment related to normative commitment. Additionally, there is a study indicating that normative commitment, along with improved quality of work, are good strategies to reduce turnover intentions of employees [28].

In the present study, job factors were identified as a known reason for staff commitment to the hospital. Older and more experienced staff members are more inclined to stay in the organization. In line with the present findings, Eleswed et.al stated that highly experienced staff members are more likely to stay in the organization than those with less work experience [29]. Also, in the study by Negussie and colleagues, organizational commitment, job satisfaction, and work experience were identified as important predictors of job performance among nursing professionals [30].

The present study found that with increasing staff age, there is a higher likelihood that they will stay in the organization. A regression analysis by Al-Haroon et al. showed that age is the only demographic factor that affects the level of

organizational commitment [31]. However, this contradicts Timalsina's findings [32]. It seems that demographic factors depend on culture.

The present study mentioned that improving job satisfaction, especially improving the work environment, is an important variable in enhancing employees' organizational commitment. This finding is consistent with similar studies conducted in Ethiopia and Riyadh [33-34]. Also, a study by Ghardashi mentioned that organizational commitment causes a group of skilled and qualified and highly experienced staff to be gathered in their work and it is considered as the biggest treasure for the organization. In contrast, when there is no organizational commitment or loyalty, after gaining experience in the organization, staff will leave the organization as soon as they find another job. Nowadays, organizations need effective and efficient staff to achieve their goals. In general, the effectiveness and efficiency of organizations depend on the effectiveness and efficiency of the human resources [35].

It seems that hospitals with a conducive work environment give employees a sense of security and comfort, which may drive them to be committed to their organization.

The present study found that empowering employees is a factor in organizational commitment, in line with a study conducted in Egypt [36]. Additionally, in the study by Rezaghi et al., efforts to enhance nurses' abilities can be a valuable strategy to improve organizational and professional commitment [37]. It seems that employees who acquire specific skills feel independent and strive to achieve their goals and those of the hospital.

In the present study, it was noted that individual factors play an important role in organizational commitment. Personal quality of life, individual sense of responsibility, and feeling useful at work are factors that influence organizational commitment. Based on the results of the present study, Zarei et al. concluded that there is a positive and significant correlation between organizational commitment and work-life quality among nurses [38].

It was stated in the present study that economic factors, such as fair distribution of wages and benefits and welfare amenities, play a role in organizational commitments. This was also mentioned in the study by Lee et al., suggesting that nursing institutions and hospitals should adopt more effective human resource management practices to improve perceived organizational justice [39]. Malik et.al states that the work motivation variable has a significant effect on organizational commitment [40].

LIMITATION

The fatigue of working personnel in the hospital might have an effect on how to respond to organizational commitments. In addition, the current research was conducted only in the environment of a government hospital; it cannot be generalized to other private medical centers, industries, and companies. It is suggested that this research can be conducted in other private, military, social security, and welfare hospitals.

CONCLUSION

Organizational commitment generally has a positive relationship with staff performance. Hospitals need organizational reforms to implement commitments that require young or long-serving employees to feel ownership of their profession within the organization. It is suggested that hospital managers, by holding discussion sessions and creating communication networks, use motivating methods to inspire employees to present salaries and ensure job security, which can take effective steps toward improving employees' organizational commitment and policymakers should employ effective motivational strategies to attract and retain human resources in hospitals. Moreover, future researchers should examine the relationship between job commitment and other behavioral dimensions within the organization for further analysis.

ETHICS APPROVAL

Ethics approval and consent to participate of the study received from the Hormozgan University of Medical Sciences, (Number: [IR.HUMS.REC.1402.116](#)). The study followed guidelines and regulations on research involving human subjects, and the collected data was used exclusively for the analyses of this study. All participants gave consent to participate and to publish data from this study.

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AUTHORS' CONTRIBUTION

MMK and NM have collected the data and interviewed the samples, NM and ZM have written the introduction and discussion, AM, NM and AGH analyzed the data and wrote the method and results. ZM, NM and AM have made comments and corrections in final analysis and preparing the final format of manuscript. All authors read and approved of the final manuscript.

CONFLICT OF INTERESTS

The authors declare that they have no competing interests.

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DATA AVAILABILITY STATEMENT

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

HUMAN & ANIMAL RIGHTS

No animals were used for studies that are the basis of this research. This research was conducted on humans are in accordance with the Helsinki Declaration of 1975, as revised in 2013 (<http://ethics.iit.edu/ecodes/node/3931>).

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READINESS OF PROVINCIAL ADMINISTRATION ORGANIZATION TO TRANSFER RESPONSIBILITIES OF SUBDISTRICT HEALTH PROMOTING HOSPITAL

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ABSTRACT

BACKGROUND:

This study assessed the readiness of personnel working in Subdistrict Health Promoting Hospitals (SHPHs) to transfer responsibilities from the Ministry of Public Health to Provincial Administrative Organizations (PAOs). Although the transfer of Subdistrict Health Promoting Hospitals to Local Administrative Organizations (LAOs) has been implemented in Thailand since 2008, it has not been implemented according to the government's plan and has not achieved the expected results. Trang Province, located in the country's southern region, has not yet implemented such a plan.

OBJECTIVES:

The purpose of this study is to scrutinise the factors contributing to the alacrity of SHPH personnel in Trang province for policy implementation related to mission transfer to the Trang provincial administrative organization (TPOA) and network.

METHODS:

The research applied a mixed-method approach, including both qualitative and quantitative approaches (QUAL + QUAN) with semi-structured interviews. 403 samples from the questionnaire were collected from public health personnel working at SHPHs. The Index of Item Objective Congruence (IOC) ranged from 0.80 to 1, and the Cronbach's alpha coefficient was 0.96. Exploratory cross-sectional descriptive research was conducted to examine factors affecting the readiness of personnel in SHPHs in Trang province for policy implementation related to mission transfers to the TPOA.

RESULTS:

This study put under scrutiny the impact of healthcare personnel performance in Trang Province, Thailand, on self-assessment of service standards at SHPHs following the mission transfer to TPOA. Leadership and governance emerged as the strongest predictors, with personnel rating it higher (OR=8.2, 95% CI=3.57-19.30). Other significant predictors included Financing (OR=3.40, 95% CI=1.61-7.37), Information Systems (OR=2.8-3.0), and Health Workforce (marginal significance). These findings accentuated the strong influence of leadership, governance, and financing on personnel performance and transfer expectations.

CONCLUSION:

The findings highlight the strong influence of leadership, governance, and financing on personnel performance and transfer expectations, with notable associations in medical products, vaccines and technologies and health services delivery, demonstrating the crucial roles these factors play in service delivery outcomes.

KEYWORDS

readiness; policy implementing; subdistrict health promoting hospital; missions transfer

INTRODUCTION

Decentralization has been widely adopted as a governance strategy to improve the efficiency, responsiveness, and equity of public service delivery by shifting authority from central governments to local administrative levels. In Thailand, this approach was formally institutionalized in the 1997 Constitution, which mandated the transfer of decision-making authority and public service responsibilities to local governments. This reform was reinforced by the Decentralization Plan and Procedures Act B.E. 2542 (1999), which outlined mechanisms for transferring functions, budgets, and personnel from central agencies to local administrative organizations (LAOs). While decentralization has enhanced local autonomy and service responsiveness, its implementation has faced persistent challenges, including overlapping mandates, limited local capacity, and unclear administrative frameworks [1-2].

Decentralization of primary healthcare is a critical component of Thailand's reform agenda. The transfer of subdistrict health-promoting hospitals (SHPHs) from the Ministry of Public Health (MoPH) to local governments was intended to strengthen community-based service delivery and improve responsiveness to local health needs. Although the original completion deadline was set for 2010, progress has been uneven [3-5]. In 2021, the Decentralization to the Local Government Organization Committee issued new guidelines enabling the voluntary transfer of SHPHs to Provincial Administrative Organizations (PAOs), with implementation beginning in October 2021. More recently, the 2023 Decentralization Plan (Issue 2) mandated further transfers, including 30 SHPHs in Trang Province during the 2024 fiscal year; however, low acceptance among healthcare personnel reflects ongoing concerns regarding job security, career progression, and organizational readiness [6].

Assessing readiness for this transition requires a comprehensive health system perspective. The World Health Organization's "Six Building Blocks of a Health System" framework provides an established approach for evaluating service delivery, workforce capacity, health information systems, access to medical products and technologies, financing, and leadership and governance. This framework is particularly relevant in the current context, as recent studies highlight the growing importance of digital health infrastructure and adaptable service delivery models [7]. Evidence from Thailand indicates that access to technology and post-COVID-19 behavioral changes have significantly influenced healthcare utilization, including antibiotic use, underscoring the need for resilient, well-coordinated primary healthcare systems at the local level [8-9].

In addition to shifting healthcare behaviors, Thailand faces rising public health challenges, including non-communicable diseases linked to urbanization and lifestyle factors. These trends emphasize the importance of strong local governance in disease prevention, surveillance, and health promotion. Against this backdrop, this study examines the readiness of Provincial Administrative Organizations to assume responsibility for SHPHs, using the WHO Six Building Blocks framework to identify key strengths, gaps, and policy implications. Understanding organizational and workforce readiness is essential for ensuring the sustainability and effectiveness of decentralized primary healthcare in Thailand.

METHODS

RESEARCH DESIGN AND LOCATION

In research on factors affecting personnel readiness for mission transfer at TSHPHs, mixed methods were used to implement the policy of transferring the mission of SHPHs. The research included both qualitative and quantitative approaches (QUAL + QUAN). This study aimed to use a triangulation design, collecting data from documents, textbooks, academic articles, and various research studies to compile a conceptual framework and systematically analyse the content to present the research findings. The researcher followed the research procedure [10].

1. Qualitative Approach: Semi-structured interviews were conducted with stakeholders and individuals involved in readiness preparation for mission transfer SHPHs in Trang Province. This included executives from the PAO, Provincial Health Office (PHO), District Health Office (DHO), community hospitals and provincial hospitals, SHPHs, and representatives from the public, totalling 28 individuals.

2. Quantitative Approach: Information was derived from 814 individuals working at SHPHs in Trang Province. A sample group of 407 individuals was randomly selected using Daniel's formula [11].

A mixed-methods approach was brought into play to examine the factors influencing personnel readiness for mission transfer at Sub-District Health Promotion Hospitals (SHPHs) for the policy implementation of transfer missions. With a combination of qualitative and quantitative methods (QUAL + QUAN), a triangulation design was achieved. Data was collected from various sources, including documents, textbooks, academic articles, and other research studies, to develop a conceptual framework and conduct a systematic content analysis to present the findings. The researcher followed the following procedure [10].

1. Qualitative Approach: Semi-structured interviews were conducted with stakeholders and individuals who were involved in preparing for mission transfer at SHPHs in Trang Province. This group had executives from the Provincial Administrative Organization (PAO), Provincial Health Office (PHO), District Health Office (DHO), community hospitals, provincial hospitals, SHPHs, and Area Health Committee (AHC), totalling 28 individuals.

2. Quantitative Approach: Information was collected from personnel working at SHPHs in Trang Province, comprising 814 individuals. A sample group of 403 individuals (response rate was 99.02%) was randomly selected using Daniel's formula [11].

$$\text{formula } n = \frac{Z_{\alpha/2}^2 NP(1-P)}{Z_{\alpha/2}^2 P(1-P) + (N-1)d^2}$$

where n = Sample size with finite population correction,

N = Number of staff at SHPHs in Trang Province, (814 people)

$Z_{\alpha/2}$ = 1.96 statistic for a level of confidence, (95%)

P = Expected proportion (0.50), and

d = Precision (0.04)

$$\text{stand for } n = \frac{(1.96)^2 \times (814 \times 0.50) \times (1-0.50)}{(1.96)^2 \times (0.50) \times (1-0.50) + (814-1) \times (0.04)^2} = 346$$

The sample size was expanded by 15% to reduce the loss of samples, resulting in a calculated adjusted sample size of 407.

RESEARCH INSTRUMENT

Five experts evaluated the in-depth interviews and questionnaire for accuracy, content validity, coverage, and clarity of language to determine the consistency (IOC). Each item in the instrument had an IOC value ranging from 0.8 1.0. Individuals with characteristics similar to those of the sample group were chosen to complete the questionnaire. The questionnaire was highly accurate, with a Cronbach's alpha coefficient of 0.96 [12, 13].

The semi-structured in-depth interviews were structured around the Six Building Blocks of a Health System framework, which encompassed six main topics: 1) health service delivery, 2) health workforce, 3) health information systems, 4) medical products, vaccines, and technologies, 5) health financing, and 6) leadership and governance. The questionnaire was divided into four parts:

Part 1: Demographic Questionnaire: This section includes 11 closed-ended and four open-ended questions.

Part 2: Work Performance Questionnaire based on the "Six Building Blocks of a Health System. It contains 25 items rated on a 5-level Likert scale [7, 14, 15].

Part 3: The Self-Assessment Questionnaire: This section assesses the expectations of SHPH workforce members regarding the policy that grants the PAO greater authority. It includes 20 items rated on a 5-level Likert scale, focusing on improved health, responsiveness, social and financial risk protection, and efficiency [14, 15].

Part 4: The Service Standards Questionnaire, aligned with the decentralization policy, uses a 5-level Likert scale and consists of 20 items to facilitate self-evaluation of service standards. Aspects such as access, coverage, quality, and safety are covered here [14, 15].

ETHICAL APPROVAL

This study was approved by the Ethics Committee for Research Involving Human Subjects at Mahasarakham University, Thailand (No. 156-028/2023). The study adhered to ethical research protocols by obtaining written informed consent from participants and ensuring confidentiality.

DATA COLLECTION PROCEDURES

A mixed-methods study was conducted in Trang Province, Thailand, from June to October 2023 to examine the perspectives and roles of health service personnel within the provincial health system. Data was collected through semi-structured in-depth interviews and questionnaire-based surveys.

Interviews: Semi-structured interviews were conducted in Thai with executives from the TPAO, PHO and DHO, provincial and district hospitals, SHPHs, and the AHC. Participants with a minimum of one year of local experience were involved in the interviews aimed to explore expectations regarding the transfer of SHPH missions under TPAO's decentralization policy, guided by the key question: "What are your expectations for the transfer of SHPH missions under TPAO's decentralization policy?" Each interview lasted between 30 and 60 minutes, was audio-recorded with participants' consent, and was transcribed verbatim.

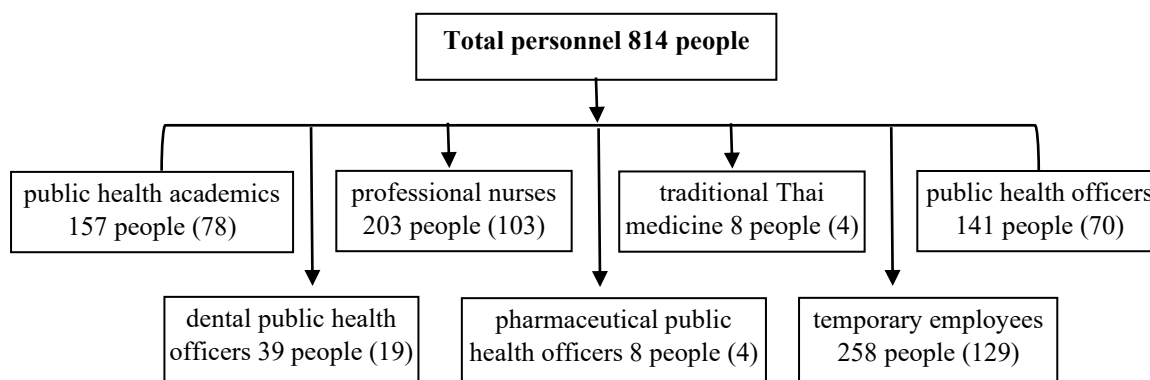
Survey: The survey targeted SHPH staff including public health academics, nurses, public health officers, dental and pharmaceutical officers, traditional Thai medicine practitioners, and temporary employees. Participants underwent random selection, based on the proportion of job roles through simple random sampling and were required to have at least one year of employment at SHPHs in Trang Province.

The findings provided insights into the perspectives and roles of health service personnel within the provincial health system (Figure 1).

The researcher adopted the following steps for data collection:

1. Request letters were sent to the executives of all the relevant agencies involved, requesting permission for data collection.
2. Upon receiving permission from the executives, research volunteers were selected, based on the predetermined criteria.
3. The study's objectives were explained and outlined on how the rights of the volunteers would be protected. In-depth interviews were conducted personally by the researcher, while trained research assistants distributed questionnaires specifically prepared for this study.
4. Signed consent was obtained from the volunteers before the commencement of the interviews and the administration of the questionnaires.
5. Upon completion of the questionnaires, the research assistants checked each response for completeness before returning it to the researcher. This process ensured both accuracy and completion. Ultimately, completed questionnaires from 403 participants were received, accounting for 99% of the target of 407 participants. The data was recorded using a software program, verified twice by two individuals, and then used for statistical analysis.

FIGURE 1 SHOWS THE POPULATION BY OCCUPATIONAL GROUPS AT SHPHS IN TRANG PROVINCE



Data analysis: Qualitative data was collected through in-depth semi-structured interviews, and document reviews analyzed using thematic analysis based on Braun and Clarke's (2006) six-step process: familiarization, coding, theme generation, theme review, theme definition, and reporting [16].

Transcripts were analyzed using Atlas. ti version 9 to organise the data and categorise it into themes aligned with the study objectives. Content analysis and categorical analysis were conducted utilizing the Six Building Blocks of a Health System framework to derive guidelines for policy implementation. Two researchers engaged in cross-referencing and interpretation to ensure reliability and address discrepancies through collaboration discussion.

Quantitative analysis: Quantitative data were analyzed using descriptive statistics and the Six Building Blocks of a Health System framework to evaluate the demographic influences on the organization of health services at the SHPH. Spearman's rank correlation coefficient was used to assess the relationships between staff performance, expectations regarding preparation for mission transfers in Trang Province, and self-assessed service standards. Additionally, ordinal logistic regression was employed to examine how preparation for mission transfers in Trang Province affected the performance of the SHPH personnel. The analyses were conducted using IBM SPSS Statistics for Windows, version 29 (licensed under a Concurrent User License from Mahasarakham University) and JAMOVI, version 2.6.26 (2025), and the integrated findings from both analyses provided a comprehensive framework to support the effective readiness of personnel in SHPHs in Trang province for policy implementation related to mission transfer to the TPOA and network.

The assumptions for Spearman's correlation and ordinal logistic regression both analyze ordinal data with different aims. Spearman measures monotonic relationships between ranked variables without requiring normal distribution or linearity. Ordinal logistic regression predicts the probabilities of ordered category membership, assuming proportional odds, independent observations, no multicollinearity, and minimal outliers. One quantifies the strength of the association, whereas the other predicts the category probabilities [17, 18].

RESULTS QUALITATIVE STUDY

There were six themes corresponding to the Six Building Blocks that emerged, each with sub-themes reflecting expectations and concerns.

1. HEALTH SERVICE DELIVERY

Stakeholders expressed their concerns for improved access and quality, but expressed concerns about consistency.

Enhanced Access and Equity: AHC anticipated modern equipment and equitable services across urban and rural areas (e.g., Informant 1: "*I expected... services with modern and equitable medical equipment*"). TPAO executives foresaw efficient primary care systems, emphasizing prevention and treatment.

Comprehensive Services: Provincial and district health officers expected seamless integration with secondary and tertiary care, maintaining or exceeding prior standards.

Concerns About Capacity: The Non-participating SHPH executives and some DOH doubted improvements, due to the unclear network coordination and professional shortages (e.g., Informant 4, District: *"I did not expect... better services because SHPHs lacked core professionals"*).

2. HEALTH WORKFORCE

Expectations centered on increased manpower and morale were tempered by professional gaps. Adequate Staffing: Most groups expected larger staffing frameworks to reduce workloads and enhance primary care (e.g., Informant 2, Public: *"I expected... larger staffing covering primary care"*).

Career Advancement: The TPAO and public stakeholders anticipated clear career paths to boost morale.

Professional Shortages: Hospital and district executives noted the absence of doctors, dentists, and pharmacists as barriers (e.g., Informant 4, District: *"Staffing did not cover essential professions like doctors"*).

3. HEALTH INFORMATION SYSTEMS

Stakeholders had expected continuity with enhancements but feared transition disruption.

System Integration: Public and TPAO stakeholders had expected existing systems to merge well with TPAO and leading IT expertise (e.g., Informant 3, Public: *"I expected... IT positions to manage and analyze data"*).

Data Utilization: PHO anticipated advanced systems for alerts and analytics.

Transition Risks: Some hospital and SHPH executives anticipated initial inefficiencies or data discrepancies (e.g., Informant 1, SHPH Transfer: *"I expected... data discrepancies hindering unified development"*).

4. MEDICAL PRODUCTS, VACCINES, AND TECHNOLOGIES

Expectations included modernized supplies that relied on existing networks.

Modern Equipment: Public and TPAO stakeholders expected technology to be upgraded, especially in rural areas.

Network Dependence: executives from community hospitals, provincial hospitals and DHO anticipated continued support from leading hospitals (e.g., Participant 3, Hospital: *"I expected... support from main hospitals"*).

Management Challenges: PHO noted that TPAO's inexperience was viewed as a potential limitation.

5. HEALTH FINANCING

Optimism prevailed for increased budgets, although allocation clarity was a concern.

Increased Budgets: Every group had expected greater financial liquidity from TPAO subsidies and NHSO funds (e.g., Informant 4, TPAO: *"I expected... subsidies based on SHPH size... increasing liquidity"*).

Flexible Allocation: TPAO and SHPH executives anticipated streamlined disbursements.

Regulatory Issues: Some officials noted potential discrepancies in compensation regulations (e.g., Informant 3, TPAO: *"I expected... issues with differing compensation regulations"*).

6. LEADERSHIP AND GOVERNANCE

Stakeholders expected decentralized authority but were worried about political interference.

Delegated Authority: TPAO and SHPH executives anticipated shorter command lines and flexible management (e.g., Informant 4, TPAO: *"I expected... delegation to SHPH directors... enabling rapid problem-solving"*).

Visionary Leadership: Provincial officers had placed considerable emphasis on outcome-focused leadership.

Political Volatility: District and hospital executives feared political interference and unclear oversight (e.g., Participant 1, Provincial: "*I thought... politicians' volatility required staff to adapt*").

CONCLUSION

Stakeholders expected the SHPH mission transfers to enhance local health systems through better access, staffing, and financing. However, concerns regarding professional shortages, system integration, and leadership clarity underscored the need for strategic planning. Recommendations included establishing precise coordination mechanisms, investments in IT and professional recruitment and fostering leadership training. Future research should evaluate post-transfer outcomes to clinch expectations.

RESULTS QUANTITATIVE STUDY

DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS

The health personnel working in the TPSHPH comprised 403 persons and manifested the following findings: women formed the majority (77.17%). The mean age was 39.88 years (S.D. = 9.84), ranging in age from 22 to 60 years. Many participants were between 20 and 35 years of age (45.41%), followed by those aged 45–60 years (31.51%). Regarding marital status, 59.06% were married and 33.75% were single. In terms of education, the majority held a bachelor's degree (75.68%), 10.17% had vocational certificates, and only a small proportion (0.25%) had completed primary school.

Regarding employment status, most participants were government officers (71.46%), followed by ministry employees (13.65%), while the smallest group consisted of permanent employees (0.25%). The largest occupational group comprised professional nurses (24.81%), followed by public health officers (24.07%), and the smallest group was financial officers (1.00%). Most participants were regular staff members (85.86%), 12.16% were SHPH directors, and 1.98% were department heads. In terms of living arrangements, 91.07% lived in their own homes, 4.71% in SHPH-provided housing, and 3.72% in rental homes. Finally, most participants did not intend to transfer the SHPH mission to the TPAO in 2024. This study examined the self-assessment scores of healthcare personnel at SHPHs in Trang province regarding policy implementation related to mission transfers to TPOA. A survey of 403 respondents revealed consistently high ratings across all evaluation categories. Personnel rated their performance levels highest in Health Service Delivery and Information Systems (both 4.37), while scoring lowest in financing (3.46). Service Standards received the strongest overall assessment (4.59), with Safety Standards (4.56) and Service Quality Control (4.55) achieving the highest individual scores. Personnel expectations were rated at a "high level" (4.13), with Improved Health receiving the highest expectation score (4.13) and Social and Financial Risk Protection the lowest (3.92). The findings generally indicated positive self-assessments across all implementation issues measured in the study (Table 1).

TABLE 1 SELF-ASSESSMENT SCORES OF HEALTHCARE PERSONNEL AT SHPHS IN TRANG PROVINCE FOR POLICY IMPLEMENTATION RELATED TO MISSION TRANSFER TO TPOA (N = 403)

Issues of implementation	$\bar{x}$	S.D.	Interpretation
1. Self-assessment of the performance level of personnel SHPHs			
Health Service Delivery	4.37	0.75	Highest level
Information system and sharing	4.37	0.68	Highest level
Leadership & Governance	4.3	0.72	Highest level
2			
Medical Products, Vaccines & Technologies	4.30	0.68	Highest level
Health Workforce	3.89	0.84	Highest level
Financing	3.4	1.11	High level
6			

Total	4.30	0.65	Highest level
2. Self-Assessment of Service Standards for personnel SHPHs			
Safety standards	4.56	0.59	Highest level
Service quality control	4.55	0.60	Highest level
Access to services for local people	4.51	0.60	Highest level
Service coverage	4.28	0.73	Highest level
Total	4.59	0.56	Highest level
3. Self-assessment according to the expectations of personnel SHPHs			
Improved Health	4.13	0.81	High level
Responsiveness	4.09	0.79	High level
Improved Efficiency	4.00	0.78	High level
Social and Financial Risk Protection	3.92	0.89	High level
Total	4.13	0.74	High level

Note: Self-assessment scores for performance of health personnel, Service Standards and expectations at SHPHs in Trang Province are divided into five levels (lowest to highest) based on average scores: 1.00 - 1.80: Lowest, 1.81 - 2.60: Low, 2.61 - 3.40: Moderate, 3.41 - 4.20: High, and 4.21 - 5.00: Highest (Best's, 1977)

CORRELATION BETWEEN THE PERFORMANCE LEVEL OF PERSONNEL AT TPSHPH AND THEIR SELF-ASSESSMENT SCORES FOR SERVICE STANDARDS IN PREPARATION FOR THE TPAO

The correlations were as follows: medical products, vaccines and technologies, leadership and governance, information systems and sharing, health workforce, and health service delivery ($r_s = .549, .528, .495, .484, \text{ and } .443$, respectively). On the other hand, the features of Financing showed a weak correlation with the self-assessment of SHPH personnel on service standards in preparation for TPAO ($r_s = .324$), which was also statistically significant ($p < .001$) (Table 2).

TABLE 2 CORRELATION BETWEEN TPSHPH PERSONNEL PERFORMANCE AND THEIR SELF-ASSESSMENT SCORES FOR SERVICE STANDARDS IN TPAO PREPARATION

Variable	Correlation Coefficient (r_s)	p-value	Interpret results
Medical Products, Vaccines & Technologies	.549*	< .001	moderate
Leadership & Governance	.528*	< .001	moderate
Information System and Sharing	.495*	< .001	moderate
Health Workforce	.484*	< .001	moderate
Health Service Delivery	.443*	< .001	moderate
Financing	.324*	< .001	weak

r_s Spearman's Rank Correlation Sig. (2-tailed)

CORRELATION BETWEEN PERSONNEL EXPECTATIONS FOR TPAO PRODUCTION AND THEIR PERFORMANCE LEVEL IN TPSHPH

The study revealed a significant and moderate relationship ($p < .001$) between personnel expectations and performance levels in all areas. The correlation coefficient rankings from highest to lowest were as follows: Leadership & Governance ($r_s = .614$), Medical Products, Vaccines & Technologies ($r_s = .545$), Health Workforce ($r_s = .521$), and Information Systems and Sharing ($r_s = .490$). The issues of Health Service Delivery ($r_s = .387$) and Financing ($r_s = .379$) showed a weak relationship ($p < .001$) (Table 3).

Significant findings revealed the correlation coefficient between the performance levels of TPSHPH personnel under the Six Building Blocks of a Health System framework and the self-assessment of SHPH personnel on service standards in preparation for TPAO. It was discovered that almost every aspect of the performance levels of TPSHPH personnel had a

moderate positive correlation with the self-assessment of SHPH personnel on service standards in preparation for TPAO, with statistical significance ($p < .001$).

TABLE 3 CORRELATION BETWEEN TPSHPH STAFF PERFORMANCE AND SHPH PERSONNEL EXPECTATIONS FOR TPAO READINESS

Variable	Correlation Coefficient (r_s)	p-value	Interpret results
Leadership & Governance	.614*	< .001	moderate
Medical Products, Vaccines & Technologies	.545*	< .001	moderate
Health Workforce	.521*	< .001	moderate
Information system and sharing	.490*	< .001	moderate
Health Service Delivery	.387*	< .001	weak
Financing	.379*	< .001	weak

r_s Spearman's Rank Correlation Sig. (2-tailed)

FACTORS AFFECTING THE HEALTHCARE PERFORMANCE OF SHPHS PERSONNEL IN TRANG PROVINCE WITH SELF-ASSESSMENT FOR SERVICE STANDARDS OF SHPHS REGARDING MISSION TRANSFER TO TPOA

The study conducted an ordinal logistic regression analysis to examine the effects of the healthcare personnel's performance of SHPH personnel in Trang Province with a self-assessment of service standards for SHPHs regarding mission transfer to TPOA. This revealed a statistically significant model ($\chi^2 = 185$, $p < .001$) explaining approximately 22-29% of the variance in service standard self-assessments (McFadden's $R^2 = 0.224$ and Nagelkerke $R^2=0.286$). Leadership and governance emerged as the strongest predictors, with personnel rating it higher, being 8.2 times (95% CI=3.57-19.30) more likely to have the highest service standard assessments. This was followed by financing (odds ratio: 3.40, 95% CI=1.61-7.37), information systems (odds ratio: 2.8-3.0, 95% CI=1.11-7.15, and 95% CI=1.30-6.88, respectively), and the Health Workforce (marginally significant). Health Service Delivery and Medical Products/Vaccines/Technologies showed no significant relationship. These findings suggest that prioritizing leadership, governance, and making improvements in finance would most effectively enhance service standards in the Trang Province mission transfer (Table 4).

TABLE 4 ORDINAL LOGISTIC REGRESSION ANALYSIS BETWEEN HEALTHCARE PERSONNEL PERFORMANCE IN TRANG PROVINCIAL HEALTH PROMOTION HOSPITALS AND SELF-ASSESSMENT FOR SERVICE STANDARDS OF SHPHS REGARDING MISSION TRANSFER TO TPOA.

Predictor	β	SE	Z	p	Odds ratio	95% CI	
						Lower	Upper
Health Service Delivery:							
Highest – Moderate	0.69	0.42	1.66	0.097	1.99	0.88	4.52
High – Moderate	0.24	0.39	0.61	0.545	1.27	0.59	2.72
Health Workforce:							
Highest – Moderate	0.67	0.38	1.78	0.076	1.95	0.93	4.09
High – Moderate	0.24	0.29	0.85	0.395	1.27	0.73	2.23
Information system and sharing:							
Highest – Moderate	1.03	0.47	2.17	0.03	2.79	1.11	7.15
High – Moderate	1.08	0.42	2.56	0.01	2.95	1.30	6.88
Medical Products, Vaccines & Technologies:							
Highest – Moderate	0.73	0.45	1.62	0.106	2.07	0.86	5.01
High – Moderate	-0.03	0.39	-0.08	0.934	0.97	0.45	2.09
Financing:							
Highest – Moderate	1.22	0.39	3.16	0.002	3.40	1.61	7.37

<i>High – Moderate</i>	0.37	0.24	1.55	0.121	1.44	0.91	2.29
Leadership & Governance:							
<i>Highest – Moderate</i>	1.21	0.37	3.27	0.001	3.34	1.64	6.97
<i>High – Moderate</i>	2.10	0.43	4.90	<.001	8.20	3.57	19.30

****Model Fit:** The overall model shows strong statistical significance ($\chi^2 = 185$, $df = 12$, $p < .001$), McFadden's $R^2 = 0.224$, Cox & Snell $R^2 = 0.142$, and Nagelkerke $R^2 = 0.286$

FACTORS AFFECTING THE HEALTHCARE PERSONNEL PERFORMANCE OF SHPHS PERSONNEL IN TRANG PROVINCE WITH PERSONNEL EXPECTATIONS REGARDING MISSION TRANSFER TO THE TPOA.

This study used ordinal logistic regression analysis to examine the relationship between the healthcare performance of SHPHs personnel in Trang province and their expectations regarding mission transfer to TPOA. The findings revealed that personnel performance across multiple healthcare domains significantly predicted transfer expectations, with particularly strong associations in Leadership & Governance (OR=4.29 for high performers, 95% CI=1.82-10.31), Financing (OR=4.39 for high performers, 95% CI=1.40-19.45), and Medical Products/Vaccines/Technologies (OR=3.31 for moderate performers, 95% CI=1.34-8.29). Health Service Delivery showed moderate significance (OR=2.26, 95% CI=1.01-5.13), while Information Systems demonstrated marginally significant relationships. The overall model demonstrated good statistical significance ($\chi^2=125$, $df=12$) with a reasonable explanatory power of approximately 24.50% of the variance in expected preparation levels (Nagelkerke $R^2=0.245$), suggesting that healthcare performance domains play an important role in shaping personnel expectations regarding mission transfer to TPOA in this provincial healthcare setting (Table 5).

TABLE 5 ORDINAL LOGISTIC REGRESSION ANALYSIS BETWEEN HEALTHCARE PERFORMANCE OF SHPH PERSONNEL IN TRANG PROVINCE WITH PERSONNEL EXPECTATIONS REGARDING MISSION TRANSFER TO TPOA.

Predictor	β	SE	Z	p	Odds ratio	95% CI	
						Lower	Upper
Health Service Delivery:							
<i>High – Highest</i>	0.35	0.27	1.28	0.2	1.42	0.83	2.41
<i>Moderate – Highest</i>	0.81	0.42	1.96	0.05	2.26	1.01	5.13
Health Workforce:							
<i>Highest – Moderate</i>	0.15	0.44	0.33	0.742	1.16	0.48	2.75
<i>High – Moderate</i>	0.45	0.29	1.52	0.129	1.56	0.88	2.80
Information system and sharing:							
<i>High – Highest</i>	0.53	0.29	1.81	0.071	1.70	0.96	3.01
<i>Moderate – Highest</i>	0.87	0.47	1.86	0.063	2.39	0.96	6.06
Medical Products, Vaccines & Technologies:							
<i>High – Highest</i>	0.61	0.31	1.96	0.05	1.84	1.00	3.41
<i>Moderate – Highest</i>	1.20	0.46	2.58	0.01	3.31	1.34	8.29
Financing:							
<i>High – Highest</i>	1.48	0.65	2.28	0.023	4.39	1.40	19.45
<i>Moderate – Highest</i>	1.15	0.67	1.72	0.085	3.16	0.96	14.32
Leadership & Governance:							
<i>High – Highest</i>	1.46	0.44	3.30	< .001	4.29	1.82	10.31
<i>Moderate – Highest</i>	1.13	0.30	3.72	< .001	3.10	1.72	5.67

****Model Fit:** The overall model shows strong statistical significance ($\chi^2 = 125$, $df = 12$), McFadden's $R^2 = 0.201$, Cox & Snell $R^2 = 0.0980$, and Nagelkerke $R^2 = 0.245$

DISCUSSION

To discuss the research results, we can seek to integrate insights from other relevant studies that align with the factors affecting the readiness of SHPHs personnel in Trang province for policy implementation related to the mission transfer to the TPOA and network.

LEADERSHIP AND GOVERNANCE:

The importance of strengthened leadership and governance in healthcare systems is well-documented. Effective leadership is essential for health system integration, particularly during transitions like mission transfers. This supports the study's findings that leadership and governance were the strongest predictors of personnel readiness and service standard self-assessments in Trang province. This emphasized the role of leadership in local administrative organizations' readiness to accept health system transfers, reinforcing the idea that leadership clarity and stability are vital for successful policy implementation [19, 20].

FINANCING:

Adequate financing is a critical determinant of health system performance and personnel expectations. The role of financing in decentralization efforts, noting that financial resources are key to maintaining service delivery, particularly in decentralized health systems. The findings from Trang Province, where financing was a significant predictor of performance and readiness, align with these conclusions [21]. Furthermore, this highlighted the need for secure financial planning when transferring primary healthcare responsibilities to local organizations, reinforcing the need for financial sustainability to support effective service provision post-transfer [22].

INFORMATION SYSTEMS AND SHARING:

The importance of robust information systems for healthcare performance was highlighted in multiple studies. This articulated that integrated information systems were essential for smooth healthcare delivery, especially during system changes [19]. In the context of Trang province, the study's findings that information systems significantly impacted service standards and personnel expectations supported this argument. This also emphasized how the health system's ability to manage data during crises (e.g., floods) influences service delivery, underscoring the need for a reliable information infrastructure to support health system transfers [23].

HEALTH WORKFORCE:

The study identified that while the health workforce had a marginal effect on performance and expectations, it remained an essential factor in readiness. Due to development, these human resources were fundamental pillars in ensuring excellence in public health [24]. As healthcare personnel were crucial to implementing new policies and maintaining service standards, investments in recruitment and training were necessary. In addition, that was necessary to improve and develop the workforce's preparedness to meet the challenges of the mission transfer [25].

HEALTH SERVICE DELIVERY AND MEDICAL PRODUCTS, VACCINES, AND TECHNOLOGIES:

Although this study found no significant association between these factors and personnel readiness in Trang Province, the broader literature indicates that they remain critical components of effective healthcare systems. The integration of disability inclusion within health systems, for instance, requires coordinated management of health services, medical products, and assistive technologies [26]. Moreover, evidence of barriers in obstetric care delivery at the primary healthcare level illustrates how the availability and quality of essential services and medical products can substantially influence health outcomes and service quality, even when such factors do not directly affect personnel expectations or perceived readiness [8–9, 27–28].

INTEGRATION WITH LOCAL HEALTH SYSTEMS:

Several studies emphasized the need for strategic integration between local administrative organizations and health systems to ensure that transferred missions were successfully incorporated into existing structures. For instance, studies in Thailand and Zimbabwe underscored the importance of local readiness and the alignment of missions with broader health system goals [20, 24].

IT AND INFRASTRUCTURE INVESTMENTS:

Several studies called for investments in information technology (IT) systems to facilitate the transfer process and improve healthcare delivery post-transfer. The health systems integration was importance of IT in enabling data sharing and service coordination, a recommendation echoed in studies from India and Thailand [8-9, 19, 25, 28].

CONCLUSION

The research highlighted the critical factors influencing the readiness of SHPH personnel in Trang Province for the mission transfer to the TPOA and network. Strong leadership and governance emerged as the most significant predictors of personnel readiness, aligning with existing literature on the importance of leadership clarity during transitions. Financing, information systems, and health workforce preparedness were crucial in implementing a successful policy. While health service delivery and medical products were not directly related to personnel readiness, the broader literature underscored the importance of maintaining service quality. Additionally, integrating local health systems and investing in IT infrastructure were identified as essential for facilitating the transfer process and improving healthcare delivery. Overall, the study reinforced the need for a comprehensive approach that combined leadership, financial sustainability, technological investment, and workforce readiness to support effective health system transitions.

LIMITATIONS AND SUGGESTIONS

The limitations of this study could be stated as follows: the participants were primarily made up of personnel working in primary healthcare units, specifically at SHPH. The study focused on quantitative data and in-depth interviews within the government sector involved in transferring responsibilities from SHPH to the PAO in Trang, and representatives from the civil society sector. The study did not focus on the general public, who are the service recipients, because the relevant laws do not grant the public the right to make decisions on this matter. However, the researcher designed additional research that included in-depth interviews with representatives from the civil society sector, allowing their involvement in this study. It was recommended that a system should be developed to monitor the outcomes of the mission transfer, including the satisfaction of the personnel involved in the transfer, and to explore opportunities for improving the primary healthcare services managed by the PAO moving forward.

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest

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HEALTH HAZARD AND RISK ASSESSMENT FOR OCCUPATIONAL HEALTH MANAGEMENT AMONG THREE DIFFERENT FARMER GROUPS IN PHRANAKORN SI AYUTTHAYA PROVINCE, THAILAND

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ABSTRACT

OBJECTIVE:

This study aimed to study occupational health hazards and risk assessment among three farmer groups and to propose guidelines for setting up occupational health management in farmer groups

METHOD:

The cross-sectional study of 315 rice, vegetable, and melon farmers in Phranakorn Si, Ayutthaya province, Thailand. The tool for data collection was a two-part questionnaire: (1) general characteristics, and (2) risk assessment from pesticide use, working behavior, and symptoms from exposure to agricultural chemicals. The questionnaire was scored on 5 levels, and the relationship was assessed using the Chi-square test.

RESULTS:

Farmers in each group are exposed to different health hazards according to the production process. The risk assessment level was low in each group: the melon group (91%), the vegetable group (89.1%), and the rice group (53.3%). The association between risk assessment levels and associated factors was statistically significant in the rice group ($p = 0.019$; $OR = 2.70$, 95% $CI = 1.22-5.97$). ($OR = 7.89$, 95% $CI = 1.98 - 31.35$) in the vegetable group, and $p = 0.023$ ($OR = 5.44$, 95% $CI = 1.32 - 22.43$) in the melon group, respectively.

CONCLUSION:

This study suggested that guidelines for occupational health management should account for differences in occupational and health hazards across groups. Nevertheless, the operation of occupational health management will be successful with close cooperation from all three parties: government agencies, community leaders, and local farmers.

KEYWORDS

health hazards, risk assessment, occupational health management, Thailand

INTRODUCTION

The COVID-19 epidemic in 2020-2021 directly and indirectly impacted Thailand's agricultural sector. Farmers need to adapt to this situation to earn enough income to make a living. The agricultural model has shifted from single-crop agriculture to mixed agriculture, with an increasing emphasis on subsistence agriculture. Although the agricultural model has changed, farmers still face workplace risks, including physical, chemical, biological, and ergonomic hazards. The National Institute for Occupational Safety and Health (NIOSH) explained that agriculture ranks among the most hazardous industries. It is well recognized that farmers are at very high risk for fatal and nonfatal injuries. In addition, farming is one of the few industries in which family members (who often share the work and live on the premises) are also at risk for fatal and nonfatal injuries [1]. Studies across various countries, including the United States, India, Brazil, and European nations, have shown that pesticide exposure, respiratory conditions, musculoskeletal disorders, and hearing loss among agricultural workers are also a concern. Recent studies from Africa and Southeast Asia reveal the impact of extreme weather conditions, economic instability, and limited access to healthcare on agricultural workers [2-5]. According to the International Labor Organization (ILO), developing countries struggle to enforce occupational health standards due to limited resources and weak regulations. Studies from Vietnam, Indonesia, and Mexico have linked prolonged pesticide use to chronic illnesses such as neurological disorders and cancer. Research in Latin America and Africa highlights the lack of access to proper pesticide training and safety measures, leading to high rates of acute poisoning. However, Canada and Germany have successfully reduced chemical dependence by adopting integrated pest management (IPM) techniques [6,7].

Thailand's agriculture has developed to produce a variety of crops, thereby increasing productivity. Chemical fertilizers are used to accelerate plant growth, and chemical pesticides are used widely. For the past decade, it has been importing chemicals and finished products from abroad, which are then mixed and used domestically, increasing 3 times, and have a rate of use per unit area of up to 100% [8]. In addition, Thailand is located in the humid tropics; heavy rain and high temperatures are suitable for the growth of diseases, insects, and various weeds that hinder the growth of plants, making farmers unable to avoid using chemicals and resulting in both environmental problems and serious negative effects on health in the long term [9]. The ILO emphasizes workplace risk assessment as a critical tool for improving occupational health and safety conditions. However, comprehensive risk assessments remain scarce among certain farmer groups, particularly smallholder farmers with limited access to occupational safety training and resources [10]. Studies in Africa and Latin America report similar findings: farmers are unaware of proper pesticide handling and disposal methods, resulting in high rates of acute poisoning and chronic health effects [11,12].

Phranakorn Si Ayutthaya province in central Thailand dedicates 71.8% of its land to farming—primarily rice, vegetables, and melons. The province has more than 42,000 farming households, with informal agricultural workers representing 18.1% of the informal workforce (National Statistical Office and Provincial Labor Office, 2018). Health and safety concerns persist among farmers: 54–74 work injuries and four pesticide poisoning cases were recorded. A local survey found that 1.4% of farmers who used chemicals experienced work-related illnesses, and 23.1% experienced pesticide-related allergies (rashes, dizziness, nausea, vomiting). Most farmers (88.9%) reported using personal protective equipment (PPE) during pesticide application and recognizing the importance of safety education [13,14]. However, most present information focuses on injuries and illnesses and lacks risk assessment. An in-depth study of the three groups' personal factors, working environment, and safety conditions is needed. It informs farmers about the root causes of health conditions. Thus, this study aimed to identify occupational health hazards and conduct risk assessments among three farmer groups, and to provide guidelines for establishing occupational health management appropriate to their respective work processes.

METHOD

STUDY DESIGN AND SETTING

This quantitative survey was a cross-sectional study in Phranakhon Si Ayutthaya province, a central lowland region characterized by its suitability for diverse cultivation. From September 2020 to May 2021, three groups of farmers were studied: rice and melon farmers in Lat Bua Luang district and vegetable farmers in Phak Hai district. These groups represent the province's diverse agricultural landscape, with unique work processes and exposure patterns from large-scale field crops (rice) to intensive cultivation (vegetables) and greenhouse farming (melons).

Data collection covered various agricultural stages and seasonal shifts to capture farmers' routine safety practices and exposure risks.

PARTICIPANTS

The study included farmers in Phranakhon Si Ayutthaya province; data from the National Statistical Office indicated that 44,242 farmers were registered. The researcher determined the sample size using Taro Yamane's formula, yielding a total sample of 363 participants. Therefore, they were divided into three groups, with approximately 120 farmers in each group. However, during the data collection period, there was still an ongoing COVID-19 outbreak in the area; thus, data were collected from a sample of only 315 persons, comprising 105 rice farmers, 110 vegetable farmers, and 100 melon farmers. Inclusion criteria: participants aged 20 years or older (ensuring legal majority and reliable self-reporting) with at least one year of active farming experience (consistent occupational exposure history). The study excluded individuals who did not perform farming activities themselves (e.g., landowners who only manage labor) to maintain the validity of data on direct safety behaviors.

RESEARCH INSTRUMENT

Health risk assessment used a semi-quantitative risk matrix model from Thailand's Department of Disease Control, with two components:

Section I: Behavioral Risk Scoring: Fifteen items assessed farmers' work habits and pesticide use. Nine risky behavior items were scored 1 (never) to 3 (regularly), and six preventive practice items were reverse scored. Total scores (15–45) were categorized as Low (15–24), Moderate (25–30), or High (31–45).

Section II: Symptom Severity Categorization: Post-exposure health symptoms were grouped into three severity levels:

Mild (Group 1): Eye or nose irritation, cough, dizziness.

Moderate (Group 2): Skin rashes, numbness, nausea/vomiting.

Severe (Group 3): Muscle twitching, seizures, loss of consciousness.

Final health risk levels were determined by integrating behavioral risk scores and symptom severity using a prioritized risk matrix (Table 1).

TABLE 1: HEALTH RISK ASSESSMENT MATRIX

Behavioral Risk Score	No Symptoms	Mild Symptoms (Group 1)	Moderate Symptoms (Group 2)	Severe Symptoms (Group 3)
Low (15-24 points)	Low	Moderate	Fairly High	High
Moderate (25-30 points)	Moderate	Fairly High	High	High
High (31-45 points)	Fairly High	High	High	Very High

The quality was assessed using the content validity index (CVI), which was 0.85; reliability was assessed in another farmer group of 30 participants; the coefficient was 0.88.

DATA COLLECTION

The researcher collected data from three farmer groups—rice, vegetable, and melon—in the sample area. Participants were recruited through local agricultural officers and village leaders, who assisted with inclusion and exclusion criteria and selected participants via purposive sampling and direct contact with village and farmer group leaders. The questionnaires and face-to-face interviews collected data on general characteristics, pesticide use, work behavior, and health symptoms. Data were collected during the day at the farming sites, allowing the researcher to observe agricultural activities and the actual work environment. Each interview session took approximately 15–30 minutes, ensuring enough time for clarified responses and data verification."

STATISTICAL ANALYSIS

SPSS for Windows was used to analyze the data, and the chi-square test was used to assess the association between demographic characteristics and risk assessment levels. A p-value of <0.05 was considered statistically significant. Testing to compare the three farmer groups was conducted using contingency tables and Fisher's exact test.

ETHICAL CONSIDERATIONS

The study received ethical approval from the Ethical Review Committee for Human Research of the Faculty of Public Health, Mahidol University, which evaluated and approved the research procedure under project number MUPH 2021-014.

RESULTS

OCCUPATIONAL HEALTH HAZARD

All the farmer groups were exposed to a high level of physical hazards; the most common hazards were hot weather, glare, noise, and vibration from the machine; however, in melon production, they were exposed to lower levels of these hazards. In chemical hazards, most hazards encompass multiple factors: plant dust, soil dust, and pesticide mist; biological hazards from fungi/bacteria; working in waterlogged/muddy soil; and poisoned animals. Most ergonomic hazards include prolonged sitting or standing, head movements, forward bending, twisting and tilting, and lifting heavy objects. The psychosocial hazards were working hastily, an uncontrollable situation, a greater workload, and uncertain income (Table 2).

TABLE 2: HAZARDS OF THE WORKING PROCESS IN THE FARMERS' GROUP

Group	Process	Hazard category
Rice	1) Soil preparation by plowing the field and release the water into puddy	1) Physical: hot weather, sunlight, noise, and vibration from tractors and sprayers
	2) Seeding preparation by water soaking for one night and covering seeds in one day	2) Chemical: soil dust, seeds dust, dust/vapor/ mist from chemicals/fertilizer
	3) Seeding and taking care of the rice consists of chemical spray for weed control, fertilizer by scattering, and insecticide use	3) Biological: bacteria/fungi in the field, poison animals
	4) Harvesting by harvester truck and keeping straw to make straw bales, destroy straw and stubble by burning	4) Ergonomics: abnormal posture, fatigue, heavy lifting
		5) Psychosocial: speed up work, workload, water shortage, inclement weather, wages
Vegetable	1) Preparation of planting by plowing the plots at the plant area with a tractor, scattering straw to cover the soil, and watering by boat	1) Physical: hot weather, sunlight, noise, and vibration from tractors, boats, and sprayers
	2) Planting, take the sprout into the planting area, and implant the sprout into the soil by hand, watering by boat or sprinkler system	2) Chemical: soil dust, straw dust, dust/vapor/mist from chemicals or fertilizer

Group	Process	Hazard category
	3) Take care of the sprouts by watering every day, insecticide spraying, chemical fertilizer by scattering, spraying nutrients/ micronutrients, and controlling weeds every month by hand	3) Biological: bacteria/fungi in the field, poison animals
	4) Harvesting in the early morning, use a small sharp knife to cut nearly the base of plants, storage in a cool place or good ventilation, pick out, quality test, and packing	4) Ergonomics: abnormal posture, fatigue, heavy lifting 5) Psychosocial: speed up work, workload, water shortage, wages
Melon	1) Seed preparation by soaking the seeds in warm/normal water for 2-6 hrs.	1) Physical: hot weather, sunlight, noise from tractor
	2) Cultivation of seedlings by mixing seedling material and filling into the seedling tray and taking it to greenhouses 10 – 13 days, transplant seedling to plant in greenhouses	2) Chemical: seeds dust, soil dust, rice husk dust/vapor/mist from fertilizer
	3) Preparing for planting by applying fertilizer and covering the planting area with rice husk.	3) Biological: fungi
	4) Planting: Remove the seedling from the seedling tray and put it in pots or soil	4) Ergonomics: abnormal posture, heavy lifting
	5) Take care of the sprouts by holding them onto the melon tree using a rope tied to the iron stick, pulling the string upward, and holding the top of the melon with the rope. Pollinate fruit when the melon is the size of an egg, choose only one fruit per group, water by a sprinkler system, spray pesticides, and provide nutrients/micronutrients.	5) Psychosocial: workload, stress from fewer seedlings or damage
	6) Harvesting by cutting and putting it into the container	

HEALTH RISK LEVEL

Following the assessment of occupational health risks and work-related symptoms using the matrix in Table 1, the resulting risk levels among the farmer groups are presented in Table 3.

Most farmers had low health risk levels, but the distribution varied among groups. Rice farmers had the highest moderate-risk levels (40.0%), indicating greater exposure to hazardous conditions. Vegetable farmers (89.1%) and melon farmers (91.0%) were predominantly low risk, likely due to the controlled environments and more effective protective measures.

TABLE 3: NUMBER AND PERCENTAGE OF INDIVIDUAL FARMERS CLASSIFIED BY HEALTH RISK LEVELS

Farmer group	Health Risk Level, n (%)		
	Low (15-24 points)	Moderate (25-30 points)	High (31-45 points)
Rice (n=105)	53.3%	40.0%	6.7%
Vegetable (n=110)	89.1%	10.0%	0.9%
Melon (n=100)	91.0%	9.0%	-

While Table 2 provides a comprehensive breakdown of all hazards across the entire work process, Table 4 synthesizes these findings to highlight the most significant occupational hazards and their associated health risk levels for each farmer group. This summary enables a direct comparison of risk profiles, revealing that although the majority of farmers fall within the 'Low' risk category, specific activities—such as chemical application in rice farming and high-heat greenhouse work in melon cultivation—pose distinct health challenges that require targeted interventions.

TABLE 4: SUMMARY OF PREDOMINANT HAZARDS AND HEALTH RISK LEVELS ACROSS FARMER GROUPS

Farmer Group	Key Work Processes with Elevated Risk	Primary Occupational Hazards Identified	Predominant Health Risk Level
Rice	Chemical spraying (weed and insecticide control) and scattering fertilizer	Chemical: Dust, vapors, and mists from pesticides. Ergonomics: Abnormal posture and heavy lifting	Low (53.3%), with significant moderate and fairly high risk (46.7%)
Vegetable	Harvesting, manual weeding, and planting sprouts by hand.	Ergonomics: Fatigue from repetitive movement and heavy lifting Physical: Sunlight and hot weather.	Low (89.1%)
Melon	Greenhouse maintenance (holding sprouts) and pesticide spraying.	Physical: Extreme heat and sunlight (greenhouse effect). Chemical: Fertilizer and pesticide mists.	Low (91.0%)

GENERAL CHARACTERISTIC

Overall, the three farmer groups had more females than males (46.1% and 53.9%, respectively). The mean age across all farmer groups was 50–56 years, and most had a primary education level (65.4%). The mean working period was 25 years in the rice group and 22 years in the vegetable group, but in the melon group, it was 10 years. Most farmers (75.6%) do not have a chronic disease, and do not exercise (60.9%). Significant differences were observed across farmer groups in education level ($p < 0.001$), chronic disease ($p = 0.016$), and exercise behavior ($p < 0.001$). (Table 5)

THE FACTOR OF ASSOCIATION

Regarding factors associated with health risk levels (Table 6), gender was found to be a significant factor among rice farmers ($p = 0.019$); specifically, males had a 2.7 times higher risk than females (OR = 2.70, 95% CI = 1.22–5.97). Among vegetable farmers, age was significantly associated with health risk ($p = 0.002$), with those aged 60 and older exhibiting a 7.89 times higher risk compared to those under 60 (OR = 7.89, 95% CI = 1.98–31.35). For the melon farmer group, alcohol consumption was a significant predictor ($p = 0.023$), where the alcohol-drinking group had 5.44 times the risk of the non-drinking group (OR = 5.44, 95% CI = 1.32–22.43).

TABLE 5: DESCRIPTIVE CHARACTERISTICS IN THE FARMERS' GROUP (N=315)

Information	Rice (n=105)	Vegetables (n=110)	Melons (n=100)	Average (%)	F	p-value
Gender						
- male	55 (52.4%)	46 (41.8%)	44 (44%)	46.1	1.327	0.267
- female	50 (47.6%)	64 (58.2%)	56 (56%)	53.9		
Mean age (year)	56	55	50			
(Min-max) (year)	40 – 81	40 – 74	21 – 81			
Education						
- primary education	84 (80%)	66 (60%)	56 (56%)	65.4	6.630	<0.001*

Information	Rice (n=105)	Vegetables (n=110)	Melons (n=100)	Average (%)	F	p-value
- secondary education	10 (9.5%)	18 (16.4%)	36 (36%)	20.3		
- high school education	7 (6.7%)	21 (19.1%)	8 (8%)	11.4		
- vocational/high certificate	3 (2.9%)	3 (2.7%)	-	1.9		
- bachelor's degree	1 (1%)	2 (1.8%)	-	0.9		
The working period in agriculture						
(Mean)(year)	25	22	10			
(Min-max) (year)	10 – 50	1 – 60	3 – 25			
Chronic disease						
- have	35 (33.3%)	27 (24.5%)	15 (15%)	24.4	4.162	0.016*
- without	70 (66.7%)	83 (75.5%)	85 (85%)	75.6		
Smoking behavior						
- no smoking	83 (79%)	88 (80%)	76 (76%)	78.4	0.172	0.842
- ex-smoker	8 (7.6%)	7 (6.4%)	9 (9%)	7.6		
- smoking	14 (13.3%)	15 (13.6%)	15 (15%)	14.0		
Drinking alcohol behavior						
- no drinking	83 (79.1%)	91 (82.7%)	78 (78%)	80.0	0.392	0.676
- used to drink	4 (3.5%)	5 (4.5%)	7 (7%)	5.1		
- drinking	18 (17.1%)	14 (12.7%)	15 (15%)	14.9		
Exercise behavior						
- regular	16 (15.3%)	42 (38.2%)	16 (16%)	23.5	7.793	<0.001*
- sometimes	14 (13.3%)	9 (8.2%)	26 (26%)	15.6		
- never	75 (71.4%)	59 (53.6%)	58 (58%)	60.9		

*Significant at p-value < 0.05

TABLE 6: ASSOCIATION BETWEEN CHARACTERISTICS AND RISK ASSESSMENT LEVEL IN THE FARMERS' GROUP

Factor	Risk assessment level (Percentage)		OR	95%CI	p-value
	Moderate to High	Low			
● Rice farmer group					
Gender					
Male	32 (58.2%)	23 (41.8%)	2.70	1.22 – 5.97	0.019*
Female	17 (34.0%)	33 (66.0%)	1		
Age					
60 years up	14 (43.8%)	18 (56.2%)	0.84	0.37 – 1.95	0.692
≤ 59 years	35 (47.9%)	38 (52.1%)	1		
Education					
Primary school	43 (51.2%)	41 (48.8%)	2.62	0.93 – 7.41	0.063
Secondary school and upper	6 (28.6%)	15 (71.4%)	1		
Working period					
21 years up	31 (50.8%)	30 (49.2%)	1.49	0.68 – 3.27	0.330
≤ 20 years	18 (40.9%)	26 (59.1%)	1		
Chronic disease					
Have chronic disease	17 (47.2%)	19 (52.8%)	1.03	0.46 – 2.32	0.934
No chronic disease	32 (46.4%)	37 (53.6%)	1		
Smoking behavior					
Smoking	14 (63.6%)	8 (36.4%)	2.40	0.91 – 6.34	0.073

Factor	Risk assessment level (Percentage)		OR	95%CI	p-value
	Moderate to High	Low			
No smoking	35 (42.2%)	48 (57.8%)	1		
Drinking alcohol behavior					
Drinking	14 (63.6%)	8 (36.4%)	2.40	0.91 – 6.34	0.073
No drinking	35 (42.2%)	48 (57.8%)	1		
Exercise Behavior					
No exercise	35 (46.7%)	40 (53.3%)	1.00	0.43 – 2.34	1.000
Exercise	14 (46.7%)	16 (53.3%)	1		
• Vegetable farmer group					
Gender					
Male	4 (8.7%)	42 (91.3%)	0.67	0.18 – 2.36	0.528
Female	8 (12.5%)	56 (87.5%)	1		
Age					
60 years up	9 (25.0%)	27 (75.0%)	7.89	1.98 – 31.35	0.002*
≤ 59 years	3 (4.1%)	71 (95.9%)	1		
Education					
Primary school	10 (15.2%)	56 (84.8%)	3.75	0.78 – 18.02	0.119
Secondary school and upper	2 (4.5%)	42 (95.5%)	1		
Working period					
21 years up	6 (14.0%)	37 (86.0%)	1.65	0.50 – 5.49	0.533
≤ 20 years	6 (9.0%)	61 (91.0%)	1		
Chronic disease					
Have chronic disease	4 (14.8%)	23 (85.2%)	1.63	0.45 – 5.91	0.484
No chronic disease	8 (9.6%)	75 (90.4%)	1		
Smoking behavior					
Smoking	1 (4.5%)	21 (95.5%)	0.33	0.41 – 2.73	0.453
No smoking	11 (12.5%)	77 (87.5%)	1		
Drinking alcohol behavior					
Drinking	2 (10.5%)	17 (89.5%)	0.95	0.19 – 4.75	1.000
No drinking	10 (11.0%)	81 (89.0%)	1		
Exercise Behavior					
No exercise	4 (6.9%)	54 (93.1%)	0.41	0.12 – 1.44	0.154
Exercise	8 (15.4%)	44 (84.6%)	1		
• Melon farmer group					
Gender					
Male	5 (11.4%)	39 (88.6%)	1.67	0.42 – 6.62	0.501
Female	4 (7.1%)	52 (92.9%)	1		
Age					
60 years up	1 (3.8%)	25 (96.2%)	0.33	0.39 – 2.77	0.439
≤ 59 years	8 (10.8%)	66 (89.2%)	1		
Education					
Primary school	6 (10.7%)	50 (89.3%)	1.64	0.39 – 6.96	0.727
Secondary school and upper	3 (6.8%)	41 (93.2%)	1		
Working period					
21 years up	2 (6.2%)	30 (93.8%)	0.58	0.11 – 2.97	0.715
≤ 20 years	7 (10.3%)	61 (89.7%)	1		
Chronic disease					
Have chronic disease	0 (0.0%)	15 (100%)	0.89	0.83 – 0.96	0.348

Factor	Risk assessment level (Percentage)		OR	95%CI	p-value
	Moderate to High	Low			
No chronic disease	9 (10.6%)	76 (89.4%)	1		
Smoking behavior					
Smoking	4 (16.7%)	20 (83.3%)	2.84	0.69 – 11.58	0.212
No smoking	5 (6.6%)	71 (93.4%)	1		
Drinking alcohol behavior					
Drinking	5 (22.7%)	17 (77.3%)	5.44	1.32 – 22.43	0.023*
No drinking	4 (5.1%)	74 (94.9%)	1		
Exercise Behavior					
No exercise	4 (6.9%)	54 (93.1%)	0.55	0.14 – 2.18	0.486
Exercise	5 (11.9%)	37 (88.1%)	1		

* Significant at p-value < 0.05 *

DISCUSSION

The study confirmed that different farming groups face distinct occupational health hazards. Rice farmers had the highest exposure to chemical and physical hazards due to frequent pesticide use and machine operation. Vegetable farmers were primarily affected by ergonomic risks, while melon farmers experienced the lowest levels of occupational hazards due to controlled greenhouse environments. In the rice field, the study of Kawitthararin K and Kanjana S revealed that most of the farmers have a high level of knowledge of how to protect themselves from exposure to pesticides 84.6%, a high level of self-defense attitude from exposure to pesticides at 100% and a high level of self-defense behavior from exposure to chemicals at 96.2% [15]. The study by Tijjani et al. revealed that most farmers were aware of pesticide safety and use practices (64%); factors influencing awareness among farmers were age, household size, and farm size [16]. However, some farmers are unaware of or ignore the potential health effects of improper pesticide use. Still, many chemicals are used by rice farmers, especially in Phachi District, Phranakhon Si Ayutthaya Province; they have been using pesticides for more than ten years, and the dominant pesticides used for their crop are 87.7 % glyphosate (herbicide) and 68.5 % abamectin (insecticide) [17].

The results indicated that gender, age, and alcohol consumption were significant factors influencing health risk levels. These findings suggest that targeted interventions should consider demographic and behavioral characteristics. In 2018, Johnson et al. reported that female farmers in the agricultural workforce face gender disparities in access to healthcare. They have limited access to healthcare resources and are more likely to be exposed to harmful agrochemicals due to inadequate protective equipment. Moreover, household and childcare responsibilities intersect with farm work, increasing physical and psychological strain [18]. Similar to other studies, females had lower mental component scores (MCS) than males [19], and females showed a significantly higher proportion than males for mental component scores (MCS) [20]. However, male farmers are exposed to numerous health risks due to the use of agrochemicals, including pesticides and fertilizers, which are associated with increased risks of pesticide-related health issues such as skin disorders, respiratory problems, and neurological disorders [21]. Furthermore, long-term exposure to these chemicals leads to higher risks of chronic conditions, including certain cancers and reproductive disorders [22]. Male or female farmers are more susceptible to health issues due to a combination of factors. It is important to implement targeted interventions that address their specific health needs. Recognizing and addressing these health risk factors can significantly help safeguard the well-being of all farmers.

Age affects farmers' health; older farmers frequently have MSDs due to long-term exposure to occupational risk factors and workplace accidents. Many studies have found that older farmers face greater job risks than younger farmers. For example, in Nan Province, Thailand, farmers aged 60 years and older were less likely to experience occupational falls than those aged 40-49 years [23]. A health and safety risk assessment of 114 informal agricultural workers in Amphoe Phu Kamyao, Phayao province, Thailand, found that the group aged 60 years and over had higher health and safety risk

scores than the group aged less than 60 years [24]. The study by Asghar et al. found that age and farming experience negatively affected the use of personal protective equipment and safety behavior; namely, older and experienced farmers did not follow safety rules [25]. On the other hand, the young farmer's group had factors associated with joint and bone pain among farmers older than 40 years and 40–60 years old [26]. Similar to data from the Department of Disease Control, Ministry of Public Health, Thailand, reported data on pesticide poisoning disease in 2018, the age group of patients was 15–59 years (67.1%) followed by the age group over 60 years (25.1%). Most patients were field crop and vegetable growers (43.2%) and general contract workers (21.1%) [27]. It is necessary to consider risk factors across age groups to mitigate potential hazards for farmers.

Alcohol consumption is a significant health risk factor in the farming community. It is prevalent among particular subgroups and can compound existing health risks. Excessive alcohol consumption is associated with various health issues, such as liver disease, cardiovascular problems, and mental health disorders. A study by Bangkadanara G. et al. found that drinking alcohol affects working safety behavior, and farmers who do not drink alcohol have better safety working behavior than those who do, with a difference of 1.9 times [28]. Additionally, farmers who consume alcohol or beverages while working are 2.5 times more likely to have injuries than those who do not drink alcohol [29]. Targeted interventions and awareness campaigns are necessary to address alcohol-related risks in the farming community.

CONCLUSION

The study results highlight significant differences in hazard exposure, risk levels, and demographic influences among the farmer groups. The interventions for each farmer group could enhance occupational health management. Rice farmers improved their training on pesticide application and the use of PPE. Vegetable farmers focus on ergonomic hazards and on providing mechanized tools to reduce physical strain. Melon farmers reduce exposure to greenhouse-related heat stress through proper ventilation and hydration programs. Furthermore, they should consider implementing safer agricultural chemical programs and establishing local health monitoring centers dedicated to farming communities. These targets will mitigate health risks and foster long-term, sustainable agricultural practices, thereby improving well-being and productivity for all farmer groups.

The operation of OHS management in agriculture will be successful; it requires close cooperation from all three parties: (1) local government agencies (e.g., Sub-district Health Promoting Hospitals) should provide specialized health screenings for rice farmers exposed to pesticides, (2) community leaders should facilitate safety training and establish equipment-sharing programs for proper PPE, and (3) the farmer group must adopt the recommended work-rest schedules, particularly melon farmers working in high-heat greenhouse environments, to reduce physical strain.

Implementing participatory hazard identification and risk assessment processes will enable farmers to actively prioritize occupational health risks. Additionally, monitoring, evaluation, and continuous improvement of OHS performance are needed to ensure sustainability. Agricultural workers will benefit from safer work environments and improved health outcomes through the integration of these policy-driven, practice-oriented approaches. The participatory approach is central to occupational health interventions. Farmers should be directly involved in hazard identification, decision-making, and evaluation of health and safety programs. It can achieve long-term sustainability and effectiveness by fostering strong partnerships and community-driven occupational health management.

This study collected data during a period in Thailand when an ongoing COVID-19 outbreak and flooding made data collection intermittent. Sometimes, community leaders must collect data on behalf of researchers, which may introduce bias into the data. Future research should examine the long-term effects of the pandemic on agricultural occupational health, including changes in pesticide use patterns, shifts in farming dynamics, and the effectiveness of safety training programs.

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IMPACT OF EXTENDED-HOURS EMERGENCY DEPARTMENT PHARMACY SERVICE ON HOSPITAL LENGTH OF STAY FOR HIGH-NEEDS PATIENTS

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ABSTRACT

OBJECTIVE

To evaluate the effect of an extended-hours emergency department (ED) clinical pharmacy service (8am–9pm, seven days a week) on hospital length of stay (LOS) for high medication needs (high-needs) general medicine unit (GMU) patients.

METHODS

This retrospective cohort study was conducted across three EDs within the same health network from March to September 2022. The study compared high-needs GMU patients who were provided a best possible medication history (BPMH) by an ED pharmacist (ED-BPMH) versus BPMH completed on the ward by a GMU inpatient ward pharmacist (GMU-BPMH). Primary outcome was inpatient LOS. Secondary outcomes included ED and total LOS. Data collected included patient demographics (age, sex), home medications, discharge disposition and Charlson Comorbidity Index (CCI), derived from ICD-10 coded records.

RESULTS

Analysis of 3,277 patients (1,597 ED-BPMH, 1,680 GMU-BPMH) revealed balanced groups with respect to age, CCI and number of home medications with a median of 83.3 vs 83.2 years; 4.0 vs 4.0; 10.0 vs 10.0, respectively. However, the GMU-BPMH group contained a higher proportion of male sex (48.4% vs. 45.1%). After adjustment for confounders, the estimated median difference for LOS was -0.71 days (-17.0 hours) lower in the ED-BPMH group (95% CI: -1.10, -0.32; $p < 0.001$). Median differences in ED and total LOS between groups were +0.32 days (95% CI: 0.29, 0.35; $p < 0.001$) and -0.49 days (95% CI: -0.88, -0.10; $p = 0.01$), respectively.

KEY FINDINGS:

- ED pharmacist review was associated with a 7.9% (0.49 days) reduction in total length of stay compared to ward pharmacist review of similar patients.
- The ED pharmacy service also resulted in a 12.5% (0.71 days) reduction in inpatient length of stay, although patients reviewed by ED pharmacists had a longer ED stay.

CONCLUSIONS

In high-needs GMU patients with a high medication burden, the extended-hours ED clinical pharmacy service was associated with shorter inpatient and total LOS, despite longer ED stay.

KEYWORDS

emergency medicine, clinical pharmacy, length of stay, access to health care

INTRODUCTION

The Australian healthcare system provides universal coverage for all residents and aims to deliver fair, accessible, safe and high-quality healthcare services to the populace.[1] Additionally, it is reported that up to one-third of all Australians aged 18 years or over access healthcare via the public health sector.[2] Over the past decade, the demand for hospital services has continued to grow and during the 2020-21 period, healthcare expenditure surged to a record high of \$220.9 billion.[3] Rising emergency departments (ED) presentations, partly exacerbated by the global pandemic, have contributed to this growth.[4] Despite recent increased funding, the Australian healthcare system has struggled to meet the demands of equitable access to healthcare, including timely access to emergency and inpatient beds.[5] To address these challenges, innovative solutions and targeted healthcare policies have been implemented to improve access to hospital services.

The World Health Organisation (WHO) defines hospital 'access' in several ways, including 'waiting times' for services, geographical distribution and the number of available services and hospitals.[6] ED access reflects these factors, with metropolitan hospitals often having longer waiting times compared to outer regional areas.[7] Improving access requires more than simply increasing supply; factors such as workforce distribution are equally important. Several systematic reviews have explored various mechanisms to improve patient hospital access and balance demand and capacity, with most pointing towards multifaceted 'whole-system' approaches. [8,9] These include medication management strategies, particularly for patients with high medication burden[10], as well as interventions aimed at reducing length of stay.

Hospital length of stay (LOS) is a validated metric for efficient hospital management and can act as a proxy for access.[10] In addition to correlations with healthcare costs, increased LOS has been linked to negative patient and staff experience and preventable patient complications.[11,12] Despite these known adverse effects, evidence surrounding the use of interventions aimed at reducing LOS is conflicting, with many struggling to produce impactful change, even in high-risk patient groups.[10] Recent studies, including a 2024 meta-analysis, have investigated the link between pharmacist-provided interventions and modest reductions in LOS (SMD -0.09 days; 95% CI -0.49 to -0.15)[13,14], although many included studies had substantial design limitations. The effect may be greater when such services are delivered early in the hospital journey (i.e., in ED) and directed towards patients with high medication burden. However, evidence on the impact of extended-hours ED pharmacy services on LOS in high-needs general medicine patients is limited.

Pharmacists are integral members of the emergency department and have a significant role in ensuring patient safety, quality of care and hospital access.[15] Potential mechanisms through which pharmacists can help improve patient flow include creating timely and accurate medication histories, reconciling medications, optimising pharmacotherapy, ensuring prompt medication supply and facilitating discharge planning.[16] Notably, in 2024, we published a paper highlighting that ED clinical pharmacy services can substantially reduce admission medication errors[17], which are known to contribute to prolonged hospital stays.[18] Early identification and prevention of medication errors through ED-based pharmacy services may therefore help prevent unnecessary prolongation of hospital stays. The aim of the current study was to evaluate the effect of an extended-hours ED clinical pharmacy service on hospital LOS for high medication needs (high-needs) general medicine patients.

STUDY SETTING AND DESIGN

This retrospective study was conducted across three EDs within the Eastern Health network from March to September 2022 (Box Hill Hospital: 61,674 admissions per year; Maroondah Hospital: 34,450 admissions per year; Angliss Hospital: 22,807 admissions per year). Two EDs provided a comprehensive seven-day extended-hours clinical pharmacy service (8am to 9pm), while the third ED provided service from 8am to 5pm. Services were prioritised for high-needs medical patients based on referrals and clinical indicators, in accordance with Advanced Pharmacy Australia (AdPha; formerly known as SHPA) standards for pharmacy practice.[15] Ethical approval was obtained from the Eastern Health Office of Research and Ethics (LR21-032-79058).

The study compared high-needs General Medicine Unit (GMU) patients who received a Best Possible Medication History (BPMH) by an ED pharmacist (ED-BPMH) versus BPMH completed on the ward by a GMU inpatient ward pharmacist (GMU-BPMH). For all patients a clinical pharmacist documented the BPMH in the patient's Electronic Medical Record (EMR) as per standard procedures. As part of standard practice, the pharmacist also documented whether patients were presenting from private residence or a Residential Aged Care Facility (RACF), the person responsible for administering medications (patient, carer or RACF staff), non-English-speaking status (requiring interpreter) and whether medication non-adherence was suspected or reported.

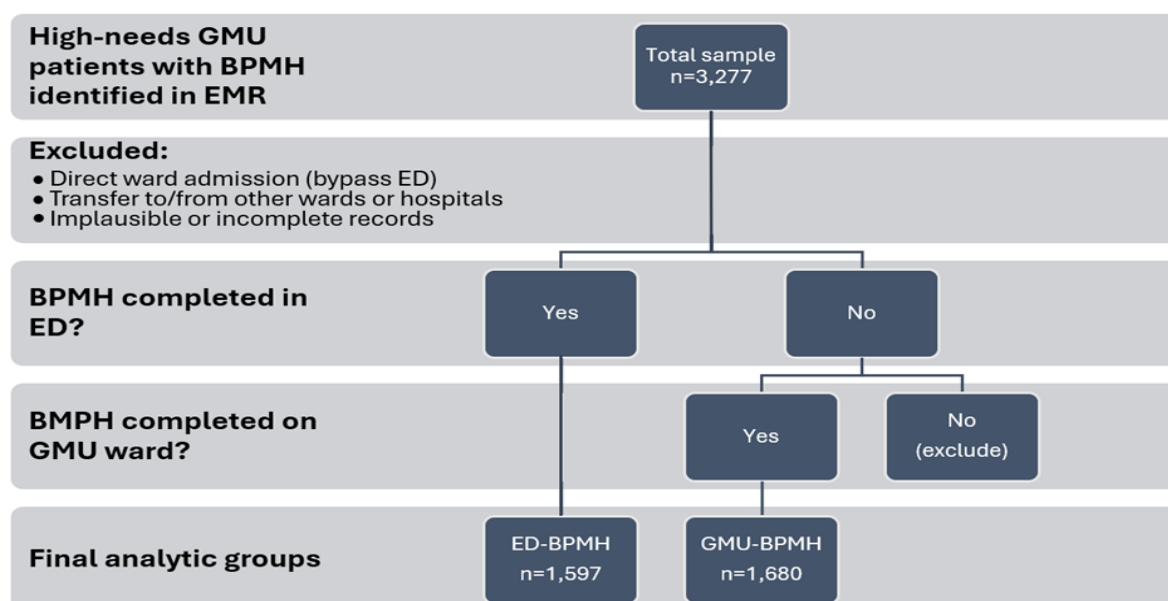
Patient allocation to ED or ward pharmacist review was based on routine service workflows and service availability. Although this approach minimised selection bias within the high-needs cohort, ED pharmacists may have prioritised patients with more complex medication histories or longer ED stays.

PARTICIPANT ELIGIBILITY

Adult inpatients aged 18 years or older, who were evaluated as 'high-needs' and who were admitted to GMU via ED were included. High-needs status was assessed using a locally validated tool¹⁹ designed to identify patients at increased risk of medication-related adverse outcomes. The tool considers criteria such as use of high-risk medicines, and patient factors including frailty and comorbidity. Patients meeting at least one criterion are classified as high-needs.

Patients directly admitted to an inpatient ward (i.e., bypassing ED) and patients transferred to or from other wards or hospitals, including those admitted to the Short Stay Unit before transfer to wards were excluded (Figure 1).

FIGURE 1: STUDY FLOW DIAGRAM SHOWING PATIENT INCLUSION AND EXCLUSION PROCESS.



GMU: General Medicine Unit; ED: Emergency Department; BPMH: Best Possible Medication History

DATA SOURCE

Data were collected within a secure cloud-based database, utilising routine EMR-based service activity cards to obtain patient demographics and data related to ED presentations and ward admissions. Other data, such as home medications and medication non-adherence status, were manually obtained from individual patient records. Data collected included patient demographics (age, sex), home medications, discharge destination and Charlson Comorbidity Index (CCI). CCI scores were derived from hospital ICD-10 coded records.

OUTCOMES

The primary outcome was inpatient LOS. Inpatient LOS was determined from the time of ward admission until discharge from the inpatient ward.

Secondary outcomes included ED and total LOS. ED LOS was determined from the time of ED presentation until the patient was admitted to the inpatient ward. Total LOS was determined from the time of ED presentation until the time of discharge from the inpatient ward.

STATISTICAL ANALYSIS

The sample size was calculated based on an average LOS of 6.1 days, derived from 13,145 Eastern Health general medicine inpatients over 12 months (October 2020 to September 2021, unpublished data). A standard deviation (SD) of 3.0 days was adopted from a previously published study by another metropolitan teaching hospital in Melbourne, Australia.[14] Using 80% power and a two-sided significance level of 0.05, the total sample size required to detect a 5% reduction in LOS was estimated to be 3,200. Implausible or incomplete records were managed using listwise deletion, whereby cases with missing or invalid data for any outcome variable were excluded from analysis. Length-of-stay data were summarised using medians and interquartile ranges due to non-normal (right-skewed) distribution, and group differences were expressed as median differences. The primary outcome, LOS, was analysed using quantile regression, with robust standard errors (unadjusted and adjusted) resulting in an estimate of a difference in medians and its 95% CI. Skewed and binary data were analysed using the Wilcoxon rank-sum test and Pearson's chi-squared test, respectively.

RESULTS

PARTICIPANTS AND DESCRIPTIVE DATA

A total of 3,277 patients were identified, of whom 1,597 had an ED-BPMH and 1,680 had a GMU-BPMH. Patient demographics and clinical characteristics are presented in Table 1. Among the total sample (n=3,277), median (IQR) age was 83.2 (73.3-89.9) years and 53% were female. Medication use was high across the cohort with a median (IQR) of 8 (5-11) regular medications and 2 (0-3) pro re nata (PRN) medications. Polypharmacy, defined as use of five or more regular medications,[20] was present in 80% of the total sample. The average CCI score across the cohort was 4.0 (3.0-5.0), depicting a moderate to high level of comorbidity in the patient population,[21] which is in line with published literature on comparable patient populations reporting median CCI scores of 3.0 to 5.0.[14,22]

TABLE 1: PATIENT DEMOGRAPHICS AND CLINICAL CHARACTERISTICS.

		GMU-BPMH N=1680	ED-BPMH N=1597	TOTAL N=3277
PATIENT CHARACTERISTICS	Age, median (IQR)	83.3 (72.7, 89.9)	83.2 (73.8, 89.8)	83.2 (73.3-89.9)
	Male Sex (%)	758 (45.1)	773 (48.4)	1,531 (46.7)
	Indigenous (%)	6 (0.4)	12 (0.8)	18 (0.5)
	Non-English speaking (%)	148 (8.8)	95 (5.9)	243 (7.4)
	CCI, median (IQR)	4.0 (3.0, 5.0)	4.0 (3.0, 5.0)	4.0 (3.0-5.0)

MEDICATION PROFILE	Home medications, regular, med (IQR)	8 (5, 11)	8 (5, 12)	8.0 (5-11)
	Home medications, PRN, med (IQR)	1 (0, 3)	2 (1, 3)	2 (0, 3)
	Home medications, Total, med (IQR)	10 (6, 14)	10 (7, 14)	10 (6, 14)
	Polypharmacy (%)	1,302 (77.5)	1,311 (82.1)	2,613 (79.7)
	Poor medication adherence (%)	207 (12.3)	133 (8.3)	340 (10.4)
MEDICATION ADMINISTRATION CONTEXT	Patient (%)	1182 (70.4)	1049 (65.7)	2,231 (68.1)
	Carer (%)	274 (16.3)	254 (15.9)	528 (16.1)
	RACF staff (%)	224 (13.3)	294 (18.4)	518 (15.8)
HOSPITAL AND DISCHARGE DETAILS	Box Hill Hospital (%)	598 (35.6)	360 (22.5)	958 (29.2)
	Maroondah Hospital (%)	614 (36.5)	466 (29.2)	1,080 (33.0)
	Angliss Hospital (%)	468 (27.9)	771 (48.3)	1,239 (37.8)
	Private Residence (%)	977 (58.2)	927 (58.0)	1,904 (58.1)
	Transfer to RACF - usual residence (%)	140 (8.3)	162 (10.1)	302 (9.2)
	Transfer to RACF -not usual residence (%)	74 (4.4)	50 (3.1)	124 (3.8)
	Statistical separation (%)	54 (3.2)	41 (2.6)	95 (2.9)
	Transition Care Bed-Based Program (%)	37 (2.2)	34 (2.1)	71 (2.2)

GMU: General Medicine Unit; ED: Emergency Department; BPMH: Best Possible Medication History; CCI: Charlson Comorbidity Index; RACF: Residential Aged Care Facility

When compared to the GMU-BPMH group, the ED-BPMH group had a higher proportion of male patients (48.4% vs. 45.1%) and more patients from RACFs (18.4% vs. 13.3%). In contrast, the GMU-BPMH group had a higher proportion of non-English speaking patients (8.8% vs 5.9%) and more patients with suspected medication non-adherence issues (12.3% vs. 8.3%). Notably, the disposition between groups and hospital campuses differed, with the highest proportion of ED-BPMH patients being recruited from Angliss Hospital. Overall, the two groups were balanced across key confounders such as age, number of home medications, and comorbidity, reinforcing comparability between cohorts (Table 1).

OUTCOME DATA

Inpatient length of stay

The median inpatient LOS (IQR) for the ED-BPMH group was 5.03 days (120.7 hours) (2.81, 8.98), compared to the GMU-BPMH group, which was 5.67 days (136.1 hours) (3.04, 10.03); resulting in a median difference of -0.64 days (-15.4 hours) (-1.08, -0.20). After adjustment for confounders (age, gender, number of home medications, CCI scores, ED campus/site), the estimated median difference for LOS was -0.71 days (-17.0 hours) lower in the ED-BPMH group (-1.10, -0.32; $p < 0.001$).

ED and total length of stay

The median ED LOS (IQR) for the ED-BPMH was 0.81 days (19.4 hours) (0.48, 0.99), compared to GMU-BPMH group, which was 0.48 days (11.5 hours) (0.31, 0.82); resulting in a median difference of +0.34 days (8.2 hours) (0.30, 0.37). This longer ED

LOS likely reflects selection bias, as ED pharmacists may have prioritised patients who had already spent more time in the ED.

The median total LOS (IQR) for the ED-BPMH was 5.91 (141.8 hours) (3.69, 9.94), compared to GMU-BPMH group, which was 6.15 days (147.6 hours) (3.87, 10.82); resulting in a median difference of -0.25 days (6.0 hours) (-0.67, -0.18).

After adjustment for the same confounders, the median differences in ED and total LOS between groups were +0.32 days (7.7 hours) (0.29, 0.35; $p < 0.001$) and -0.49 days (11.8 hours) (-0.88, -0.10; $p = 0.015$), respectively. For further details refer to Table 2.

The median time (IQR) from arrival in ED to BPMH in the ED-BPMH group was 15.4 hours (7.1-21.2), compared to the GMU-BPMH group, which was 45.7 hours (26.7-70.4).

TABLE 2: MAIN RESULTS: INPATIENT, ED AND TOTAL LENGTH OF STAY

	GMU-BPMH N=1680	ED-BPMH N=1597	LOS DIFFERENCE (95% CI)	LOS ADJUSTED DIFFERENCE (95% CI)*	P-VALUE
INPATIENT LOS, (DAYS), MEDIAN (IQR)	5.67 (3.04, 10.03)	5.03 (2.81, 8.98)	-0.64 (-1.08, -0.20)	-0.71 (-1.10, -0.32)	<0.001
ED LOS, (DAYS), MEDIAN (IQR)	0.48 (0.31, 0.82)	0.81 (0.48, 0.99)	0.34 (0.30, 0.37)	0.32 (0.29, 0.35)	<0.001
TOTAL LOS, (DAYS), MEDIAN (IQR)	6.15 (3.87, 10.82)	5.91 (3.69, 9.94)	-0.25 (-0.67, -0.18)	-0.49 (-0.88, -0.10)	0.015

GMU: General Medicine Unit; ED: Emergency Department; BPMH: Best Possible Medication History; LOS: Length of Stay

DISCUSSION

This study compared high-needs general medicine patients across three Victorian metropolitan EDs who were reviewed by a pharmacist in ED versus general medicine wards. The ED-based pharmacist review resulted in an expedited time to BPMH, approximately three times faster. The ED pharmacy service was associated with a significant reduction in both inpatient and total hospital LOS, by 12.5% and 7.9%, respectively. These observed reductions in LOS are in line with emerging published literature highlighting the importance of early pharmacist interventions in reducing LOS.[13] They are also particularly relevant for improving patient access to healthcare services, especially given the heightened operational demands on health services in recent years.

Pharmacy services targeted at high medication needs patients are a potentially effective strategy that, in synergy with broader organisation-level strategies, can be utilised to improve patient flow across the continuum of hospital care. This is in line with the 2024 evidence briefing from the Australian Commission on Safety and Quality in Health Care, which emphasises that early pharmacist interventions aimed at improving medication reconciliation and reducing medication errors at the 'transition of care' can indeed shorten a patient's hospital stay.[23] These interventions are likely effective because they ensure timely and accurate medication reconciliation, preventing downstream prescribing errors[17] and

subsequent adverse drug events, and promote early discharge planning to minimise delays at the point of discharge. By resolving medication discrepancies early, pharmacists can expedite medical review and facilitate ward admissions. In turn, this supports the broader advanced discharge planning, which is widely accepted as the gold standard for addressing healthcare access.[8,9] While impactful, ED pharmacist interventions complement other strategies such as early discharge planning, geriatric assessments, multidisciplinary care, and post-discharge programs.[10]

In this study, we observed a predominantly older adult population with a very high rate of polypharmacy. This patient population is particularly vulnerable at points of transition of care such as transition through the ED, where the likelihood of medication-related adverse events is significantly increased.[23,24] Polypharmacy further heightens the risk of such events and is associated with increased falls, fractures, prolongation of hospitalisation and overall mortality.[20] ED pharmacy services focused on older medical patients with polypharmacy can therefore address key factors driving medication errors in this setting—namely, the unavailability of accurate home medication histories and limited time and training among medical staff to manage patients with large numbers of medications. Additionally, ED pharmacy services may help prevent medication errors from progressing to the inpatient setting, likely having a significant downstream impact by reducing the workload in inpatient units.[17] This aligns with existing literature, which associates early pharmacist review in ED with improved patient access to care and shorter hospital stay.[25] Moreover, when pharmacists conduct BPMHs in the ED, they free up significant time for medical staff, allowing the team to focus on medical priorities in the fast-paced ED environment.

Increasing demand in Australian EDs is an ongoing and significant barrier for patient access to healthcare and overcrowding cannot be explained solely by population growth alone[26] and there are likely complex root causes. Crowding reflects imbalance across input, throughput and output[27], with medication-related misadventures a recurring contributor to throughput and output pressures. The Australasian College for Emergency Medicine recognises the impact of inpatient access block on ED, leading to overcrowding.[28] Whilst we observed a significant downstream impact of early ED-based BPMH on reducing inpatient LOS, the ED LOS was longer for the intervention cohort. Our primary explanation for this observation is that ED pharmacists, when starting their shifts, strategically choose to see patients who have been in ED longer. This may have introduced selection bias, reducing the likelihood of newly arrived patients being captured in the ED-BPMH arm of our study. Furthermore, pharmacist reviews in ED are often challenging and time-consuming, especially when patients are unable to provide a reliable history and carers are absent. In these circumstances, establishing an accurate medication history may require contacting GPs, community pharmacists, or next of kin, which can extend the time patients remain in ED. Further research is warranted to explore additional factors beyond selection bias that may have contributed to this observation.

There is extensive literature demonstrating the positive impact of ED pharmacy services on patient safety and quality of care across both ED and inpatient settings.[29] Numerous health economic studies have also highlighted the cost-effectiveness of these services.[13,30] Beyond financial value, ED pharmacy services enhance workforce efficiencies by alleviating pressure on medical and nursing staff, streamlining medication management and reducing prescribing errors[17]. However, few studies have rigorously evaluated the role of ED pharmacy services in enhancing hospital efficiency and facilitating patient flow into inpatient settings. This study builds upon prior research, highlighting the health-economic benefits of extended-hours ED pharmacy services, particularly its impact on reducing LOS. Notably, the only variable between the compared groups was the timing of the pharmacy review—conducted either in the ED or upon ward admission—indicating that the observed improvements required no additional resources. These findings have important policy implications, highlighting extended-hours ED pharmacy services as a cost-effective and workforce-efficient strategy to enhance hospital efficiency and improve access to care, while promoting medication safety, quality, and timelier patient care.

LIMITATIONS

Limitations of this study include a retrospective design which precludes inference of causation, and inclusion of only 'high-needs' medical patients, who may have a higher rate of medication errors in the absence of an ED pharmacist and as such our results may not be necessarily generalisable to all patient populations.

Unmeasured confounders such as illness severity, socioeconomic factors, and clinician workload may also have influenced the outcomes. Additionally, the study did not capture post-discharge data, such as readmission rates or medication-related adverse events, limiting assessment of longer-term outcomes. It was also noted that the ED-BPMH group included a larger proportion of male patients compared to the GMU-BPMH group, though its impact on study outcomes is unclear. The ED-BPMH group also included more patients who presented directly from a RACF, and it is possible that these patients may have a higher likelihood of earlier discharge back to their usual residence, as they do not face barriers such as identifying suitable new placements. In contrast, the GMU-BPMH cohort contained more patients who were reported to have medication adherence issues, which may correlate with extended length of hospital stay.

CONCLUSION

This study provides evidence supporting the potential of extended-hours pharmacy services in ED to reduce LOS, reinforcing prior evidence that early medication reconciliation and pharmacist-led interventions can enhance patient flow and healthcare system efficiency. Although the ED cohort experienced a longer ED stay, the observed benefits of earlier BPMH completion were substantial, particularly for high-needs patients with polypharmacy. Overall, this study contributes to the growing body of evidence supporting the health-economic benefits of pharmacist-led interventions in ED, showcasing their potential to improve hospital efficiency and patient access to care.

Future research could include prospective or multicentre studies and formal cost-benefit evaluations to further establish the effectiveness and sustainability of ED pharmacy services across diverse healthcare settings, particularly among surgical and mental health patient groups. Collectively, these findings support broader implementation of extended-hours ED pharmacy services as a cost-efficient strategy to improve patient flow, enhance hospital efficiency, and strengthen system-wide access to timely, safe care.

CONFLICT OF INTEREST:

The authorship team declares no conflict of interest.

ETHICS APPROVAL:

This study received ethical approval from the Eastern Health Human Research Ethics Committee (HREC) (LR21-032-79058).

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WILLINGNESS TO PAY FOR HEALTH INSURANCE AMONG ATTENDEES OF SELECTED URBAN HEALTH CENTRES IN MYANMAR

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ABSTRACT

BACKGROUND:

Reforming health system in Myanmar is crucial aiming to achieve universal health coverage in 2030. High out-of-pocket (OOP) payment is the main cause of increasing financial hardship, and hence, implementing effective health insurance system is necessary to lower the financial burden. Since it is novel for most people, it is mandatory to consider their willingness upon such system.

OBJECTIVE:

This study aimed to assess the willingness to pay (WTP) status for proposed health insurance plan among the attendees visiting selected urban health centers (UHCs) of Myanmar.

METHODS:

The cross-section study was conducted on 261 out-patient department (OPD) attendees visiting selected UHCs in Yangon Region, Myanmar from July-December, 2023. Two UHCs were selected using simple random sampling from a purposively selected district, and the participants were recruited consecutively. Face-to-face interview was done using questionnaires and contingent valuation method (bidding approach). Binary logistic regression was done to determine factors influencing the WTP status.

RESULTS:

The results showed that awareness of the health insurance was low (37.5%). Among all, 61.1% of the participants were willing to pay for the recommended amount [10,000MMK per month per person (~5US\$)] and higher for proposed plan. The WTP was negatively associated with older age group (AOR: 0.35, CI: 0.12-0.97), poor self-rated health status (AOR: 0.32, CI: 0.11-0.95), and not experiencing illness within one year (AOR: 0.46, CI: 0.22-0.94), but positively associated with higher average monthly family income (AOR: 2.07, CI: 1.10-3.88).

CONCLUSION:

The finding indicates that the WTP level of participants for health insurance was relatively high once it was established. The result also provides amount for monthly premium. Therefore, policy makers should consider building up robust health insurance system with comprehensive coverage, and using the premium as one of the reference values for upcoming health insurance plan.

KEYWORDS:

Willingness to pay, Health insurance, Contingent valuation, Myanmar

INTRODUCTION

Accessing equitable health services with financial protection is a priority to achieve Universal Health Coverage (UHC) for low- and middle- income countries (LMICs) in recent decades [1]. However, evidences showed that in many developing countries, the out-of-pocket (OOP) payment is the primary resource for financing health services, pushing families into the catastrophic situation and impoverishment [2, 3]. Still, the South East Asia Region contributes the highest share of OOP on health spending, 40% of current health expenditure (CHE) in 2018 [4]. In Myanmar also, most of the CHE are incurred by OOP payments, 78.2% of total health expenditure in 2020, significantly higher than the recommended threshold of 30% [5-7]. It is also much higher when comparing to neighboring countries, for instance, Thailand whose OOP expenditure is merely 10% in 2020 [8].

One solution for reducing OOP payments and attaining Universal health coverage (UHC) is developing the health insurance system [9, 10]. Myanmar has also implemented different form of health insurance system; the social insurance scheme by Social Security Board (SSB) and the voluntary health insurance scheme by Myanma Insurance with minor role of private health insurance system [11, 12]. Nonetheless, all these plans cover only 2.5% of Myanmar population (51.4 million) [11, 13], due to unawareness and unfamiliar with the insurance system, low acceptability level, and lack of willing to pay premiums [14].

To develop robust health insurance system, it is mandatory to assess willingness to pay (WTP) for health insurance of the people [15]. Extensive literature has been conducted to determine the WTP level for health insurance. Studies from Indonesia (41.2%) and India (19.4%) showed lower WTP for health insurance [16, 17] while South Sudan (68%), East Caribbean (69.5%) and Saudi Arabia (77.9%) studies showed higher WTP status [18-20]. The literature also explored that several factors including socioeconomic and health related ones remained major contributing factors for WTP [14-16, 21-25]. However, there is limited evidence on acceptability and feasibility of health financing reform in Myanmar. Hence, this study aims to assess WTP status, desired amount and its contributing factors for a proposed health insurance plan among attendees of selected urban health centres (UHCs) in Myanmar. The WTP amount resulted could use as a reference rate for defining premiums, and for future policy decision making in feasibility and acceptability of the Myanmar health financing reform.

METHODS**ETHICAL CONSIDERATIONS**

The ethical approval was received from the Institutional Review Board of University of Public Health, Yangon, Myanmar with the approval number [UPH-IRB (2023/MPH/7)]. The participants were requested for voluntary participation, and written informed consent was obtained from each participant.

STUDY DESIGN, PERIOD AND SETTING

The cross-sectional study design was performed in this study from July, 2023 to December, 2023. The study population were out-patient department (OPD) attendees visiting selected UHCs in Yangon Region, Myanmar. All OPD attendees 18 years and above including both sex who visited UHCs were included. People visiting to take administrative services such as birth registry, etc. were excluded from the study.

SAMPLING AND SAMPLE SIZE

Yangon region is purposively selected since it is the biggest commercial capital with rapid urbanization in Myanmar. Also, there is diverse mix of socio-economic cluster, hence can represent the population with outcome of interest. Then, one

district (Thingangyun District) was selected purposively as there is a balanced mix of population in terms of place of residence, wealth status and labour force. There are 4 UHCs in this district. Of these, 2 UHCs were randomly selected using simple random sampling.

The sample size was determined using the formula: $\frac{z_{1-\alpha/2}^2 pq}{d^2}$ where n= total number of participants required, z= standard normal deviate for α , =1.96 at 95%CI, p =proportion of willingness to pay from previous literature =41.2% [16]. According to the formula, the minimum required sample size was 258. Thus, each UHC accounted for 129 participants equally assuming the same size, organization structure and workload. After that, all eligible participants attending the centres during the study period were recruited consecutively until the target sample size was reached. Actually, the total sample was 261 in this study.

DATA COLLECTION METHODS AND TOOLS

The face-to-face interview was done by main investigator and two assistant interviewers in Myanmar language after getting permission from authorized persons. The assistant interviewers (a township health nurse and a trained nurse) were trained by the main interviewer during a one-day training period. The questionnaires and the proposed health insurance plan were used as training tools.

The questionnaires included (a) socio-demographic characteristics [age, gender, marital status, education, occupation, and income], (b) health status and healthcare seeking behavior [experience any illness within 1 year (experience of ill health or hospitalization in last year apart from the current visit), self-rated health status (how participant perceived his or her health by rating it), difficulties occurred in healthcare payments, and coping method (ways that participant used for paying healthcare expenses)], (c) awareness of health insurance, and (d) WTP for proposed health insurance plan [amount of money willing to pay for first bid of recommended amount (10,000MMK), and subsequent bids].

All the variables for questionnaire were based on previous literature, specific context, and existing knowledge. The interview time was about 25 to 30 minutes per participant. Pre-testing was done among 25 OPD attendees in one UHC from the same district and questionnaire was revised as necessary. Reliability statistics were also calculated and Cronbach's alpha based on standardized items value was 0.77, showing reliable results.

ELICITING WTP FOR A PROPOSED PLAN OF HEALTH INSURANCE

In order to assess WTP, contingent valuation (CV) technique was used with double-bounded dichotomous choice elicitation approach [19]. Firstly, a proposed health insurance plan was developed. All reference values were based and simplified from the pre-existing scheme of Myanmar Insurance under Ministry of Planning and Finance. The insured person could claim the benefits within 10 days of post-hospitalization. The insured person could get healthcare services at contracted public hospitals in accordance with the packages. The expenses for OPD services were not included in this plan. Although description of the proposed plan was divided into 3 parts, people have to buy the whole package [Table 1].

TABLE 1. DETAILED DESCRIPTION OF THE PROPOSED HEALTH INSURANCE PLAN

No.	Proposed health insurance package	Insurance coverage	Benefit packages
1.	Basic cover	-Accidental hospitalization	-20,000MMK/day (max:60days)
		-Any hospitalization	-10,000MMK/day (max:60days)
		-Death from disease or total disability	-1,000,000MMK
		-Accidental death	-2,000,000MMK
2.	Supplementary (1)	-Any surgical treatment	-500,000MMK
3.	Supplementary (2)	-Cancer treatment	-1,000,000MMK

MMK: Myanmar Kyat

The proposed plan was explained to the study population (giving printed fact sheets) and then asked each whether he or she is willing to participate in this plan or not. If they answered "yes", then the bidding approach was applied. The first bid for the game was 10,000 MMK (~5US\$) per person per month (using basic cover value of Myanmar Insurance as a reference) and asked them if they are willing to pay. The exchange rate used was the official government rate concurrent with the data collection period (1US\$ = ~2000MMK). If they answered "yes", 1,000 MMK was increased per one bid till the maximum amount they wanted to pay. If the participants did not want to pay the first bid, the bidding amount was reduced by 1,000 MMK per one bid up to the minimum they wanted to pay.

STATISTICAL ANALYSIS

The outcome variable was WTP or not for first bid (recommended amount) of proposed health insurance scheme. Data entry, data clean up, data summarization and data analysis were carried out using Statistical Package for Social Science (SPSS-26) software (SPSS Inc, Chicago, IL, USA). Categorical data was presented as number and percentage. The WTP amount was described as mean, standard deviation, median, minimum and maximum. The outcome (WTP) was regarded as dichotomous variable (willing to pay = 1, not willing = 0) and factors influencing WTP for health insurance were assessed by logistic regression model. Firstly, simple logistic regression, then multiple logistic regression (binary logit) was done. The results were expressed as crude odds ratio (COR) and adjusted odds ratio (AOR) respectively along with their confidence interval (CIs). The variance inflation factor (VIF) was also calculated to determine multicollinearity among predictor variables. The VIF value of <5 was regarded as the acceptable level. The P value <0.05 was considered statistically significant in this study.

RESULTS

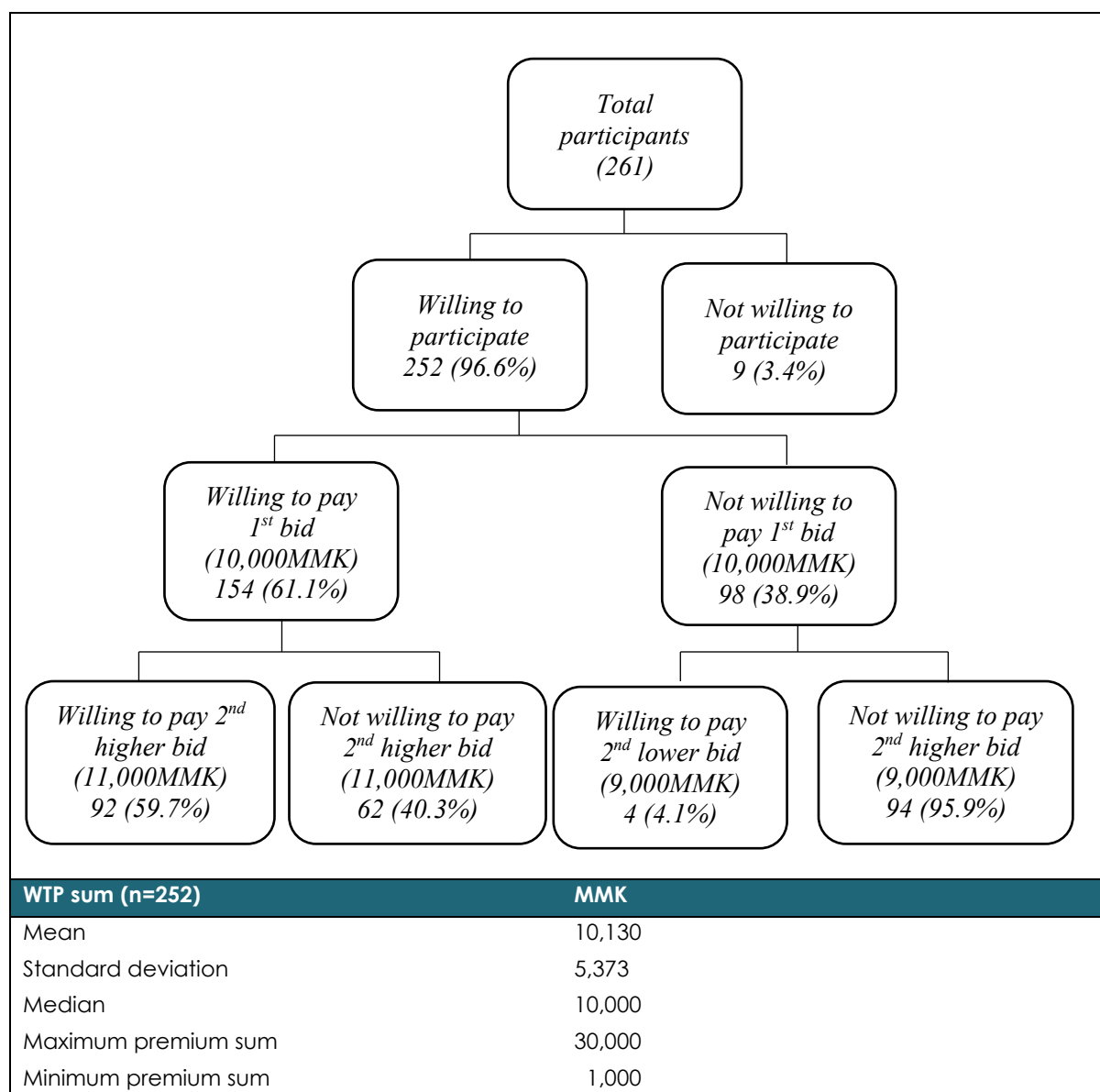
The study included 261 participants where more than half (60.9%) were between 18-44 years, more than two-third (72.4%) were female and 69.7% were married. The proportion of participants with primary to high school level education was 57.1% while 35.2% remained dependent. More than two-thirds (65.1%) had lived with family members less than five where 39% had average family monthly income less than 300,000MMK. More than two-third (73.2%) experienced illness within one year while 59.8% occurred difficulties in health care payments. More than half (56.9%) marked themselves as good health status, however, only one-third (37.5%) knew about the health insurance. Nearly half (44.9%) borrowed money from others to solve their problems [Table 2].

TABLE 2. SOCIO-DEMOGRAPHIC AND HEALTH-RELATED CHARACTERISTICS OF THE STUDY POPULATION (N=261)

Characteristics	Category	No	%
Age (years)	18-44	159	60.9
	45-59	70	26.8
	60 and above	32	12.3
Gender	Male	72	27.6
	Female	189	72.4
Marital status	Currently married	182	69.7
	Currently not married	79	30.3
Education	No formal education	10	3.8
	Primary to high school level	149	57.1
	University and above	102	39.1
Occupation	Dependent	92	35.2
	Currently working	169	64.8
Family size	1-5	170	65.1
	5 and above	91	34.9
Average monthly family income (MMK) (N=249)	<=300,000	97	39
	>300,000	152	61
Self-rated health status (N=260)	Good	148	56.9

Characteristics	Category	No	%
	Fair	86	33.1
	Poor	26	10
Experience any illness within 1 year	Yes	191	73.2
	No	70	26.8
Difficulties occurred in healthcare payments	Yes	156	59.8
	No	105	40.2
Awareness of health insurance	Yes	98	37.5
	No	163	62.5
Coping method (multiple response)	Borrowing money	70	44.9
	Ask help from others	47	30.1
	Withdrawing from savings	38	24.4
	Selling assets	30	19.2
	Pawning properties	9	5.8
	Doing extra jobs	3	1.9
	Drawing children out of school	1	0.6

TABLE 3. SUMMARY STATISTICS OF DOUBLE-BOUNDED DICHOTOMOUS CHOICE QUESTIONS AND WTP STATUS FOR PROPOSED HEALTH INSURANCE



When the participants were explained about proposed health insurance plan and asked for their willingness, majority of them (96.6%) answered that they were willing to participate. As for the WTP, 154 (61.1%) out of 252 participants were willing to pay the recommended amount (1st bid). After performing up and down bidding approaches, maximum premium sum was 30,000 MMK (~15US\$), and minimum was 1,000 MMK (~0.5US\$). The average amount of willingness to pay was 10,130 MMK (~5US\$) [Table 3]. The final regression analysis found that participants with older age group (60 years and above) (AOR: 0.35, CI: 0.12-0.97), poor self-rated health status (AOR: 0.32, CI: 0.11-0.95), and not experiencing illness within one year (AOR: 0.46, CI: 0.22-0.94) were negative predictors for WTP. On the other hand, those with higher average monthly family income (AOR: 2.07, CI: 1.10-3.88) were positively predictors for WTP. Moreover, the mean VIF value of 2.02 refers to low multicollinearity level [Table 4].

TABLE 4. DETERMINANTS OF WTP FOR PROPOSED HEALTH INSURANCE (N=252)

Variables	WTP n (%)	COR	95% CI	P	AOR	95% CI	P
Age (years)							
18-44	105(67.3)	1			1		
45-59	40(60.6)	0.75	0.41-1.36	0.338	0.97	0.48-1.96	0.937
60 and above	9(30)	0.21	0.09-0.49	<0.001*	0.35	0.12-0.97	0.045*
Sex							
Male	40(57.1)	1			1		
Female	114(62.6)	1.26	0.72-2.20	0.423	1.77	0.87-3.61	0.118
Marital status							
Currently married	113(64.2)	1			1		
Currently not married	41(53.9)	0.65	0.38-1.13	0.126	0.75	0.39-1.47	0.404
Education							
No formal education	3(30.0)	1			1		
Primary to high school level	74(51.8)	2.50	0.62-10.06	0.196	2.51	0.56-11.29	0.231
University and above	77(77.9)	8.17	1.95-34.23	0.004*	4.82	0.99-23.43	0.051
Occupation							
Dependent	43(49.4)	1			1		
Currently working	111(67.3)	2.10	1.23-3.58	0.006*	1.82	0.90-3.72	0.098
Family size							
1-4	104(63.0)	1			1		
5 and above	50(57.5)	0.79	0.47-1.35	0.390	0.82	0.43-1.55	0.542
Average family monthly income (MMK)							
<=300,000	43(46.2)	1			1		
>300,000	107(72.8)	3.11	1.80-5.37	<0.001*	2.07	1.10-3.88	0.024*
Self-rated health status							
Good	96(66.7)	1			1		
Fair	47(58.0)	0.69	0.39-1.21	0.197	0.66	0.33-1.33	0.246
Poor	10(38.5)	0.31	0.13-0.74	0.008*	0.32	0.11-0.95	0.040*
Experience any illness within 1 year							
Yes	114(61.6)	1			1		
No	40(59.7)	0.92	0.52-1.63	0.782	0.46	0.22-0.94	0.034*
Difficulties occurred in healthcare payment							
Yes	84(54.9)	1			1		
No	70(70.7)	1.98	1.16-3.39	0.013*	1.54	0.81-2.93	0.189

Variables	WTP n (%)	COR	95% CI	P	AOR	95% CI	P
Awareness of health insurance							
Yes							
No	69(72.6) 85(54.1)	1 0.44			1 0.74		
			0.25-0.76	0.003*		0.38-1.42	0.372
Mean VIF	2.02						

* Refers to statistically significant results

DISCUSSION

This study was conducted among 261 OPD attendees aiming to assess WTP for proposed health insurance plan. The result of the study revealed that almost all of the participants were willing to participate for proposed health insurance plan though their level of willingness to pay amount were different from each other.

Nearly two-third of the participants had difficulties in making payment for medical expenses and mostly used coping method was borrowing money from others. It is highlighted that although drawing children out of school to solve financial difficulties showed less than 1%, it is somewhat of an alarming sign for country to become widening the poverty gap. Correspondingly, one Ethiopia study stated that nearly half of the respondents had difficulties for paying medical costs and more than one-third of them had to borrow money from someone to cover the costs [26]. Differing from current study, a West Africa study reported that approximately 40 percent who met difficulties in making payments had to use their savings as a coping method for paying medical costs [24].

About one-third of the participants were aware about health insurance in the current study, and this is in agreement with an India study done in 2013 [27]. Elsewhere, Bawa and Ruchita presented the higher results where majority of the respondents were aware of the health insurance [17]. Nonetheless, Oo et al. stated that merely 8.4 percent of participants from Myanmar had awareness about health insurance [28] indicating that the awareness level was unsatisfactory in Myanmar. The reason might be due to differences in education status, socio-demographic circumstances, and lack of robust health insurance system. Hence, it is mandatory to develop proper channel for advocacy and awareness raising about nature of health insurance, how it works and which benefits could be received to break such barriers.

On exploring the prevalence of WTP status, almost all of the participants were willing to participate in the proposed health insurance plan in the current study. Among these participants, nearly two-thirds were willing to pay for the first bid of recommended amount and higher but the rest of them were willing to pay lower. Policymakers may conclude from this result that most people are in favor of such a system. This finding could help policymakers create a strategy that encourages the greatest amount of public participation. Likewise, study done in St. Vincent and Grenadines, and South Sudan where about two-third were willing to pay [19, 20]. This might be due to more or less similar socio-economic position, level of awareness and level of knowledge about health insurance among countries.

Different from current study, one Myanmar study conducted during 2019 highlighted that member of SSS had higher proportion of WTP with over 90 percent [13]. There are certain reasons for such diversity. Firstly, the Myanmar SSS is well-known for Myanmar people to certain extent since it has established decades ago. In addition, participants from previous study are the SSS members so they have already awareness about the benefits of health insurance. This was consistent with one West Africa study which was done in informal sector revealed that WTP for first premium was nearly 90 percent [24]. The explanation for higher WTP might be that different income of the participants and level of knowledge about benefits of health insurance. Nonetheless, one Indonesia study done in 2022 described that less than half of the participants were willing to pay for cost sharing NHI [16]. Similarly, WTP was just less than one-fifth of the study population in India study [17]. The reasons for lower WTP might be lack of trust in existing schemes, low knowledge associated with health insurance and socio-economic status of the participants.

The WTP amount was assessed using bidding game approach in this study. The first bid of recommended amount is 10,000 MMK (~5US\$). By comparing with previous studies, the South Sudan study mentioned that the WTP amount for majority was 50 local currency (5US\$), consistent with the current study [20]. Yet, the 2021 Mongolia study set the first bid as 12US\$ and nearly half showed their willingness [29]. These diverse results could be due to different income status, nature of health insurance system and different bid offers. As for policy perspectives, this result can be used as one of the reference values in setting the premium for upcoming health insurance plan.

After regression analyses, it was found that the older age group (60years and above) was less likely to pay than younger age groups (45-59 years, and 18-44 years). Similarly, a systematic review of WTP for health insurance in low-and-middle income countries stated that increasing age and reduced WTP were strongly correlated [25]. A plausible explanation is that some of the older people had to depend on their children and some earned fewer amount of pension that they could not afford to invest in insurance. Another influencing factor in current study was average monthly family income. Participants with higher household income were more willing to pay status and this is in conformity with economic theory. Correspondingly, Nugraheni et al. stated that increased income was correlated with higher WTP [16]. Perhaps, increased household income has certainty for source of payment to demand and purchase health insurance. A less anticipated result is that participants with poor self-rated health status showed less WTP which remained against the hypothesized relationship. Meantime, participants experiencing illnesses within a year were more likely to have greater participation since people who are generally risk averse remain more prepared to cover cost-sharing, and this finding is also concordant with the study by Nugraheni et al [16].

The significant strength in this study is that it was done using contingent valuation method (bidding game), one of the most reliable and common methods for financial evaluation, to elicit WTP amount of the participants. This could allow the participants to meet the most suitable amount for them. However, Since the study area belongs to urban hub, there might be limitation to apply the result of the study in the rural area. Hence, further studies should be done among rural population in order to assess their willingness and raise awareness among them. Moreover, participants could only answer whether they would like to pay or not for the proposed plan and they could not suggest what kind of health care services they wanted to be included due to certain close-ended questions. Studies using qualitative approach should be recommended in future to explore in-depth understanding about the health services needed for the population.

CONCLUSION

The results from this study provide an insight into key factors regarding the WTP status and its influencing factors. Almost all of the participants in the study were willing to participate in proposed health insurance. Among them, nearly two-thirds were willing to pay above the recommended amount of premium. Determinants of WTP for health insurance in this study were age, average monthly family income, self-rated health status, and experiencing any illness within one year. Since average monthly individual income of most participants was found to be low, the premium for proposed plan could be adjusted according to the individual and household income. The results of the study suggested that the acceptance level of participants regarding health insurance was satisfactory once it was established. The result also provides amount for monthly premium of the participants. Therefore, policy makers should consider building up robust health insurance system with comprehensive coverage and using the premium as one of the reference values for upcoming health insurance plan.

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Conflicts of interest

Authors declare that there is no conflict of interest.

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THE EFFECT OF ORGANIZATIONAL COMMUNICATION AND ORGANIZATIONAL HEALTH ON ORGANIZATIONAL TRUST IN HOSPITALS

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ABSTRACT

BACKGROUND:

It is known that in institutions where organizational trust is low, there will be disruptions and disconnections in business processes, and deficiencies in communication.

OBJECTIVE:

The purpose of this study was to evaluate the attitudes of employees working in a health institution towards organizational communication, organizational health perception, and organizational trust.

METHODS:

The research was conducted with survey forms received from a total of 285 participants working on four campuses of a private university hospital in Istanbul. Ethical principles were followed during the research process. IBM SPSS and AMOS 24.0 were used for data analysis. The analyses structured are descriptive statistics, as well as explanatory and confirmatory factor and distribution analyses, normal distribution tests, distribution and regression analyses, and t-Test and variance analyses in inter-group comparisons.

RESULTS:

The healthcare professionals participating in the study were predominantly female (73.3%), between the ages of 18-25 (37.9%), and had associate and undergraduate education levels (57.9%). A new Organizational Scale was created as part of this study. As a result of the analysis made with the structural equation model, the effect of organizational communication on organizational trust was found to be 0.76. The direct effect of organizational health on organizational trust is 0.93; The mediating role of organizational communication climate between organizational communication and organizational trust is 0.62. The mediating role of organizational communication between organizational health and organizational trust is 0.60, and the mediating role of organizational communication climate among the same variables is 0.24.

CONCLUSION:

As a result of the structural equation modeling, the effect of organizational communication on organizational trust was found to be 0,76. The direct effect of organizational health on organizational trust was 0,93. The mediating role of organizational communication climate between organizational communication and organizational trust was 0,62. The

mediating role of organizational communication between organizational health and organizational trust was 0,60. The mediating role of organizational communication climate between organizational health and organizational trust was 0.24.

KEYWORDS

Organizational communication, organizational health perception, and organizational trust

INTRODUCTION

The first evidence regarding scientific studies on organizational communication can be traced back to the Hawthorne Studies, which emphasized the importance of communication between employees and employee behavior and led to the emergence of the "Behavioral Approach". [1]. Organizational communication is the process that connects employees, communicates with the institution and the environment, and ensures the formation and continuity of the institution [2]. According to Elmas (2017), when the scope and pace of communication are put into practice in the professional business environment, this situation is defined as 'organizational communication' [3].

Regarding organizational communication, Redding (1979) draws attention to two issues [4]. One of these is about the spread of good news upwards and the spread of bad news downwards. The second element is that the manager's being an empathetic listener and supporter increases employees' satisfaction with their jobs and makes them more productive. It should not be ignored that intra-organizational communication processes are built on the organizational structure. According to Jablin and Putnam (1990), organizational communication is structured on one of three traditional understandings (positional, relational, and cultural) [5]. It is emphasized that organizational communication should be addressed from different aspects. The first of these is related to revealing the institutions with which the organizations are related. The second element is about creating an institutional perspective and structuring the process with a historical approach. Utilizing comparative research and evaluating levels and units of analysis are other complementary elements [6]. Studies on organizational communication are generally categorized as up, down, lateral, formal, and informal. However, research goes beyond these categories and also provides insight into organizational structure. These studies also reify and elaborate the communication processes within the organization [1]. It is emphasized that organizational communication can be built on trust [7]. It's believed that communication and trust can be particularly strong in healthcare institutions. Because healthcare is a service built on communication and trust, communication and trust between employees are also crucial.

Trust is not only a calculation made to avoid risk, but also a part of the process of adaptation to people and society [8]. Organizational trust is the trust created by employees within the organization and is the positive expectation and goodwill of employees based on experiences and communication [9]. It is stated that people who trust their organizations believe that their interests are linked to success. It is also stated that trust in the groups affiliated with the organization brings success, while lack of trust can cause various problems [10]. Findings have been found that employee-perceived trust is moderately related to organizational mindset and collaboration, and highly related to organizational culture, integrity/ethical behavior, and innovation. It is also seen that there is evidence that the factor that most positively affects organizational trust is organizational culture [11]. There is various evidence in the literature about the relationship between the concept of organizational trust, which is considered as 'employees' belief in their managers, and that organizational activities will benefit employees', with the mentioned variables [12]. There is also evidence in the literature that ethical climate has an impact on organizational trust. It is seen in the literature that there are findings that ethical climate has a positive effect on employee speech. The same study also showed that organizational trust has a mediating effect between ethical climate and employee voice [13]. It is becoming increasingly important to evaluate ethical approaches and trust in healthcare institutions in terms of their impact on patients. It is important to remember that these concepts are among the fundamental medical principles.

According to the World Health Organization (WHO), health is 'a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity.' Health is a very important issue and is not limited to human health. The concept of health is also used to express very different situations, and one of these concepts is 'organizational health'. Organizational health has been explained as 'an organization that not only maintains its existence within its environmental conditions but also continuously improves its basic capabilities and life in the long term' [14]. While the financial strength of the organization can be an indicator of its health, the effort to achieve short-term goals or create change has also been considered an indicator of organizational health [14]. It is stated in the literature that organizational health should be built on organizational trust [7]. Organizational health is an issue that the manager should address as a priority and within the innovation approach. Because organizational health provides many advantages for the organization and is a process that needs to be constantly improved. Organizational health covers the issues of conducting meaningful and rational research to improve the organization, developing the organization as a living, working, and learning area, and reducing day-to-day approaches [14]. It is important for the institutions established to provide health services to be healthy organizations in order to provide the service in a timely and accurate manner.

It is known that organizations that strive to maintain their continuity due to competitive conditions today must value people first. It is possible to say that these concepts have become more important, especially when it comes to health organizations. The reason for this is that the organization consists of more than one unit, directly or indirectly, and each unit consists of individuals with different goals and ideas. These different goals and ideas affect the organization in various ways. Establishing open communication between units has an impact on the efficiency of the organization and also has the potential to continue its development. Organizational communication becomes more important, especially in institutions such as hospitals, where a lack of communication can cause significant negative consequences. In addition, hospitals, as health institutions that undertake the duty and responsibility of providing health services, are expected to be healthy organizations. Creating a culture of trust in institutions where health services based on trust are provided is also considered to be a very important element. Based on the evidence that organizational communication and communication climate will affect organizational trust and organizational health variables, it is believed that this study, which has the stated purpose, will make a meaningful contribution to the literature.

METHODOLOGY

The scope of the research, population and sample, data collection tools used in the research, data analysis methods and techniques, and research hypotheses will be discussed separately in this section.

SCOPE OF THE RESEARCH, POPULATION, AND SAMPLE

The research was conducted with employees working on four campuses of a foundation university hospital chain in Istanbul and with the Ethics Committee decision numbered 125, E-10840098-772.02-6710. It was carried out by the decision of Istanbul Medipol University Non-invasive Clinical Research Ethics Committee. All national and international ethical principles were complied with during the research process.

The total number of employees in the hospitals is 360 people, 105 people work in Hospital A, 70 people work in Hospital B, 115 people work in Hospital C and 70 people work in Hospital D. 85 people from Hospital A, 51 people from Hospital B, 100 people from Hospital C, and 49 people from Hospital D were included in the study. In the study conducted by survey method, the sample consists of 285 employees. 79% of the universe has been reached. A total of 305 people participated in the research, and 20 people's answers that were filled in incorrectly or incompletely were not included in the research. The answers of 285 people were taken into account and included in the research. The study was carried out in February-March 2022. The research was carried out with the participation of doctors, nurses, midwives, physiotherapists, technicians, dentist assistant personnel, cleaning personnel, security, administrative affairs, and other unit employees who are actively involved in health institutions.

$$n = \frac{Nt^2\sigma^2}{d^2(N-1) + t^2\sigma^2} = \frac{360 * 1,645^2 * 0,43343^2}{0,05^2(360-1) + 1,645^2 * 0,43343^2} = 130,1 \sim 130$$

When the required sample size for the study was calculated with 95% reliability and 5% margin of error, it was determined that the minimum sample size was 130. Since 285 participants were reached in this study, it can be said that the results can be generalized for the research population.

DATA COLLECTION TOOLS USED IN THE RESEARCH

A survey form was used as the data collection tool used in the research. The survey form consists of four parts. In the first part, nine questions aim to determine age, gender, profession, education level, marital status, unit of employment, professional experience, length of time working in the institution, and average monthly income. The Organizational Trust Scale was developed by adding items from the studies of Aydın (2019), Ersan (2018), and Çalışkan (2021) [18,19,20]. The Organizational Health Scale was used by taking statements from Gül's (2018) study [21]. The reliability values (Cronbach's alpha) of the scales taken from the literature are as follows; Organizational Communication Scale, Kalkın (2009) reliability value is 0.89 [15]. Elmas (2017) reliability value is 0.74 [3]. Eyyüpoğlu (2017) reliability value is 0.92 [16]. Kayasandık (2019) reliability value is 0.80-0.94 [17]. Organizational Trust Scale, Aydın (2019) reliability value is 0.90. Ersan (2018) reliability value is 0.95 [18,19]. Çalışkan (2021) reliability value is 0.90 [20]. Organizational Health Scale, Gül (2018) reliability value is 0.96 [21]. In this study, the researcher added two statements to contribute to Organizational Communication Scale development process. There are 29 questions in the second part (Organizational Communication Scale), 37 questions in the third part (Organizational Trust Scale), and 26 questions in the fourth part (Organizational Health Scale). A 5-point Likert Scale (1: False, 5: True) was used for the participants to evaluate the scales.

DEVELOPMENT OF AN ORGANIZATIONAL COMMUNICATION SCALE

The Organizational Communication Scale and was used by taking items from the studies of Kalkın (2009), Elmas (2017), Eyyüpoğlu (2017) and Kayasandık (2019) [3;15,16,17]. The scale used in Elmas's (2017) study for the organizational communication variable was adopted, and statements from other studies were added. Organizational communication is addressed in different dimensions using scales employed in existing research, and due to the large number of items, the addition of statements was preferred. The added statements were either directly taken from studies or created by drawing inspiration from them. The suitability of the added and newly created statements was then evaluated by obtaining expert opinions. Subsequently, a pilot study was conducted with 30 participants, and the statements were found to be understandable. The statements taken from and added to the research, as well as those created by drawing inspiration, are presented below:

Items Obtained Directly

My manager listens to me and takes my opinions into consideration (Kayasandık, 2019).
Communication with employees at the same level as me is complete and free (Kayasandık, 2019).
Employees are encouraged to express their opinions (Kalkın, 2009).
Employees receive a quick response when they want to obtain information on a subject (Kalkın, 2009).

Items Formed

Employees in different units of our hospital can work together (Kayasandık, 2019).
There are sufficient information exchange and coordination among all units in our hospital (Eyyüpoğlu, 2017; and Kayasandık 2019).
Announcements are made on time and accurately at the hospital where I work (Kalkın, 2009; Eyyüpoğlu 2017).
Announcements are made on time and accurately at the hospital where I work (Eyyüpoğlu, 2017).
There is widespread and effective communication among all units in our hospital (Eyyüpoğlu, 2017).
In our institution, which is part of the health system, all units work in cooperation (Eyyüpoğlu, 2017).

Researchers also contributed to the statements inspired by the aforementioned scales, and expert opinions were obtained. This approach stemmed from the lack of a unique scale study for organizational communication in the healthcare field. The aim was to strengthen the scale development process by supporting it with subsequent studies.

DATA ANALYSIS METHODS AND TECHNIQUES

Within the scope of the research, the data obtained from the survey form was analyzed using IBM SPSS 25.0 and AMOS 25.0 package programs. In addition to descriptive statistics, the statistical analyses performed include explanatory and confirmatory factor and reliability analyses, normal distribution tests, correlation and regression analyses, and t-test and variance analyses for comparisons between groups. In comparisons between groups, the method of analysis was decided by taking into account the kurtosis and skewness values ($-2 < X < 2$). Factor analysis was performed using the Varimax Rotation Technique, and the principal component method was used to create the dimensions. Statements with factor loadings below 0.5 were removed from the analysis. In addition, unstable expressions that had loads under more than one dimension with a difference of less than 0.1 were also removed from the analysis. Care was taken to include at least two statements under each dimension. When performing correlation analyses, values of 0.4 and below were considered low, values between 0.4-0.7 were considered medium, and values above 0.7 were considered high [22].

RESEARCH HYPOTHESES

H1: Health worker's perception of organizational communication affects organizational trust.

H2: Organizational health affects the healthcare worker's perception of organizational trust.

H3: Health workers' perception of organizational communication climate affects organizational trust.

H4: Organizational health has a mediating role between organizational communication and organizational trust.

H5: Organizational health has a mediating role between organizational communication climate and organizational trust.

H6: Organizational communication has a mediating role between organizational communication climate and organizational trust.

RESULTS

Findings regarding the socio-demographic characteristics, percentage, and frequency information of the 285 healthcare professionals participating in the study are given in Table 1. 73.3% of the healthcare workers participating in the study are women, 37.9% are between the ages of 18-25, and 61.4% are single. The education level of 19.3% is high school or below, 57.9% have an associate degree or bachelor's degree, and 22.8% have a master's degree or doctorate level. 38.6% of the healthcare professionals participating in the study have professional experience between 1 and 5 years, and 44.2% of them have worked at the institution where the study was conducted between 1 and 5 years (Table 1).

Although the dimensions were not specified because factor analysis was not performed in two of the studies from which the Organizational Communication Scale was taken, Elmas (2017) addressed organizational communication in two sub-dimensions, and Kayasandık (2019) in five sub-dimensions [3,17]. In this study, as a result of the factor analysis of the Organizational Communication Scale, three dimensions were formed. The total reliability value of the Organizational Communication Scale is 81% and its variance is 55.2%.

TABLE 1: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS

	n	%		n	%
Age			Gender		
18-25 years old	108	37.9	Woman	209	73.3
26-35 years old	103	36.1	Male	76	26.7
>36 years old	74	26.0			
Marital Status			Educational Status		
Married	110	38.6	High School and Below	55	19.3
Single	175	61.4	Associate's degree/Bachelors degree	165	57.9
			Master's/Ph.D.	65	22.8
Job			Unit Name		
Doctor	43	15.1	Emergency Department/Polyclinic	47	16.5

Nurse/Midwife/Physiotherapist	25	8.8	External	118	41.4
Technician/Technician	35	12.3	Clinic/Service/Clinical support services (Laboratory/Radiology)	31	10.9
Cleaning/Security Worker	34	11.9	Cleaning/Security Services	30	10.5
Dentist Assistant Staff	48	16.8	Administrative Affairs	35	12.3
Administrative Affairs	72	25.3	Other (Information technology service, technical support service, psychologist, dietitian, etc.)	24	8.4
Other (IT, Technical service, Psychologist, Dietitian, etc.)	28	9.8			
Professional Experience			Working Time in the Institution		
<1 year	37	13.0	<1 year	55	19.3
1-5 years	110	38.6	1-5 years	126	44.2
5-10 years	62	21.8	5-10 years	63	22.1
10 years>	76	26.7	10 years>	41	14.4
Average Monthly Income					
<4.500 TL	123	43.2			
4.501-9.000 TL	100	35.1			
>9.000 TL	62	21.8			

Aydin (2019) and Ersan (2018) evaluated the Organizational Trust Scale in three sub-dimensions. Because this study was a new scale development effort, the factor analysis resulted in a significant number of excluded statements. To prevent data loss, factor analysis was conducted again for the excluded statements, and consistent results were obtained. The statements grouped under a single factor were found to represent organizational communication climate. Therefore, these statements were evaluated as organizational communication climate and used as a measurement tool. In this study as a result of factor analysis of the Organizational Trust Scale, it was reduced to three dimensions [18,19]. The total reliability value of the Organizational Trust Scale is 98% and its variance is 72.3%.

It is seen that the Organizational Health Scale was evaluated in one dimension by Gül (2018) [21]. In this study as a result of factor analysis, three dimensions were formed in the Organizational Health Scale. The total reliability value of the Organizational Health Scale is 92% and its variance is 67.3%.

As a result of factor analysis, a single dimension was formed in the Organizational Communication Climate Measuring Tool. The total reliability value of the Organizational Communication Climate is 91% and its variance is 56.7%. Organizational Communication Measuring Tool was evaluated as a single-factor measurement tool that emerged by re-factor analysis for the statements obtained as a result of the factor analysis conducted for the Organizational Communication Climate Measuring Tool used within the scope of the study, and since this measurement tool has not been used before, comparison with previous studies cannot be made. Dimensions, reliability, variance, and mean and standard deviation values of all scales and their sub-dimensions are presented in Table 2.

TABLE 2: DIMENSIONS OF THE SCALES AND RELIABILITY MEAN AND STANDARD DEVIATION VALUES

Scale Name	Dimension Name	Variance	Reliability	$\bar{X}(\sigma)$
Organizational Communication Scale	Organizational Communication	30.9	0.88	2.05 (0.83)
	Communication with Superiors	12.4	0.63	2.52 (1.08)
	Communication Barriers	11.8	0.62	3.02 (1.19)
Organizational Trust Scale	Trust the Manager	29.5	0.97	1.96 (0.87)
	Trust Your Colleagues	21.5	0.96	2.01 (0.91)
	Trust in the Organization	21.3	0.96	2.30 (0.96)
Organizational Health Scale	Organizational Integrity	28.0	0.93	2.13 (0.84)
	Resource Support	22.2	0.92	2.60 (1.06)
	Morale	17.2	0.89	2.73 (1.05)
Organizational Communication Climate	Organizational Communication Climate	56.8	0.91	2.21 (0.91)

As a result of the correlation analysis, it is seen that the scale total scores generally have a medium and high correlation with their sub-dimensions. It is seen that it only has a low level of correlation with the communication with superiors dimension, one of the sub-dimensions of the Organizational Communication Scale, and does not correlate with the communication barriers dimension. Some scale total scores show high correlations with sub-dimensions of other scales. It is noteworthy that especially the organizational trust sub-dimensions show a high level of correlation with the organizational communication total score and other sub-dimensions of the scale. The total dimension of the Organizational Communication Climate Scale and the total dimension of the Organizational Communication Measuring Tool show a high correlation of $r = 0.72$ (Table 3).

The differentiation in the scale total scores and factors according to groups is shown in bold in Table 4, and the test values are presented below the table with numbers corresponding to exponents. Whether demographic variables create a significant difference in terms of research variables can be analyzed for all variables. The table of significant differences seen as a result of the analysis is expressed in exponent numbers and details about the test values are stated opposite the numbers at the bottom of the table. The table also includes the arithmetic mean and standard deviation values of the research variables and their sub-dimensions according to demographic variables. It is seen that the most significant difference between the groups is in the occupation variable (Table 4).

When the model in Figure 1 is examined, it is seen that the effects of the independent variables on the dependent variable are at medium and high levels. It is also seen that organizational communication climate mediates the effect of both organizational communication and organizational health on organizational trust. Model fit values based on the structural equation model are presented in the table above. The fit values of the model created according to the structural equation model show that the established model is acceptable [23].

TABLE 5: THE EFFECT OF ORGANIZATIONAL COMMUNICATION AND ORGANIZATIONAL HEALTH ON ORGANIZATIONAL TRUST MODEL FIT VALUES

Model	χ^2	df	χ^2/df	p	NFI	CFI	RMSEA	PCLOSE
			(≤ 5)	(<0.05)	(≥ 0.90)	(≥ 0.95)	(≤ 0.08)	(>0.05)
SEM	96,846	29	3.34	<0.001	0.96	0.97	0.091	0.001
SEM: Structural Equation model								

TABLE 3: CORRELATIONS OF DEMOGRAPHIC VARIABLES AND RESEARCH VARIABLES

	1.Age	2.Educational Status	3.Average Monthly Income	4.OCS Organizational	5.OCS Communication	6.OCS Communication	7.Organizational Communication	8.OTS Trust in Manager	9.OTS Trust Your Colleagues	10.OTS Trust in the Organization	11.Organizational Trust Scale	12.OHS Organizational	13.OHS Resource Support	14.OHS Morale	15.Organizational Health Scale
2	0,056														
3	0,479	***	0,601	***											
4	-0,038	-0,132	-0,021												
5	-0,067	0,072	0,052	0,249	***										
6	-0,135	-0,022	-0,171	0,101	0,308	***									
7	-0,095	-0,092	-0,065	0,872	***	0,554	***	0,518	***						
8	0,002	-0,06	0,063	0,762	***	0,226	***	0,163	**	0,705	***				
9	0,127	*	0,107	0,181	**	0,551	***	0,166	**	-0,005	0,466	***	0,592	***	
10	0,073	-0,057	0,059	0,725	***	0,184	**	0,032		0,618	***	0,793	***	0,665	***
11	0,064	-0,017	0,103	0,777	***	0,219	***	0,084		0,686	***	0,921	***	0,807	***
12	0,024	-0,122	0,01	0,749	***	0,235	***	0,118	*	0,681	***	0,787	***	0,625	***
13	0,104	-0,153	0,027	0,574	***	0,149	*	0,006		0,483	***	0,633	***	0,476	***
14	0,090	-0,156	0,032	0,516	***	0,098		0,088		0,456	***	0,575	***	0,436	***
15	0,072	-0,154	0,023	0,699	***	0,192	**	0,081		0,618	***	0,753	***	0,584	***
16	0,006	-0,104	-0,021	0,862	***	0,21	***	0,027		0,729	***	0,775	***	0,598	***
										0,784	***	0,819	***	0,776	***
												0,718	***	0,778	***
												0,712	***	0,704	***
												0,944	***	0,915	***
												0,637	***	0,849	***
												0,615	***	0,556	***
														0,737	***

OCS: Organizational Communication Scale OTS: Organizational Trust Scale OHS: Organizational Health Scale, OCCS: Organizational Communication Climate (16)

*:p < 0,05; **:p < 0,01; ***:p < 0,001

TABLE 4: MEAN AND STANDARD DEVIATION VALUES OF SCALES AND SUB-DIMENSIONS ACCORDING TO DEMOGRAPHIC VARIABLES

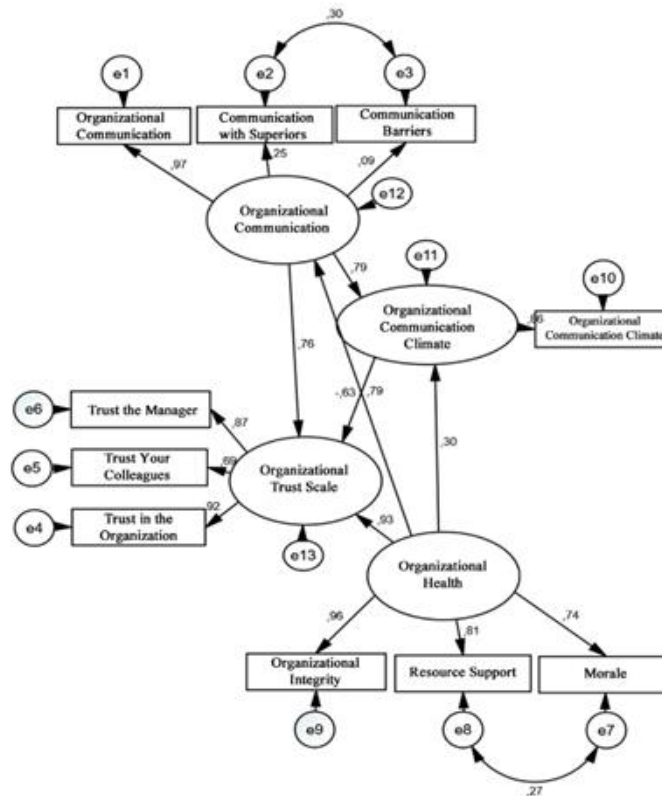
		OCS Organizational Communication		OCS Communication with Superiors		OCS Communication Barriers		Organizational Communication Scale		OTS Trust in Manager		OTS Trust Your Colleagues		OTS Trust in the Organization		Organizational Trust Scale		OHS Organizational Integrity		OHS Resource Support		OHS Morale		Organizational Health Scale		Organizational Communication Climate	
		X	σ	X	σ	X	σ	X	σ	X	σ	X	σ	X	σ	X	σ	X	σ	X	σ	X	σ	X	σ	X	σ
Gender	Woman	3,94	0,57	3,51	0,90	3,1 ¹	0,87	3,72	0,50	4,03	0,76	3,96	0,72	3,65	0,81	3,89	0,68	3,84	0,66	3,37	0,91	3,26	0,94	3,59	0,72	3,78	0,67
	Male	3,99	0,58	3,39	0,99	2,83 ¹	0,94	3,68	0,48	4,09	0,68	4,10	0,70	3,84	0,77	4,01	0,64	3,97	0,61	3,52	0,84	3,31	0,86	3,72	0,65	3,83	0,72
Age	18-25 years old	3,98	0,52	3,55	0,96	3,19	0,77	3,77	0,46	4,03	0,68	3,88	0,68	3,62	0,67	3,86	0,59	3,86	0,55	3,29	0,89	3,22	0,95	3,58	0,65	3,80	0,61
	26-35 years old	3,95	0,62	3,46	0,82	2,94	1,01	3,68	0,51	4,08	0,82	4,04	0,75	3,72	0,97	3,95	0,78	3,86	0,78	3,47	0,99	3,21	0,96	3,62	0,82	3,77	0,77
	>36 years old	3,93	0,58	3,40	1,00	2,90	0,88	3,65	0,52	4,02	0,72	4,11	0,70	3,77	0,72	3,96	0,63	3,91	0,58	3,51	0,73	3,45	0,79	3,71	0,60	3,81	0,66
Marital Status	Married	3,96	0,55	3,44	0,91	2,95	0,95	3,69	0,48	4,08	0,73	4,05	0,71	3,80	0,74	3,98	0,64	3,91	0,62	3,48	0,88	3,38	0,85	3,68	0,67	3,86	0,67
	Single	3,95	0,58	3,50	0,93	3,07	0,86	3,71	0,50	4,02	0,75	3,96	0,72	3,64	0,83	3,88	0,69	3,85	0,67	3,37	0,90	3,21	0,96	3,59	0,72	3,75	0,69
Job	Doctor	3,77 ²	0,70	3,57	0,95	2,61 ⁴	0,98	3,51 ⁵	0,54	3,99 ^{9,10}	0,76	4,37	0,64	3,76	0,96	4,02	0,71	3,81	0,76	3,41	0,99	3,13	0,93	3,57	0,81	3,69	0,83
	Nurse/Physiother	3,88	0,59	3,36	0,91	3,24	0,96	3,69	0,63	4,00	1,00	3,93	0,86	3,58	0,96	3,85	0,86	3,71	0,86	3,29	0,94	3,27	1,00	3,50	0,86	3,64	0,71
	Tech.	3,92	0,59	3,33	0,88	3,03	0,73	3,66	0,44	3,99	0,69	4,00	0,85	3,61	0,77	3,87	0,66	3,81	0,56	3,22 ^{13,14}	0,74	3,07	0,79	3,50	0,56	3,68	0,70
	Clean/Secu Per	4,04	0,48	3,41	0,89	2,80	0,92	3,71	0,36	4,17	0,66	3,92	0,73	3,91	0,62	4,02	0,61	4,06	0,52	3,83 ¹³	0,70	3,68 ¹⁵	0,75	3,92 ¹⁷	0,55	3,92	0,58
	Dentist	3,86 ³	0,51	3,46	0,87	3,13	0,87	3,66 ⁶	0,45	3,81 ^{8,9}	0,67	3,68	0,69	3,47	0,82	3,67 ¹¹	0,66	3,64 ¹²	0,63	2,97 ¹⁴	1,05	2,90 ^{15,16}	0,87	3,31 ^{17,18}	0,72	3,64 ¹⁹	0,62
	Administrative	4,17 ^{2,3}	0,54	3,66	0,92	3,31 ⁴	0,88	3,93 ^{5,6,7}	0,47	4,3 ⁸	0,66	4,10	0,58	3,84	0,67	4,10 ¹¹	0,56	4,07 ¹²	0,54	3,58	0,75	3,52 ¹⁶	0,86	3,82 ¹⁸	0,58	4,05 ¹⁹	0,62
	Other	3,83	0,47	3,27	1,04	2,82	0,64	3,55 ⁷	0,44	3,83 ¹⁰	0,76	3,86	0,63	3,57	0,82	3,75	0,70	3,84	0,63	3,58	0,83	3,24	1,10	3,65	0,73	3,66	0,59
Professional Experience	<1 year	3,97	0,47	3,54	0,91	3,28	0,70	3,78	0,42	4,10	0,62	4,00	0,53	3,80	0,64	3,98	0,55	3,97	0,48	3,54	0,82	3,45	0,92	3,75	0,60	3,85	0,57
	1-5 years	4,02	0,53	3,47	0,95	3,00	0,86	3,75	0,44	4,08	0,69	3,91	0,72	3,63	0,74	3,89	0,61	3,84	0,60	3,25	0,90	3,12	0,93	3,54	0,67	3,81	0,63
	5-10 years	3,83	0,58	3,38	0,79	2,75	0,91	3,56	0,46	3,90	0,81	3,91	0,76	3,61	0,96	3,81	0,78	3,79	0,77	3,55	0,97	3,25	0,91	3,61	0,81	3,68	0,73
	10 years>	3,94	0,65	3,54	0,99	3,15	0,97	3,73	0,60	4,08	0,80	4,19	0,73	3,82	0,81	4,02	0,72	3,93	0,67	3,47	0,83	3,44	0,88	3,71	0,70	3,83	0,76
Working Time in the Institution	<1 year	3,96	0,45	3,45	0,96	3,19	0,75	3,74	0,41	4,12	0,62	3,98	0,55	3,80	0,62	3,98	0,53	3,95	0,52	3,50	0,88	3,49	0,90	3,73	0,64	3,81	0,58
	1-5 years	4,00	0,60	3,44	0,98	2,90	0,92	3,70	0,49	4,06	0,74	3,92	0,76	3,63	0,87	3,88	0,70	3,86	0,68	3,33	0,94	3,16	0,93	3,58	0,72	3,81	0,69
	5-10 years	3,87	0,57	3,57	0,73	3,07	0,94	3,67	0,48	3,94	0,83	4,01	0,77	3,69	0,85	3,88	0,77	3,81	0,70	3,53	0,85	3,24	0,93	3,62	0,75	3,76	0,73
	10 years>	3,94	0,65	3,49	0,97	3,09	0,92	3,71	0,62	4,04	0,76	4,24	0,66	3,80	0,72	4,01	0,63	3,89	0,63	3,35	0,83	3,38	0,83	3,64	0,66	3,77	0,73
Unit of Study	Emergency/Polycl	3,89	0,62	3,40	0,96	2,92	0,84	3,63 ²¹	0,48	4,04	0,80	3,92	0,72	3,58	0,90	3,86	0,73	3,77	0,68	3,39	0,92	3,18	0,94	3,55	0,74	3,67	0,75
	External	3,86 ²⁰	0,58	3,57	0,89	3,00	0,91	3,65 ²²	0,48	3,90 ²³	0,72	3,94	0,78	3,63	0,85	3,82	0,70	3,78	0,67	3,29	0,98	3,00 ^{24,25}	0,92	3,49 ^{26,27}	0,74	3,69	0,70
	Clinic/Service	4,02	0,55	3,16	0,97	3,13	0,93	3,73	0,49	4,25	0,63	4,31	0,56	3,82	0,71	4,13	0,52	3,91	0,54	3,24	0,84	3,37	0,83	3,62	0,61	3,96	0,62
	Clean/Security	4,02	0,47	3,30	0,88	2,80	0,90	3,68	0,38	4,11	0,67	3,82	0,69	3,86	0,59	3,95	0,60	4,04	0,51	3,76	0,69	3,73 ²⁴	0,77	3,90 ²⁶	0,54	3,89	0,57
	Administrative	4,24 ²⁰	0,58	3,79	0,73	3,36	0,90	4,00 ^{21,22}	0,55	4,36 ²³	0,70	4,18	0,61	3,87	0,64	4,15	0,60	4,12	0,59	3,62	0,71	3,66 ²⁵	0,77	3,89 ²⁷	0,56	4,05	0,67
	Other	3,98	0,47	3,35	1,12	2,99	0,85	3,69	0,50	4,00	0,84	3,97	0,57	3,64	0,84	3,87	0,71	3,90	0,74	3,53	0,82	3,54	0,89	3,73	0,75	3,76	0,56
	<High School	4,06	0,52	3,38	0,93	2,85	0,91	3,73	0,42	4,12	0,65	4,01	0,68	3,89	0,67	4,02	0,61	4,07 ³⁰	0,56	3,80 ^{31,32}	0,75	3,68 ^{33,34}	0,79	3,92 ^{35,36}	0,60	3,92	0,63

Education al Status	Assoc/Undergra	3,97	0,53	3,47	0,91	3,16 ²⁸	0,81	3,74	0,46	4,04	0,69	3,90 ²⁹	0,67	3,62	0,74	3,87	0,63	3,83 ³⁰	0,58	3,30 ³¹	0,86	3,16 ³³	0,91	3,55 ³⁵	0,64	3,78	0,62
	Master's/Ph,D,	3,83	0,70	3,58	0,95	2,83 ²⁸	1,03	3,59	0,62	3,99	0,92	4,23 ²⁹	0,80	3,73	1,00	3,97	0,82	3,82	0,84	3,35 ³²	1,01	3,21 ³⁴	0,96	3,57 ³⁶	0,86	3,70	0,84
Average Monthly Income	<4,500 TL	3,93	0,50	3,45	0,95	3,17 ³⁷	0,78	3,71	0,45	3,96	0,68	3,87 ³⁸	0,68	3,62	0,75	3,82	0,62	3,82	0,56	3,31 ³⁹	0,90	3,20	0,93	3,55 ⁴⁰	0,66	3,76	0,58
	4,501-9,000TL	4,05	0,54	3,44	0,85	3,02	0,94	3,76	0,45	4,16	0,67	4,03	0,71	3,77	0,72	4,00	0,63	3,99	0,57	3,6 ³⁹	0,76	3,39	0,82	3,77 ⁴⁰	0,59	3,89	0,66
	>9,000 TL	3,85	0,73	3,60	0,97	2,76 ³⁷	0,99	3,60	0,62	4,04	0,93	4,20 ³⁸	0,74	3,72	1,00	3,98	0,82	3,78	0,87	3,30	1,04	3,23	1,03	3,54	0,90	3,68	0,88
Hospitals	Hospital A	4,01	0,58	3,44	0,92	2,85	0,96	3,70	0,50	4,08	0,76	3,97	0,80	3,72	0,88	3,93	0,75	3,86	0,69	3,43	1,04	3,20	0,92	3,61	0,75	3,90	0,70
	Hospital B	3,99	0,63	3,41	1,10	2,92	0,92	3,70	0,53	4,08	0,92	4,02	0,74	3,70	0,90	3,94	0,81	3,86	0,76	3,50	0,94	3,32	0,94	3,65	0,79	3,76	0,76
	C Hospital	3,85	0,58	3,55	0,82	3,13	0,84	3,67	0,51	3,93	0,69	3,99	0,69	3,64	0,75	3,85	0,61	3,86	0,61	3,35	0,83	3,21	0,96	3,59	0,68	3,68	0,66
	D Hospital	4,04	0,46	3,47	0,94	3,21	0,82	3,80	0,42	4,18	0,57	4,03	0,60	3,78	0,63	4,01	0,50	3,94	0,53	3,43	0,69	3,48	0,78	3,70	0,56	3,85	0,57

***OCS:** Organizational Communication Scale; **OTS:** Organizational Trust Scale; **OHS:** Organizational Health Scale, **Other:** Psychologist, Dietician, Information Technology Services, Technical Services

1: $t = 2.24$; $SH = 0.12$; $p = 0.026$, **2:** $F_{(6,278)} = 3.23$; $SH = 0.11$; $p = 0.005$ (Tukey), **3:** $F_{(6,278)} = 3.23$; $SH = 0.10$; $p = 0.048$ (Tukey), **4:** $F_{(6,278)} = 3.85$; $SH = 0.17$; $p = 0.001$ (Tukey), **5:** $F_{(6,278)} = 4.43$; $SH = 0.91$; $p < 0.001$ (Tukey), **6:** $F_{(6,278)} = 4.43$; $SH = 0.89$; $p = 0.042$ (Tukey), **7:** $F_{(6,278)} = 4.43$; $SH = 0.11$; $p = 0.008$ (Tukey), **8:** $F_{(6,278)} = 2.99$; $SH = 0.14$; $p = 0.007$ (Tukey), **9:** $F_{(6,277)} = 4.30$; $SH = 0.15$; $p < 0.001$ (Tukey), **10:** $F_{(6,277)} = 4.30$; $SH = 0.17$; $p = 0.048$ (Tukey), **11:** $F_{(6,277)} = 2.69$; $SH = 0.12$; $p = 0.010$ (Tukey), **12:** $F_{(6,278)} = 3.16$; $SH = 0.12$; $p = 0.006$ (Tukey), **13:** $F_{(6,278)} = 4.46$; $SH = 0.17$; $p = 0.014$ (Dunnett), **14:** $F_{(6,278)} = 4.46$; $SH = 0.19$; $p = 0.001$ (Dunnett), **15:** $F_{(6,278)} = 4.04$; $SH = 0.20$; $p = 0.002$ (Tukey), **16:** $F_{(6,278)} = 4.04$; $SH = 0.17$; $p = 0.004$ (Tukey), **17:** $F_{(6,278)} = 4.28$; $SH = 0.15$; $p = 0.001$ (Dunnett), **18:** $F_{(6,278)} = 4.28$; $SH = 0.13$; $p = 0.001$ (Dunnett), **19:** $F_{(6,278)} = 3.17$; $SH = 0.12$; $p = 0.017$ (Tukey), **20:** $F_{(5,279)} = 2.71$; $SH = 0.11$; $p = 0.017$ (Tukey), **21:** $F_{(5,279)} = 3.20$; $SH = 0.11$; $p = 0.009$ (Tukey), **22:** $F_{(5,279)} = 3.20$; $SH = 0.93$; $p = 0.003$ (Tukey), **23:** $F_{(5,279)} = 2.80$; $SH = 0.14$; $p = 0.015$ (Tukey), **24:** $F_{(5,279)} = 5.83$; $SH = 0.18$; $p = 0.001$ (Tukey), **25:** $F_{(5,279)} = 5.83$; $SH = 0.17$; $p = 0.002$ (Tukey), **26:** $F_{(5,279)} = 3.10$; $SH = 0.14$; $p = 0.045$ (Tukey), **27:** $F_{(5,279)} = 3.10$; $SH = 0.13$; $p = 0.034$ (Tukey), **28:** $F_{(2,282)} = 4.60$; $SH = 0.13$; $p = 0.028$ (Tukey), **29:** $F_{(2,281)} = 5.00$; $SH = 0.10$; $p = 0.005$ (Tukey), **30:** $F_{(2,282)} = 3.40$; $SH = 0.88$; $p = 0.018$ (Dunnett), **31:** $F_{(2,282)} = 6.80$; $SH = 0.14$; $p = 0.001$ (Tukey), **32:** $F_{(2,282)} = 6.80$; $SH = 0.16$; $p = 0.016$ (Tukey), **33:** $F_{(2,282)} = 7.10$; $SH = 0.14$; $p = 0.001$ (Tukey), **34:** $F_{(2,282)} = 7.10$; $SH = 0.16$; $p = 0.013$ (Tukey), **35:** $F_{(2,282)} = 6.23$; $SH = 0.11$; $p = 0.002$ (Tukey), **36:** $F_{(2,282)} = 6.23$; $SH = 0.13$; $p = 0.016$ (Tukey), **37:** $F_{(2,282)} = 4.36$; $SH = 0.14$; $p = 0.010$ (Dunnett), **38:** $F_{(2,281)} = 4.73$; $SH = 0.11$; $p = 0.008$ (Tukey), **39:** $F_{(2,282)} = 3.58$; $SH = 0.11$; $p = 0.028$ (Dunnett), **40:** $F_{(2,282)} = 3.20$; $SH = 0.84$; $p = 0.034$ (Dunnett).

FIGURE 1: ORGANIZATIONAL COMMUNICATION, ORGANIZATIONAL HEALTH, ORGANIZATIONAL TRUST AND ORGANIZATIONAL COMMUNICATION CLIMATE SCALES STRUCTURAL EQUATION MODEL



DISCUSSION

Among the findings obtained as a result of this research, there is differentiation in the sub-dimensions of the Organizational Communication Scale in terms of gender, profession, unit, education and monthly family income variables. It is seen in the literature that there are findings that organizational communication causes differentiation in demographic variables [24,25,26]. In the study of Bektaşoğlu and Şengün (2020), it is seen that different findings were obtained from the findings obtained in this study [27].

In this study, it is seen that there is a significant difference in the sub-dimensions of Organizational Trust Scale, in terms of profession, unit, educational status, monthly average income, and trust in the manager. These findings regarding the Organizational Trust Scale and its sub-dimensions are generally compatible with some studies in the literature [28,29,30] seems to be partially compatible with the study of Baş and Şentürk (2011) [31]. The findings obtained in Altunay's (2017) and Çiftçi's (2015) studies are completely different from the findings obtained in this study [32,33].

According to the findings obtained in this research, there are significant differences in the sub-dimensions of the Organizational Health Scale according to the variables of profession, educational status, unit and monthly average income. It can be said that the findings obtained are generally compatible with the literature [34,35,36].

In this study, it is seen that only the occupation variable causes a significant difference in the Organizational Communication Climate. It is seen that the studies of Ballı and Ateş (2021) and Arslan and Gül (2022) reached different results than the findings obtained in this study [37,38].

It is seen that the differences seen in demographic variables in terms of research variables are mostly in terms of occupation variable. The reason for this may be related to the fact that many professional groups work in healthcare institutions and these professional groups are affected differently by the variables included in the research. When

evaluated in terms of educational status, it is noteworthy that increasing education level negatively affects the perception of organizational health. The reason for this may be related to the fact that participants make a more critical evaluation as their education level increases.

There is evidence in the literature that organizational communication and trust positively affect organizational commitment [39,40]. It has been found that the approach that has the most impact on employees' trust in the institution they work for is empathic communication, and that using an empathetic language in the organizational communication process affects organizational trust by 53% [41]. According to the findings obtained in this study, it is seen that organizational communication affects organizational trust by 76%. It can be said that these findings are compatible with the findings obtained by Men et al. (2021). Zainab et al. (2022) showing that organizational trust has a mediating effect between organizational communication and openness to change can also be said to support the mediating effect in this study [10,41]. Findings from another study conducted with healthcare professionals show that transparency is positively related to trust. Increasing employees' perceptions of corporate transparency also increases their trust in the hospital. In the study, organizational trust is discussed with the sub-dimensions of competence, integrity and goodwill and transparency was evaluated with the sub-dimensions of participation, substantial information, accountability and confidentiality. Other findings from the same study revealed that employees find honesty and goodwill more important than competence. Employee participation, which occurs when employees develop attitudes towards sharing information they find important, is the strongest determinant of overall transparency [42]. The findings obtained in Rawlins's (2008) study coincide with the findings obtained in this study in that healthcare professionals found the concepts of communication and trust to be related [42].

Evidence that trust, leadership, and effective communication have a significant impact on organizational health supports the findings of this study. [43]. A meta-analysis study on organizational health literacy shows that communicating with clients is the concept most closely associated with organizational health literacy [44]. The findings reveal the importance of communication in the delivery of health services.

It should not be ignored that this situation will increase employee performance and service quality. It is thought that the high impact of organizational health and organizational communication on organizational trust are the most important findings obtained in this study and should be supported by other studies. However, studies in which research variables are handled with different variables also reveal that more studies should be conducted with these variables. For example, it is seen that organizational trust affects organizational commitment but has no effect on work engagement [39]. There is also evidence in the literature that organizational communication increases organizational commitment [40]. In addition, evidence has been found in the literature that organizational trust and communication have a positive effect on openness to change. It was also shown in the same study that organizational trust has a mediating effect between organizational communication and openness to change [10]. Therefore, evaluating organizational trust only in the context of organizational communication and organizational health will be limited. It is also thought that it is important to evaluate the relationship between the variables discussed in the research, especially organizational trust, and variables such as quality of working life and performance.

CONCLUSION

The findings of this study indicate that organizational communication has a 76% impact on organizational trust, while organizational health has a 93% impact on organizational trust. Furthermore, organizational communication climate has a 62% mediating effect between organizational communication and organizational trust, and communication climate has a 24% mediating role between organizational health and organizational trust. In light of these findings, it can be recommended that healthcare managers undertake efforts to improve the communication climate to increase trust and communication. These interrelated variables, which have such a strong impact on each other, once again demonstrate the importance of communication and trust among healthcare professionals.

In the study, various findings were obtained through the structural equation model, in which correlation between variables, comparison between groups and organizational trust were evaluated as dependent variables and the effects of other variables were examined. It has been observed that studies in the literature are generally conducted outside the healthcare sector. In this respect, the dynamics of the health sector have been ignored. This study is unique from other studies in the literature because healthcare workers are taken into account as the sampling frame. For example, it is quite durable among those with under five years of experience. It suggests that the fact that the employees are predominantly young can give institutions a dynamic and innovative structure. Another unique aspect of the research is related to the limited number of studies conducted with the variables included in this research in the business literature. It is thought that this study is an original study because these variables include the concepts of health and trust, which are the basic elements in the service process for healthcare institutions.

Considering the evidence that organizational trust not only increases communication among employees but also increases positive behaviors such as organizational commitment, job satisfaction, performance, innovative behaviors and organizational citizenship behavior, it can be said that the research findings are within the framework of the literature [45]. The findings of this study support the evidence in the literature on the relationship between organizational trust and communication [46].

The findings obtained in this research show that organizational communication and organizational health greatly increase the employee's sense of organizational trust. In this context, it is thought that the employee's trust in the organization will reduce the intention to leave the job and increase the employee's commitment to the organization. It can be also said that the communication established by managers is very effective in the trust of employees in the organization. One of the factors that reduce organizational trust may be the negative emotions reflected by the manager. Especially during crisis periods (COVID-19), organizational communication and trust become more important. Organizational health is necessary for patient health, and maintaining organizational health depends on the optimization of communication processes [7].

When studies with similar findings are evaluated, it is thought that organizational trust should be addressed with different variables. This research represents a limited population and contains many limitations inherent in the research. One of these limitations is that the research was not supported by qualitative data. To reach generalizable results, more research is needed on the variables included in the study. In addition, it is recommended to conduct studies with other variables that may influence, be affected by, or interact with the research variables. The fact that the findings obtained are findings obtained in the health sector should be taken into consideration in studies to be conducted in different sectors. It is hoped that the study will contribute to the literature.

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SPATIAL ANALYSIS OF HEALTHCARE VULNERABILITY AND ACCESSIBILITY UNDER PMJAY IN UTTAR PRADESH

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ABSTRACT

This study investigates spatial disparities in healthcare access under the Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (PMJAY) across the districts in Uttar Pradesh, India. Despite being the highest contributor to Ayushman card distribution and hospital empanelment under PMJAY, Uttar Pradesh ranks low in the hospital admissions. This reflects a gap between coverage and utilization.

Using district-level data from the District Wise Development Indicators (2021), National Family Health Survey-5 and the PMJAY Dashboard (2024), the study constructed a composite vulnerability index. Spatial analysis techniques, including Local Indicators of Spatial Association (LISA), percentile mapping, and spatial regression models were employed. This paper analyzes district variations in utilization of PMJAY and examines that how the social, economic and health infrastructure of the districts shape the utilization pattern. The results reveal that educational disadvantage, rural location, and infrastructure gaps are significantly associated with lower healthcare utilization.

The Spatial Error Model (SEM) provided the best model fit, indicating that unobserved spatial factors play a critical role in shaping healthcare outcomes. The findings highlight the need for geographically targeted health policies that address structural inequalities to enhance the effectiveness of public health insurance programs like PMJAY.

KEYWORDS

PMJAY, spatial analysis, Uttar Pradesh, health inequality, LISA, spatial regression, healthcare access, vulnerability index

INTRODUCTION

Despite substantial policy commitments to achieving Universal Health Coverage (UHC), India continues to encounter enduring obstacles to equitable healthcare access, particularly in states like Uttar Pradesh (UP), its most populous and socioeconomically diverse state. One of the most significant initiatives toward UHC is the Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (PMJAY), launched in 2018 as the world's largest publicly funded health insurance scheme. PMJAY aims to cover up to ₹5,00,000 (\$5520; 1 INR=0.011 US \$) per family per year for secondary and tertiary healthcare services across empanelled public and private hospitals, eliminating family size caps and enabling nationwide portability [1].

Although the program has scaled up rapidly, with over 500 million Ayushman cards issued nationwide by 2024, substantial regional disparities remain in service utilization. For instance, while states such as Tamil Nadu, Karnataka, and Kerala report high hospitalization rates under PMJAY, Uttar Pradesh despite leading the country in card distribution and hospital empanelment, ranks among low performing states in terms of total admissions [1].

Uttar Pradesh, home to over 240 million people, serves as a critical case study in understanding the spatial inequalities embedded in public health delivery. Despite extensive enrolment (over 52 million Ayushman cards) and a large number of empanelled hospitals (5,867), the utilization of PMJAY services remains skewed, with many vulnerable districts reporting low admissions. Internal disparities between western UP and the underdeveloped eastern and Bundelkhand regions, coupled with rural–urban divides in infrastructure, further exacerbate inequities [2–5].

Various socio-economic determinants such as caste composition, female literacy, pupil–teacher ratio (PTR), electricity access, and income levels intersect to influence healthcare access [6–9]. In particular, education-related vulnerabilities are known to hinder awareness, entitlement navigation, and trust in health systems [10,11]. Furthermore, only a small fraction of private hospitals in aspirational districts offer specialized services, pointing to systemic private sector disengagement [12,13]. Most literature relies on aggregate statistics without uncovering spatial clustering, spatial spillovers, or local drivers of underperformance [14–17].

This study addresses that gap by conducting a district-level spatial analysis of PMJAY implementation in Uttar Pradesh. This study aims to: map the spatial disparities in PMJAY card distribution, hospital empanelment, service utilization across the state, construct multidimensional vulnerability index to identify disadvantaged districts and see the relationship between vulnerability factors and insurance scheme variables. Given the size and demographic complexity of Uttar Pradesh, the results of this study hold broader implications for equitable health policy in India.

DATA AND METHODOLOGY

DATA

The District Wise Development Indicators (DWDI), 2021 and National Family Health Survey (NFHS), 2019-21 are used to calculate the vulnerability index at district level. The indicators related to the PMJAY scheme, including the number of Ayushman Bharat cards distributed, the number of empanelled hospitals, private hospitals, and hospital admissions, were sourced from the PMJAY dashboard ([PMJAY - Dashboard](#)) as of June 2024. Due to the unavailability of data pertaining to certain indicators, 71 out of 75 districts of the state were included in the analysis – Hapur, Amethi, Sambhal, and Shamli being excluded.

A composite vulnerability index was considered to provide a holistic measure of socioeconomic disadvantages by aggregating multiple indicators with equal weights. Furthermore, individual vulnerability indicators were also analysed separately to better capture the distinct effects of socioeconomic disparities on healthcare access. The following dimensions were included:

- **Social Vulnerability** is measured by the percentage of SC/ST population, sourced from the District Wise Development Indicators, 2021, as these groups face historical socioeconomic disadvantages [7,8].
- **Economic Vulnerability** is calculated by taking aggregate value of percentage of households belonging to the poorest wealth quintile of a district, using NFHS, 2019-21 data set. Evidence indicates that low-income households are more susceptible to financial shocks [4].
- **Gender Inequality** is calculated using the female literacy rate data, extracted from the DWDI, 2021, as an indicator of gender disparities in education and socioeconomic participation [18].
- **Educational Vulnerability** is captured through the pupil-teacher ratio from the DWDI, 2021, as a high ratio indicates inadequate educational infrastructure and limited access to quality education [6].

- **Rural Status** is measured as the proportion of the rural population in each district, obtained from the DWDI, 2021, since rural areas generally have poorer access to healthcare and bear a higher financial burden of health expenditures [7].
- **Infrastructure Availability** is measured using per capita electricity consumption (K.W.H.), sourced from the DWDI, 2021, as a proxy for overall infrastructural development that influences socioeconomic disparities [19].

Each indicator was scaled[20] using the formula:

$$Z_i = (X_i - X_{\min}) / (X_{\max} - X_{\min})$$

where Z_i is the normalized value of the indicator, X_i is the actual observed value, and $X_{\min}$ and $X_{\max}$ are the minimum and maximum values respectively across the districts. The composite vulnerability index was obtained by summing the normalized values of all indicators, with higher scores indicating greater vulnerability[21,22].

This study employs spatial analysis techniques to examine the distribution and accessibility of healthcare services at the district level. The analysis is conducted using GeoDa, a specialized software for spatial econometric modelling and visualization. The primary focus is to identify spatial dependence in key healthcare indicators using Univariate Local Moran's I, which measures the degree of spatial autocorrelation and detects local clustering patterns. A queen contiguity weight matrix was used to define spatial relationships between districts.

Local Indicators of Spatial Association (LISA) analysis was applied to assess spatial clustering and disparities across multiple healthcare-related variables. The LISA analysis was conducted for the Vulnerability Index, Ayushman Card Distribution, Hospital Admissions per One Lakh Ayushman Cards, Total Hospitals per One Lakh Ayushman Cards, Public Hospitals per One Lakh Ayushman Cards and Private Hospitals per One Lakh Ayushman Cards.

For each indicator, a LISA significance map, a cluster map, and a Moran's scatter plot with correlation values were generated. The LISA significance map highlights districts with statistically significant spatial clustering, while the cluster map categorizes districts into four spatial patterns:

- High-High (HH) clusters: Districts with high values surrounded by similar high-value districts.
- Low-High (LH) spatial outliers: Districts with low values surrounded by high-value neighbours.
- Low-Low (LL) clusters: Cold spots with low values surrounded by similar districts.
- High-Low (HL) spatial outliers: High-value districts surrounded by low-value neighbours.

The Moran's scatter plot visually represents the correlation between each district's values and the weighted average of its neighbouring districts. To further analyse spatial disparities, percentile mapping was employed for all indicator variables analysed in LISA. This method was chosen over predefined classification schemes because it offers a data-driven approach, ensuring consistency in comparative spatial representation across different indicators. By using percentiles, we avoid arbitrary thresholds and instead create a uniform distribution-based categorization, which better captures variations in the data and enables more precise spatial comparisons.

Each percentile category was assigned a distinct colour in a red-to-blue gradient to reflect card issuance intensity. Specifically, districts in the >99% were shaded dark red, indicating the highest levels of distribution. The 90%–99% percentile group appeared in orange-red, followed by light orange or tan for the 50%–90% percentile range. Districts within the 10%–50% percentile were coloured light blue, while the 1%–10% percentile appeared in blue, and the <1% percentile was marked with dark blue, indicating the lowest levels of distribution. This color-coded visualization allowed for an intuitive and comparable spatial interpretation of the data.

To better understand the relationship between vulnerability factors and hospital admissions, spatial regression models were employed. Ordinary Least Squares (OLS) regression was first conducted as a baseline model to establish correlations

between hospital admissions and independent variables. However, Moran's I test on the residuals confirmed the presence of spatial dependence, necessitating the use of spatial econometric models.

The Spatial Lag Model (SLM) was used to account for spillover effects, where hospital accessibility in one district influences that of neighbouring districts. The model is specified as:

$$Y = \rho WY + X\beta + \epsilon$$

where Y represents hospital admissions, WY is the spatially lagged dependent variable, ρ is the spatial autoregressive coefficient, X is the matrix of explanatory variables, and ϵ is the error term. A significant ρ suggests that hospital admissions in one district are influenced by those in surrounding districts.

Additionally, the Spatial Error Model (SEM) was applied to account for unobserved spatial dependencies that may impact hospital admissions. The model is defined as:

$$Y = X\beta + u, \quad u = \lambda Wu + \epsilon$$

where u represents the spatially autocorrelated error term and λ is the spatial autoregressive parameter for the error term. A significant λ indicates that unobserved spatial factors contribute to hospital admissions.

The dependent variable in this study is hospital admissions per district, representing the extent to which residents utilize healthcare services under the PMJAY scheme. The independent variables included in the model were, number of Ayushman cards distributed, number of empanelled hospitals, economic vulnerability, rural status, infrastructure availability, social vulnerability, gender inequality and education vulnerability. By integrating LISA analysis, percentile mapping, and spatial regression models, this study provides a comprehensive assessment of spatial disparities in hospital accessibility and highlights districts requiring targeted policy interventions.

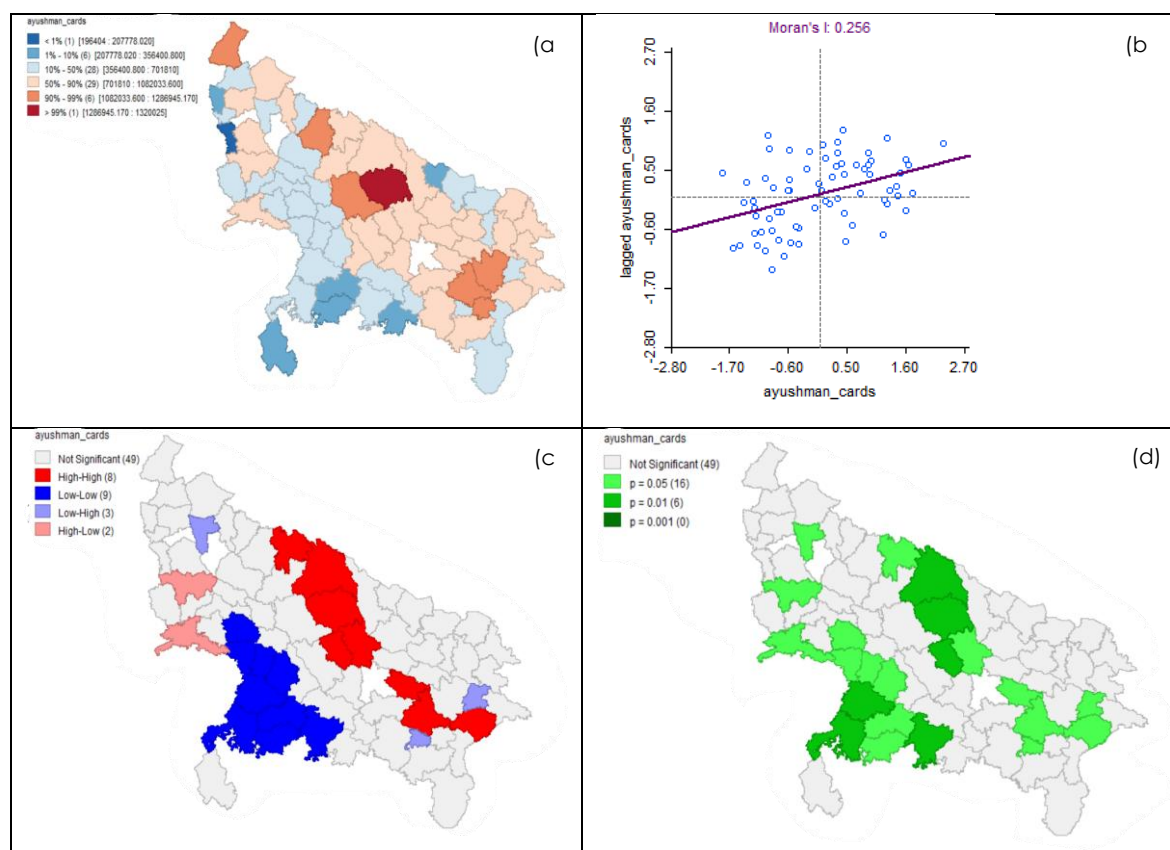
RESULTS

DISTRIBUTION OF AYUSHMAN BHARAT CARD

The distribution of Ayushman Bharat (PMJAY) cards across districts in Uttar Pradesh exhibits significant spatial disparities. A percentile-based classification reveals that Gautam Buddha Nagar falls in the <1% category with only 196,404 cards issued, the lowest in the state (Figure 1). Following this, six districts fall into the 1-10% percentile range such as Lalitpur (282,092), Chitrakoot (301,096), Baghpat (353,525), and Shravasti (319,385). Shravasti and Chitrakoot were also added in the NITI Ayog's Aspiration districts Program in 2018 advocating for stronger investment in health. On the other end, districts within 90-99% percentile range include Hardoi (1100,411), Bareilly (1086,827), Azamgarh (1140,440), and Jaunpur (1127,444). Sitapur stands in the greater than 99% category, with the highest number of Ayushman cards issued at 1,320,025.

The LISA cluster map revealed high-high clusters (hotspots) in districts such as Pilibhit, Kheri, Sitapur, Barabanki, Jaunpur, Barabanki, Lucknow and Ghazipur, where both the district and its neighbours show high levels of card coverage (Figure 1). These hotspot areas are often highlighted in red in the cluster map. Conversely, low-low clusters (cold spots) were identified in Mainpuri, Etawah, Jalaun, Mahoba, Hamirpur, Jhansi, Kanpur Dehat and Banda, where card distribution is consistently low across adjacent regions. The significance map, based on p-values, confirms that these clusters are statistically meaningful ($p < 0.05$). A Moran's I coefficient of 0.256 indicates moderate positive spatial autocorrelation, suggesting that districts with similar levels of card issuance, whether high or low, tend to be geographically proximate. This clustering implies spatial dependence in PMJAY implementation, highlighting the need for regional strategies to address underperformance in neighbouring low-coverage districts.

FIGURE 1: (A) PERCENTILE PLOT (B) MORAN'S I SCATTER PLOT, (C) UNIVARIATE LOCAL INDICATORS OF SPATIAL ASSOCIATION (LISA) CLUSTER MAP AND, (D) LISA SIGNIFICANCE MAP FOR AYUSHMAN CARDS



STATUS OF HOSPITAL ADMISSIONS PER 1 LAKH AYUSHMAN CARDS

Hospital admissions per one lakh Ayushman cardholders provide a clearer picture of the actual utilization of services under the PMJAY scheme. Substantial inter-district variation is evident across Uttar Pradesh. At the lower end, Chitrakoot reported the lowest hospitalization rate with 2,365.03 admissions, placing it in the less than 1 percentile. In contrast, the highest utilization was recorded in Bareilly, with 13,092.70 admissions per one lakh cards, shown in dark red, placing it in the greater than 99% category. LISA cluster analysis revealed distinct high-high clusters (hotspots) in Amroha, Bulandshahr, Gautam Buddha Nagar, and Rampur, where both the district and surrounding areas exhibit high hospital admissions. The significance map, using p-values, confirmed statistical significance of these clusters ($p < 0.05$), especially across Bundelkhand and southeastern regions of the state. The Moran's I coefficient of 0.336 indicates a moderate positive spatial autocorrelation. This implies that districts with high hospital utilization tend to be located near others with similarly high rates, and vice versa for low-performing districts. These findings suggest persistent underperformance in certain regions points to structural barriers, such as lack of empanelled hospitals, logistical issues, and informational gaps.

REGIONAL DISPARITIES IN VULNERABILITY INDEX

The spatial analysis of the Vulnerability Index across districts in Uttar Pradesh reveals significant regional inequalities. Shravasti recorded the highest vulnerability score of 4.9. Other highly vulnerable districts in the 90-99% percentile include Kaushambi (4.83), Kheri (4.78), Sitapur (4.79), Bahraich (4.89), Balrampur (4.66), and Sonbhadra (4.83). These districts are largely concentrated in the eastern and central parts of the state, areas historically marked by poor infrastructure and limited economic development. In contrast, the least vulnerable districts include Gautam Buddha Nagar (0.8828), Ghaziabad (1.37), Kanpur Nagar (1.47), Lucknow (1.61), Meerut (1.89) and Varanasi (2.00). These urban and peri-urban districts have greater access to health services, better educational infrastructure, and higher economic activity. The LISA cluster map further supports these findings. High-vulnerability areas in central and eastern UP form tight clusters, emphasizing regional development imbalances. The Moran's I scatter plot shows that highly vulnerable districts are more likely to be located near others with similar levels of vulnerability, reinforcing the presence of spatially structured disadvantage.

FIGURE 2: (A) PERCENTILE PLOT (B) MORAN'S I SCATTER PLOT, (C) UNIVARIATE LOCAL INDICATORS OF SPATIAL ASSOCIATION (LISA) CLUSTER MAP AND, (D) LISA SIGNIFICANCE MAP FOR HOSPITAL ADMISSIONS PER 1 LAKH AYUSHMAN CARDS

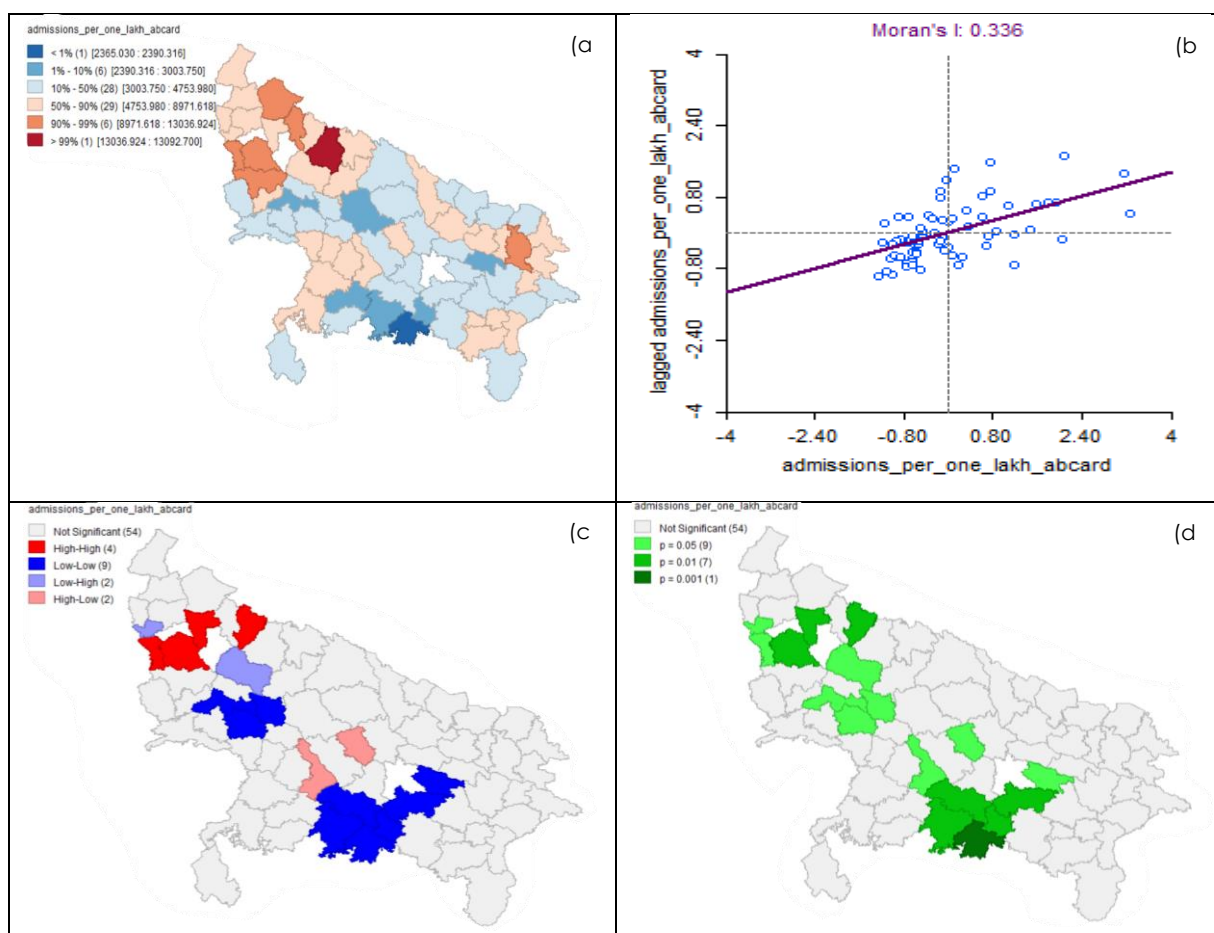
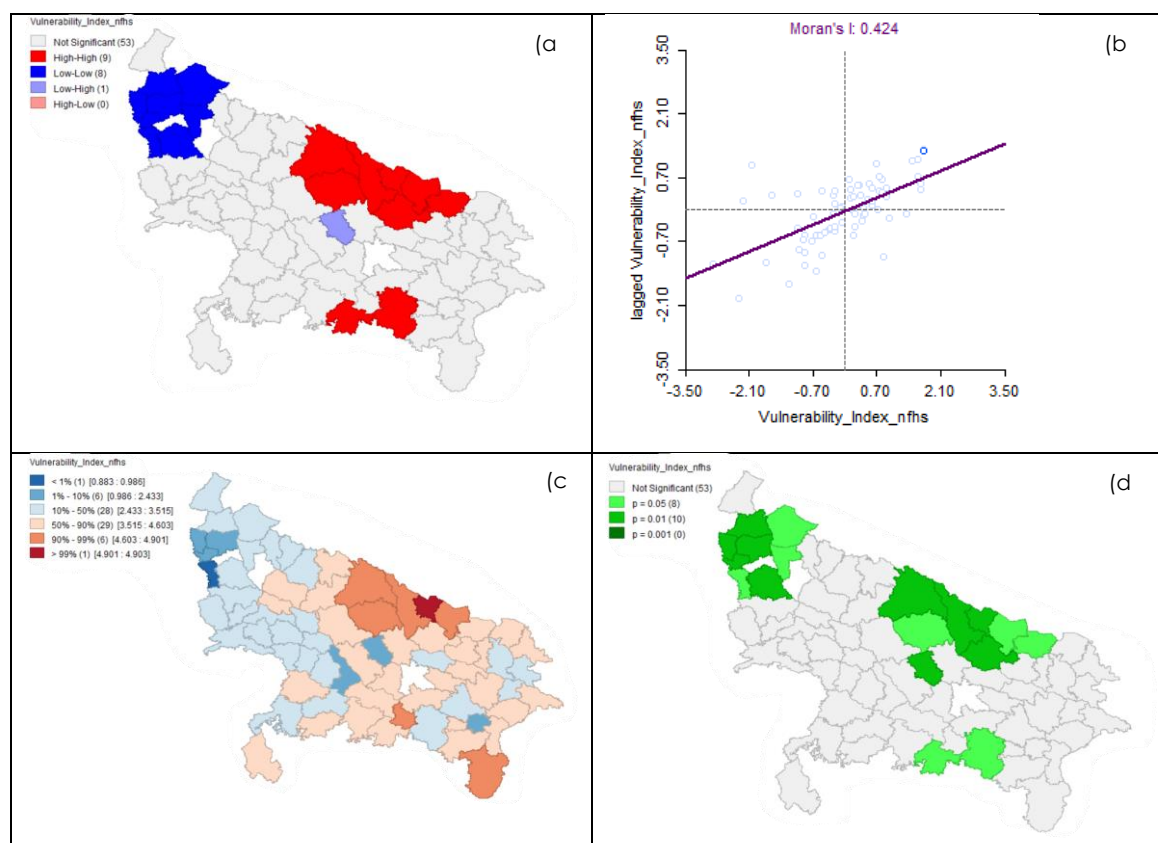


FIGURE 3: (A) PERCENTILE PLOT (B) MORAN'S I SCATTER PLOT, (C) UNIVARIATE LOCAL INDICATORS OF SPATIAL ASSOCIATION (LISA) CLUSTER MAP AND, (D) LISA SIGNIFICANCE MAP FOR VULNERABILITY INDEX

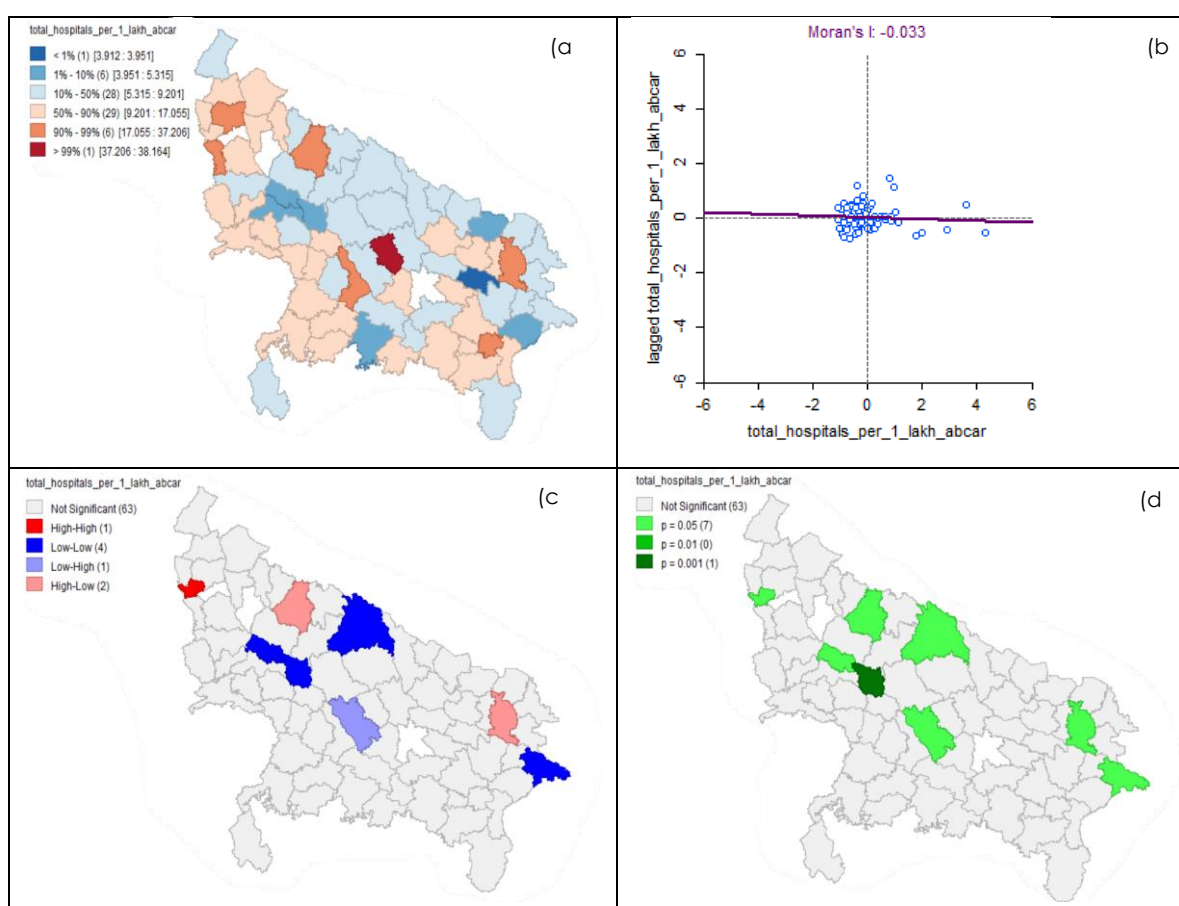


HOSPITAL DENSITY ANALYSIS AND PUBLIC-PRIVATE COMPARISON

Districts such as Lucknow (38.16), Gautam Buddha Nagar (33.60), Kanpur Nagar (29.23), Gorakhpur (23.54), report the highest hospital densities and are shown in dark red on the percentile map. These districts, mostly urban or regional centers, have better access to healthcare facilities and a stronger presence of both public and private providers. On the lower end, districts like Ambedkar Nagar (3.91), Ghazipur (4.09), Etah (4.45), exhibit extremely low hospital densities and are marked in dark blue. This indicates a critical shortage of accessible empanelled hospitals, limiting healthcare service availability.

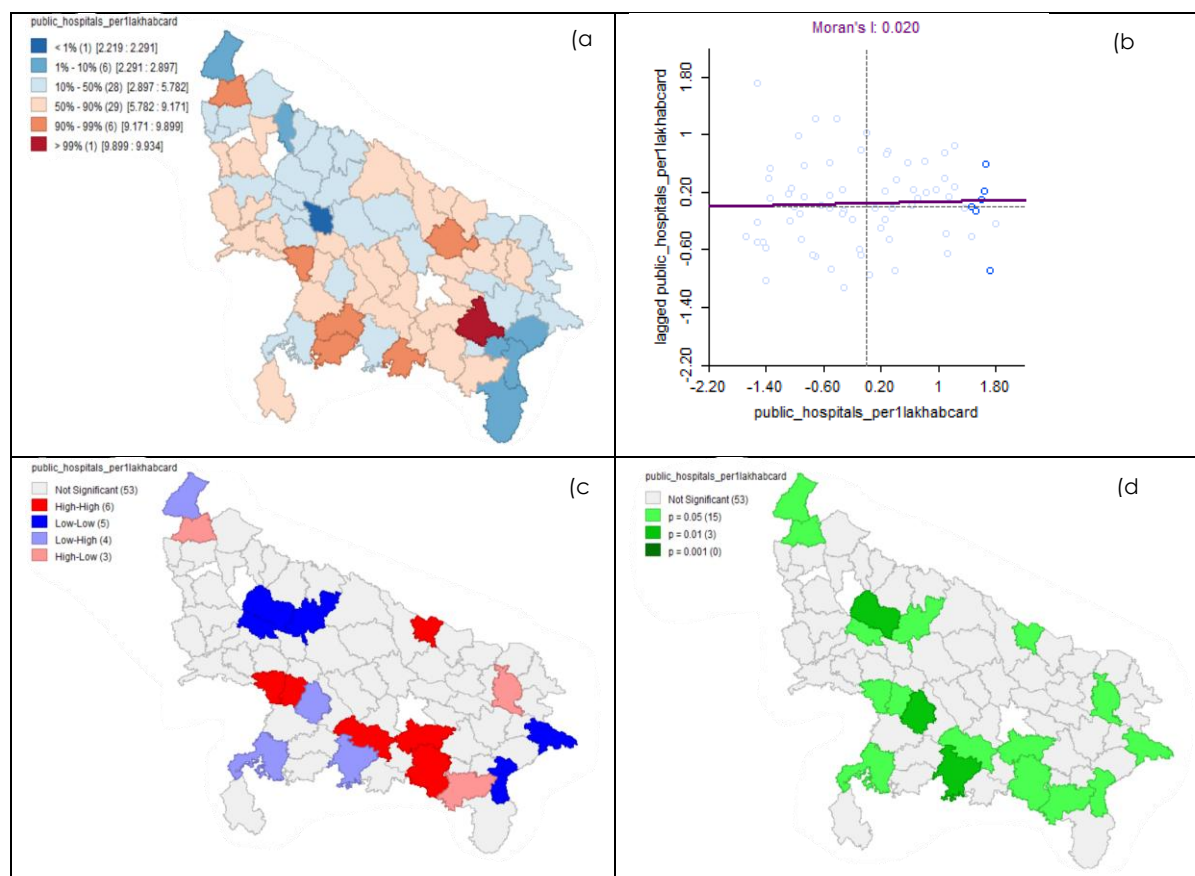
LISA cluster analysis shows that low-low clusters (coldspots) are identified in districts such as Ballia, Farrukhabad, Kasganj, and Kheri, indicating consistently poor hospital access across these neighboring areas. The significance map, with a p-value threshold of 0.05, further validates these clusters, particularly in eastern and central regions. The Moran's I value for total hospital density is -0.033 (Figure 4), suggesting no significant global spatial autocorrelation. This implies that hospital distribution does not follow a clear spatial pattern statewide, possibly reflecting uneven policy implementation or localized infrastructural bottlenecks.

FIGURE 4: (A) PERCENTILE PLOT (B) MORAN'S I SCATTER PLOT, (C) UNIVARIATE LOCAL INDICATORS OF SPATIAL ASSOCIATION (LISA) CLUSTER MAP AND, (D) LISA SIGNIFICANCE MAP FOR TOTAL HOSPITALS EMPANELLED PER ONE LAKH AYUSHMAN CARDS



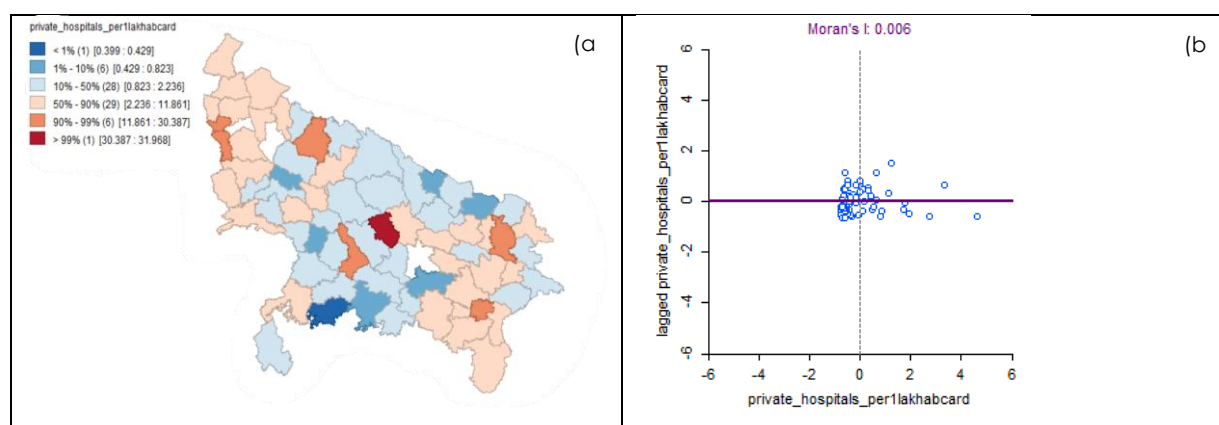
When examining the availability of public hospitals, districts like Jaunpur (9.93), Muzaffarnagar (9.76), Etawah (9.63) stand out in dark red for their higher public hospital densities. Moran's I value for public hospitals is 0.020 (Figure 5), indicating very weak spatial autocorrelation, meaning that some clustering exists, but the spatial pattern is not strong or consistent.

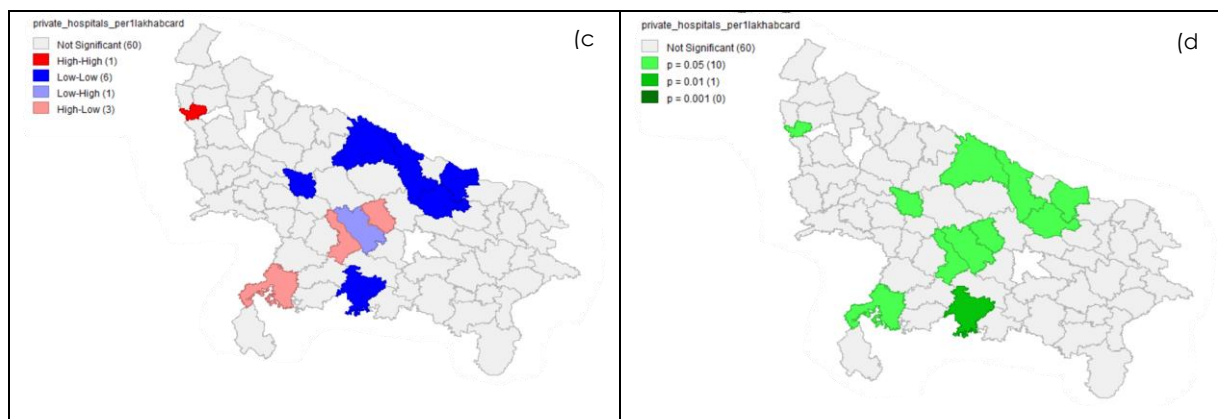
FIGURE 5: (A) PERCENTILE PLOT (B) MORAN'S I SCATTER PLOT, (C) UNIVARIATE LOCAL INDICATORS OF SPATIAL ASSOCIATION (LISA) CLUSTER MAP AND, (D) LISA SIGNIFICANCE MAP FOR PUBLIC HOSPITALS EMPANELLED PER ONE LAKH AYUSHMAN CARDS



In the case of private hospitals, urban districts dominate. Lucknow (31.96) has the highest private hospital density, followed by Kanpur Nagar (20.87), Gautam Buddha Nagar (24.43). On the other end, Mahoba (0.39), Kasganj (0.54), Shrawasti (0.62), and Siddharthnagar (0.57) show low private hospital densities, represented in dark blue. The LISA cluster map identifies Ghaziabad as a hotspot whereas Kheri, Bahraich, Banda, Balrampur, Gonda Farrukhabad are recognized as coldspots. Moran's I value for private hospitals is 0.006, indicating minimal spatial autocorrelation, suggesting that private hospital availability is highly localized and largely influenced by urbanization and market dynamics.

FIGURE 6: (A) PERCENTILE PLOT (B) MORAN'S I SCATTER PLOT, (C) UNIVARIATE LOCAL INDICATORS OF SPATIAL ASSOCIATION (LISA) CLUSTER MAP AND, (D) LISA SIGNIFICANCE MAP FOR PRIVATE HOSPITALS EMPANELLED PER ONE LAKH AYUSHMAN CARDS





FINDINGS FROM SPATIAL REGRESSION ANALYSIS

The figure 6 given below showcases the ordinary least squares and spatial regression results. The OLS model explained 74.63% of the variation in PMJAY utilization ($R^2 = 0.7463$). Ayushman card coverage exhibits a positive and highly significant association with admissions ($p < 0.001$), implying that districts with higher beneficiary identification records have greater utilization of PM-JAY hospital services. Similarly, the number of empanelled hospitals shows a statistically significant positive effect (β coeff. = 177.34, $p < 0.001$), underscoring the importance of provider availability in enabling scheme utilization. However, spatial diagnostics suggested the presence of spatial dependence. The Spatial Lag Model (SLM) produced a non-significant spatial autoregressive coefficient ($\rho = 0.0129$, $p = 0.9097$), indicating that utilization in one district does not directly influence utilization in neighbouring districts.

In contrast, the Spatial Error Model (SEM) yielded a statistically significant spatial error parameter ($\lambda = 0.3799$, $p = 0.0077$), confirming the presence of spatially correlated unobserved factors. The SEM also demonstrated superior model performance, with a higher R^2 (0.7668), lower AIC (1566.9), and improved log-likelihood (-774.44) relative to OLS and SLM. These findings suggest that spatial dependence operates through omitted regional characteristics rather than through direct inter-district spillover effects. Accordingly, the SEM was identified as the most appropriate specification for interpretation.

Ayushman Card Coverage was positively and highly significant ($\beta = 0.0490$, $p < 0.001$), indicating that districts with greater enrolment under PMJAY experience higher healthcare utilization. This highlights the critical role of beneficiary identification and scheme penetration in facilitating access. Similarly, the number of Empanelled Hospitals showed a strong positive association ($\beta = 192.95$, $p < 0.001$), underscoring the importance of healthcare infrastructure and provider availability in driving service uptake. Among structural determinants, Economic Vulnerability exhibited a significant negative association ($\beta = -33886.5$, $p = 0.0048$). Districts with higher proportions of economically disadvantaged populations demonstrated lower utilization levels, suggesting that financial risk protection alone may be insufficient to overcome entrenched structural barriers. PTR (Pupil-Teacher Ratio) Vulnerability was also negatively associated with utilization ($\beta = -20465.7$, $p = 0.027$), indicating that broader developmental deficits may indirectly constrain healthcare access.

In contrast, Female Vulnerability showed a positive and statistically significant relationship ($\beta = 41720.9$, $p = 0.0072$), potentially reflecting higher healthcare need or increased maternal and reproductive health service utilization in vulnerable districts. Overall, the spatial regression results demonstrate that both scheme-level factors, health infrastructure, and structural socioeconomic conditions significantly shape district-level variations in PMJAY healthcare utilization.

FIGURE 7: OLS, SLM AND SEM REGRESSION MODELS

Variable	OLS Coeff. (SE)	SLM Coeff. (SE)	SEM Coeff. (SE)
Intercept	-1895.29 (12336.1), $p=0.8436$	-2432.93 (12336.1), $p=0.8436$	-10275 (13204.7), $p=0.4364$
Ayushman Cards	0.04668 (0.00912), $p<0.001$	0.04645 (0.0088), $p<0.001$	0.0490258 (0.00834), $p<0.001$
Empanelled Hospitals	177.34 (47.83), $p<0.001$	177.97 (44.83), $p<0.001$	192.946 (42.336), $p<0.001$
Economic Vulnerability	-41566.2 (11549.2), $p<0.001$	-41012.3 (11463.7), $p<0.001$	-33886.5 (12020.5), $p=0.0048$
Rural Pop. Vulnerability	8863.59 (15708.6), $p=0.5746$	8544.51 (14880.4), $p=0.5658$	8687.32 (14429), $p=0.5471$
Electricity Vulnerability	-7634.62 (20266.1), $p=0.7076$	-7038.25 (19358), $p=0.7161$	1151.09 (18582.2), $p=0.9506$
SC-ST Vulnerability	3190.64 (13463.1), $p=0.8134$	3063.03 (12591.1), $p=0.8078$	238.269 (12698.1), $p=0.9850$
Female Vulnerability	47658.5 (14163.6), $p=0.0013$	47121.9 (13857.1), $p<0.001$	41720.9 (15524.4), $p=0.0072$
PTR Vulnerability	-17984 (10233.4), $p=0.0837$	-18133.3 (9592.7), $p=0.0587$	-20465.7 (9263.87), $p=0.02716$
Spatial Lag ρ (SLM)	NA	0.0129276 (0.11407), $p=0.9097$	NA
Spatial Error λ (SEM)	NA	NA	0.37996 (0.14268), $p=0.00775$
R-squared	0.7463	0.74641	0.76684
AIC	1570.4	1572.39	1566.9
Log-Likelihood	-776.2	-776.196	-774.44

DISCUSSION

The spatial analysis reveals stark disparity in the implementation of PMJAY across districts of Uttar Pradesh, building on earlier observations of a mismatch between insurance coverage and healthcare access. Our spatial analysis confirms that private hospitals are disproportionately located in urban centres, reinforcing pre-existing service gaps in rural areas [23]. This was especially evident in clusters across Bundelkhand and Eastern UP, where both hospital density and service utilization remained low despite high vulnerability [2,4,5]. The regression results highlight that Ayushman card distribution and the number of empanelled hospitals are key predictors of admissions. Districts such as Shravasti, Bahraich, Kaushambi, and Sonbhadra exemplify this dynamic, with high vulnerability scores, weak infrastructure, and low utilization. This underpins the lens of Andersen's Behavioral Model of health services use as the amalgamation of predisposing, enabling and need factors at individual and community levels. These findings align with national patterns in aspirational districts, where private participation is limited, and public services are underutilized [12,13]. The spatial regression models confirm that healthcare access is not only structurally constrained but also geographically patterned. These findings underscore the need for tailored policy strategies that go beyond financial protection and address the spatial and structural roots of exclusion. Integrating spatial diagnostics into the PMJAY dashboard can support more equitable planning. This framework is scalable and replicable across other Indian states, and future research should incorporate longitudinal or patient-level data to assess temporal dynamics and causality [25]. In many underperforming districts, the presence of empanelled hospitals did not correlate strongly with service utilization—suggesting that structural barriers, such as literacy gaps limit

effective demand. Conversely, districts with lower vulnerability and better private hospital access often converted card distribution into higher hospitalization rates.

The consistent negative association between PTR vulnerability and hospital admissions across all models suggests that educational disadvantage operates as a predisposing constraint. This finding aligns with the finding that alongside school education, health education is a significant determinant of health behavior[26]. The concentration of private hospitals in urban districts reflects market-driven supply responses, reinforcing Penchansky and Thomas' availability and accessibility dimensions. In high-vulnerability districts, the absence of private providers limits effective choice, resulting in underutilisation despite nominal insurance coverage. While this study identifies robust spatial associations, the findings should be interpreted as indicative of structural pathways rather than causal effects.

LIMITATIONS

The study used the data available on the PMJAY dashboard and the district wise development indicators. Data related to insurance claims, household hospital admissions, cultured vulnerability indicators can further supplement and confirm the findings of this study. A comprehensive volume of services are provided under the PMJAY via the public and private empanelled hospitals. However, the study could not include the package wise hospitalization, as the study was based on the indicators on the dashboard.

CONCLUSION

This study offers a spatially grounded evaluation of the PMJAY scheme's implementation across Uttar Pradesh, revealing key mismatches between health insurance coverage and actual healthcare access. Despite wide distribution of Ayushman cards and substantial hospital empanelment, many districts with high vulnerability remain underserved and underutilized. The spatial regression analysis identified Ayushman card distribution, hospital availability, and educational disadvantage (PTR) as consistent predictors of hospital admissions, while also highlighting the significance of spatial spillovers and unobserved local influences. The findings reinforce the importance of addressing geographic and structural barriers, such as low health literacy, uneven hospital distribution, and regional exclusion in policy design and implementation. For PMJAY to deliver on its promise of universal health coverage, policymakers must shift focus on the pre-existing, spatially entrenched inequalities in health infrastructure and social development.

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HEALTHCARE DECISION-MAKING AUTONOMY AMONG RURAL INDONESIAN WOMEN: THE INTERPLAY OF CULTURAL, EDUCATIONAL, AND ECONOMIC FACTORS

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ABSTRACT

BACKGROUND

Autonomy in health decision-making is an important indicator of individual empowerment, especially for women in rural areas. Factors such as cultural norms, family dynamics, geographic access to health services, education level, health literacy, and economic status are thought to influence an individual's ability to determine his or her health measures independently. This study aims to analyze the influence of cultural norms, family dynamics, geographic access to health services, education level, health literacy, and economic status on health decision-making autonomy. This study uses a quantitative design with a cross-sectional approach.

METHODS

A total of 720 female respondents of productive age in three rural districts were selected by stratified random sampling. The instrument used is a structured questionnaire that has been validated. Data analysis was carried out multivariate using multiple linear regression using the SPSS program.

RESULTS

Results showed that all independent variables had a significant effect on health decision-making autonomy ($p < 0.05$). The variable of geographic access to health services had the greatest influence ($\beta = 0.41$, 95% CI= 0.30-0.42, $p = <0.001$), followed by family dynamics ($\beta = 0.22$, 95% CI= 0.17-0.30, $p = <0.001$), education level ($\beta = 0.14$, 95% CI= 0.41-1.30, $p = <0.001$), health literacy ($\beta = 0.12$, 95% CI= 0.04-0.14, $p = <0.001$), cultural norms ($\beta = 0.09$, 95% CI= 0.02-0.10, $p = 0.007$), and economic status ($\beta = 0.08$, 95% CI=0.01-0.14, $p = 0.020$).

CONCLUSION

Health decision-making autonomy is significantly influenced by social, economic, and cultural factors. Autonomy-enhancing interventions should consider a multidimensional approach that includes economic empowerment, education, health literacy, and socio-cultural change at the community level.

KEYWORDS

Autonomy, health decisions, cultural norms, geographic access, health literacy, economic status

Autonomy in health decision-making is an important indicator in women's empowerment and overall health quality. Women's ability to make independent decisions about health care for themselves and their families not only determines access to and use of health services, but also impacts long-term health outcomes [1]. A study by Osamor and Grady (2018) shows that only 6% of women make their own decisions about their health care, while 61% of those decisions are made by husbands or partners without women's participation [2]. Therefore, a deep understanding of the factors that affect the autonomy of health decision-making is essential for designing effective policies and intervention programs [3]. In rural communities in Indonesia, strong patriarchal and traditional norms still dominate patterns of social interaction and gender role-sharing [4].

Family dynamics are also a crucial factor that affects women's autonomy in health decision-making. Patriarchal family structures and less open communication patterns can limit women's freedom to actively participate in decision-making [5,6]. Family involvement in health decisions can be a supporting factor if communication and understanding in the family go well, but on the contrary it can be an obstacle if there is a conflict of interest or dominance of one of the parties [7,8]. Access to health services is a real challenge in rural Indonesia. A study by Anggraini (2023) found that only 25% of Indonesia's population lives within a 1 km radius of health facilities, with a national average of 2.6 km. Long distances and inadequate infrastructure are major obstacles in the accessibility of health services in rural areas [9]. In addition, the lack of information and awareness about the types of healthcare services available exacerbates such access conditions [10]. These barriers not only impact the quantity of visits to health facilities, but also on the quality of health-related decision-making.

The level of health education and literacy has a significant influence on women's ability to understand, evaluate, and use health information effectively [11]. A study by Jassim (2023) reports that women with higher education tend to have better access to health services and are more active in making decisions related to their health [12]. Education plays an important role in empowering women to make more logical and information-based decisions when it comes to their health [13]. Women with good levels of health literacy tend to be more independent and confident in making decisions related to health care [14]. In addition to social and educational factors, family economic conditions are also the main determinants of women's health decision-making autonomy [15]. Research by Terefe et al. (2025) reveals that economic status is a major determinant in determining women's access to health services in low- and middle-income countries [16].

Although these factors have been widely identified, the reality on the ground shows that there is a significant gap between expectations and reality. Ideally, women in rural areas are expected to have high autonomy in health decision-making to achieve optimal health. However, in practice, many women still experience significant limitations due to conservative cultural norms, inequalities in family dynamics, unequal access to services, low levels of education and health literacy, and inadequate economic conditions [17]. This gap poses major challenges in efforts to empower women and strengthen health systems at the rural community level. Therefore, research that comprehensively examines the interaction of these factors is needed to identify the main obstacles and formulate targeted solutions.

Despite the growing body of literature on women's healthcare decision-making autonomy, most studies have examined these determinants in isolation or within urban or nationally representative contexts. There remains limited evidence that simultaneously explores the interaction between geographic access, sociocultural norms, and individual-level capacities within rural settings, particularly in Indonesia. This study aims not only to examine the individual effects of cultural, educational, and economic factors, but also to provide a more integrated understanding of how these factors interact in shaping women's healthcare decision-making autonomy in rural communities. By focusing on a rural population with distinct structural and sociocultural characteristics, this study contributes to the existing literature by offering context-specific and multidimensional insights that may inform more targeted and culturally sensitive health interventions.

METHODS

STUDY DESIGN AND SETTING

The study employed a quantitative design with a cross-sectional approach to examine the relationship between cultural, educational, economic, and geographic access factors to health decision-making autonomy among women in rural Indonesia. The research was conducted in several villages in Malang, Kediri, and Sampang Regencies, East Java Province, Indonesia, representing rural communities with diverse socio-cultural and economic characteristics. These villages were selected using purposive sampling based on three key considerations. First, the selected villages represent typical rural communities where women's healthcare decision-making is potentially influenced by cultural norms, household hierarchies, and traditional gender roles. This makes them appropriate settings for examining the interplay of cultural, educational, and economic influences on women's autonomy. Second, regional health data from the respective local health offices indicated persistent disparities in maternal and reproductive health service utilization, suggesting potential limitations in women's health decision-making autonomy. Third, the villages share comparable sociodemographic patterns, including lower educational attainment, constrained economic resources, and limited geographic access to healthcare facilities. These shared characteristics support a more focused assessment of how contextual factors intersect to influence autonomy. By selecting villages that represent typical rural Indonesian contexts where structural and cultural constraints are most prominent, the inclusion of these sites strengthens the study's ability to capture the nuanced interplay of contextual factors influencing women's healthcare decision-making autonomy. Data collected during the period February to May 2025. Figure 1 is a map showing the locations of the study villages in Malang, Kediri, and Sampang Regencies, East Java Province, Indonesia.

FIGURE 1. GEOGRAPHIC LOCATION OF THE STUDY VILLAGES IN EAST JAVA PROVINCE, INDONESIA



POPULATION AND SAMPLE

The study population consisted of women of reproductive age (18–49 years) who lived in the selected villages and had experience in making decisions related to family health. The sample was obtained using a purposive sampling method with the following inclusion criteria: women aged 18–49 years, having experience in making personal or family health decisions, being willing and able to complete the questionnaire, and having resided in the village for at least six months prior to data collection. This residency requirement ensured that participants were sufficiently familiar with local socio-cultural norms, community dynamics, and geographic access to health services relevant to the study context.

STUDY INSTRUMENTS

This study uses an instrument in the form of a structured questionnaire that is prepared to measure dependent and independent variables. The instruments are arranged on a 5-point Likert scale, with a score range from 1 (Strongly Disagree) to 5 (Strongly Agree). The healthcare decision-making autonomy variable was measured using 10 statement

items that evaluated the extent to which women have control, initiative, and freedom in determining personal health actions. The cultural norms variable consists of 12 items that measure the influence of social norms, cultural values, and traditional beliefs on women's involvement in health decision-making. The family dynamics variable was measured through 12 statements that assessed the extent to which power structures, communication between family members, and emotional support in the family influenced women's health decisions. The variables of geographic access to health services were measured with 10 items covering the spatial, financial, informative, and cultural aspects of geographic access to health services. The health literacy variable is measured through 15 items that measure an individual's ability to acquire, understand, assess, and use relevant health information. Educational level is measured based on the last formal education level completed by respondents. Economic status is measured based on the respondent's monthly household income.

The questionnaire used in this study was specifically developed based on a comprehensive review of previous literature on women's autonomy, health decision-making, and socio-cultural determinants in rural settings. Content validity was evaluated by three experts in public health, women's health, and community health nursing, who assessed each item for relevance, clarity, and cultural appropriateness. Revisions were made according to expert feedback to ensure that the instrument accurately reflected the contextual factors influencing women's healthcare decision-making autonomy. A pilot test was conducted with 30 women in a non-study village who shared similar sociodemographic characteristics with the target population. The pilot testing aimed to evaluate item comprehension, response clarity, and the overall usability of the questionnaire. Internal consistency reliability was assessed using Cronbach's alpha, which demonstrated strong reliability across the primary constructs, with alpha values of 0.88 for healthcare decision-making autonomy, 0.84 for cultural norms, 0.86 for family dynamics, 0.82 for geographic access to health services, and 0.89 for health literacy.

DATA COLLECTION

The data collection process in this study was carried out using a field survey approach with the assistance of a structured questionnaire. Data were collected over a period of 3 months in rural areas that had been designated as research locations based on criteria of limited geographic access to health services and sociocultural contexts where cultural norms are expected to influence family decision-making processes. However, cultural influence was not assumed solely based on rural residence, but was quantitatively assessed using a structured measurement of cultural norms within the study instrument. The selection of locations and participants was conducted using a purposive sampling method, taking into account the demographic representation of women of reproductive age (18–49 years). To ensure effectiveness and accuracy during data collection, the study involved specially trained field assistants or enumerators. Enumerators were recruited from local communities, each with a minimum high school educational background and the ability to communicate effectively in the local language, with six enumerators assigned to each district. During the interview process, the enumerators did not provide personal interpretations of the questions but instead read directly from the questionnaire and recorded respondents' answers according to the given instructions. After the data collection process was completed, all questionnaires were gathered and re-checked (data cleaning) to identify any incomplete, illogical, or duplicate responses. Valid data were then entered into SPSS software version 26 for further analysis using the multiple linear regression (multivariate) method.

DATA ANALYSIS

Descriptive analysis was conducted to describe the demographic characteristics of respondents and the score distribution of the research variables. To test the influence of independent variables (cultural norms, family dynamics, geographic access to health services, education level, health literacy, and economic status) on dependent variables (autonomy of health decision-making), multiple linear regression analysis was performed using SPSS software version 26. Multiple linear regression models were then estimated to determine the contribution of each independent variable simultaneously and partially to health decision-making autonomy. The regression coefficient (β) and significance value (p -value) are used to assess the strength and direction of the relationship between variables. Variables with a p -value of 0.05 were considered to have a significant influence on health decision-making autonomy.

RESEARCH ETHICS

This research has received approval from the Research Ethics Committee of Bhakti Wiyata Kediri Institute of Health Sciences (Number: 37/FTMK/EP/I/2025). All respondents provided written informed consent. The data obtained were kept confidential, and all information collected was analyzed solely for research and publication purposes and was not shared, distributed, or used for administrative, commercial, or any other non-research activities.

RESULTS

TABLE 1. RESPONDENTS CHARACTERISTICS

Characteristics	n	%
Age		
<25	127	17.6
25-34	220	30.6
35-44	198	27.5
≥45	175	24.3
Status		
Single	114	15.8
Married	580	80.6
Divorced	26	3.6
Number of Children		
0	125	17.4
1-2	448	62.2
≥3	147	20.4
Education Level		
Junior High School	520	72.2
Senior High School	107	14.9
A 3-year Diploma	9	1.3
A 4-year Diploma	23	3.2
Bachelor Degree	22	3.1
Master's Degree	39	5.4
Occupation		
Housewife	283	39.3
Farmer	129	17.9
Private Employee	136	18.9
Self-employed	107	14.9
Civil Servant	65	9.0
Income		
< Regional Minimum Wage	540	75.0
≥ Regional Minimum Wage	180	25.0
Distance to Nearest Health Facility		
< 1 km	194	26.9
1-4 km	365	50.7
≥ 5 km	161	22.4
Type of Health Facility Usually Visited		
Health Center	312	43.3
Private Clinic	189	26.3
Hospital	219	30.4
Health Insurance Status		

Yes	573	79.6
No	147	20.4
Geographic Access to Health Services in the Last 6 Months		
Yes	608	84.4
No	112	15.6

A total of 720 women from rural areas participated in the study. Based on age distribution, the majority of respondents were in the age group of 25–34 years (30.6%). In terms of marital status, most of the respondents were married (80.6%). Regarding the number of children, the majority of respondents had 1–2 children (62.2%). Based on education level, most respondents only completed education up to the junior high school level (72.2%). In terms of employment, the majority of participants were employed across various sectors (60.7%). Most respondents (75.0%) had an income below the regional minimum wage (UMR). The distance of respondents' residence to the nearest health facility varied, with 50.7% being within 1–4 km. The most visited health facilities were health centers (43.3%). Most of the respondents had a membership status in health insurance (79.6%). In the last six months, as many as 84.4% of respondents were recorded to have accessed health services.

TABLE 2. DESCRIPTIVE STATISTICS OF VARIABLES

Variable	SD	Mean	Min	Max
Healthcare Decision-Making Autonomy	8.62	35.53	15	50
Cultural Norms	13.30	32.59	10	60
Family Dynamics	7.98	32.10	19	58
Geographic Access to Health Services	9.84	27.29	10	50
Educational Level	1.38	1.66	1	6
Health Literacy	11.17	35.58	5	75
Economic status	8.91	29.89	16	58

Table 2 summarizes the descriptive statistics of all variables. The mean score for healthcare decision-making autonomy was 35.53, indicating moderate variation. Cultural norms (Mean = 32.59) and family dynamics (Mean = 32.10) showed diverse beliefs and household roles. Geographic access to health services (Mean = 27.29) reflected disparities in service availability. The average educational level (Mean = 1.66 on a 1–6 scale) indicated low formal education. Health literacy (Mean = 35.58) varied widely, as did economic status (Mean = 29.89).

TABLE 3. ASSOCIATIONS BETWEEN SOCIOCULTURAL, EDUCATIONAL, ECONOMIC FACTORS AND HEALTHCARE DECISION-MAKING AUTONOMY

Variable		Healthcare Decision	Cultural Norms	Family Dynamics	Geographic access	Educational Level	Health Literacy	Economic status
Healthcare Decision	Pearson Correlation	1	-.022	.277**	.457**	.300**	.024	.164**
	p		.562	.000	.000	.000	.516	.000
Cultural Norms	Pearson Correlation	-.022	1	.061	-.258**	-.182**	.145**	-.130**
	p	.562		.102	.000	.000	.000	.000
Family Dynamics	Pearson Correlation	.277**	.061	1	.099**	.111**	-.053	.035
	p	.000	.102		.008	.003	.159	.344
Geographic access	Pearson Correlation	.457**	-.258**	.099**	1	.362**	-.123**	.162**
	p	.000	.000	.008		.000	.001	.000

Education Level	Pearson Correlation	.300**	-.182**	.111**	.362**	1	-.189**	.374**
	p	.000	.000	.003	.000		.000	.000
Health Literacy	Pearson Correlation	.024	.145**	-.053	-.123**	-.189**	1	-.250**
	p	.516	.000	.159	.001	.000		.000
Economic status	Pearson Correlation	.164**	-.130**	.035	.162**	.374**	-.250**	1
	p	.000	.000	.344	.000	.000	.000	
**. Correlation is significant at the 0.01 level (2-tailed).								

Table 3 presents the results of a bivariate correlation analysis between the variables of health decision-making autonomy and socio-cultural, educational, and economic factors. Results showed that health decision-making autonomy had a positive and significant correlation with the variables family dynamics ($r = 0.277$; $p < 0.01$), geographic access to health services ($r = 0.457$; $p < 0.01$), educational level ($r = 0.300$; $p < 0.01$), and economic status ($r = 0.164$; $p < 0.01$). This indicates that the better the family dynamics, geographic access to health services, education level, and economic status of the respondents, the higher their autonomy in health decision-making.

TABLE 4. MULTIVARIATE LINEAR REGRESSION ANALYSIS OF FACTORS INFLUENCING HEALTHCARE DECISION-MAKING AUTONOMY

Variables	Unstandardized coef. (B)	SE	Standardized coef. (β)	t	p	95% CI	
						Lower	Upper
Cultural Norms	0.06	0.02	0.09	2.70	0.007	0.02	0.10
Family Dynamics	0.24	0.03	0.22	6.92	<0.001	0.17	0.30
Geographic Access	0.36	0.03	0.41	11.93	<0.001	0.30	0.42
Educational Level	0.85	0.23	0.14	3.77	<0.001	0.41	1.30
Health Literacy	0.10	0.03	0.12	3.64	<0.001	0.04	0.14
Economic status	0.08	0.03	0.08	2.32	0.020	0.01	0.14

Table 4 presents the multivariate regression results showing that all tested variables significantly and positively influenced women's healthcare decision-making autonomy in rural areas. Geographic access to health services had the strongest effect ($\beta = 0.41$, $p < 0.001$), followed by family dynamics ($\beta = 0.22$), educational level ($\beta = 0.14$), and health literacy ($\beta = 0.12$). Cultural norms ($\beta = 0.09$, $p = 0.007$) and economic status ($\beta = 0.08$, $p = 0.020$) also showed significant associations.

DISCUSSION

This study highlights the importance of sociocultural context in shaping women's autonomy in health decision-making. Cultural norms had a significant influence on health decision-making autonomy among women. This data indicates that social values, customs, and collective beliefs prevailing in communities can encourage or hinder women in making decisions related to their personal health. Based on the Health Belief Model (HBM), an individual's perception of health risks, the benefits of medical measures, and psychological and social barriers to accessing health services is greatly influenced by the cultural context in which the individual lives [18]. In addition, social norms and values including patriarchal culture, maternal values, and power structures in the household are very strong non-medical determinants in influencing health outcomes and access to health services [19]. These findings are consistent with previous studies by Olwanda et al. (2024), which emphasize the role of cultural norms as key determinants of women's autonomy, while also

suggesting that cultural norms may not function solely as barriers but can act as enabling factors depending on how they are interpreted within the community context [20].

This study also emphasizes the role of intra-household relationships in shaping women's decision-making autonomy. Family dynamics contributed significantly to the autonomy of health decision-making. The coefficient value indicates that the relationship between family members, the power structure in the household, and the way of joint decision-making in the family have a strong influence on the extent to which individuals, especially women, have independence in determining the health measures to be taken [21]. Families that are collaborative, supportive, and open to dialogue allow for the active participation of other family members, including women, in health-related decision-making. It reinforces an individual's involvement and sense of responsibility for his or her own health [22]. Family dynamics influence health decisions through interconnected household relationships [23]. In this context, health decisions are not only individual, but are the result of complex interactions between family members [24]. These findings are in line with prior research by Rizkianti et al. (2020), highlighting the importance of family support in shaping women's health decision-making autonomy [6]. The empowerment of the family as the smallest social unit is therefore essential.

This study further demonstrates the critical role of structural factors, particularly geographic access to health services, in shaping autonomy. Geographic access to health services was identified as the strongest predictor of health decision-making autonomy. This means that the easier it is for individuals to access facilities, health workers, medical information, and affordable service costs, the higher the likelihood of individuals engaging in health-related decision-making. When services are geographically accessible, individuals may be more likely to engage in health-related decision-making. However, this relationship should be interpreted with caution, as geographic availability does not necessarily equate to effective access, nor does it inherently facilitate independent decision-making. A range of additional factors, including sociocultural norms, financial constraints, health literacy, and intra-household power dynamics, may also significantly influence these outcomes [25,26]. This finding aligns with previous studies on healthcare access, yet it also highlights that access is a multidimensional concept that extends beyond spatial proximity alone. Based on these findings, geographic access to health services is not only a technical issue, but also closely related to aspects of human rights, social justice, and individual empowerment. Autonomy in health decision-making is difficult to achieve when individuals are constantly hampered by unresponsive, unaffordable, and unfriendly systems. Therefore, there needs to be a transformation in the healthcare system to ensure equitable availability, affordability, and geographic access to services.

This study also underscores the importance of educational attainment in enhancing women's autonomy. Education level had a positive and significant relationship with health decision-making autonomy. This suggests that individuals with higher education tend to have a greater ability to make health decisions independently. Education plays an important role in shaping a person's cognitive capacity, including in terms of understanding health information, considering different service options, and assessing the risks and benefits of certain medical procedures. The higher a person's level of education, the higher their ability to access, understand, evaluate, and use health information effectively to make informed decisions [27]. Education increases self-efficacy, or self-confidence that a person is able to control and make decisions over his or her own health [28]. The knowledge gained from formal education enables individuals to develop better outcome expectation and self-regulation in health decision-making.

Health literacy showed a significant positive relationship with decision-making autonomy in health services. This means that the higher the level of health literacy a person, the higher his ability to make health-related decisions independently. Health literacy reflects an individual's ability to acquire, understand, and use health information to make informed decisions. In the context of this study, individuals with good health literacy are able to recognize their own medical needs, evaluate treatment options, and communicate effectively with health care providers. High health literacy strengthens one's competence in understanding the risks and benefits of medical measures, which in turn increases feelings of autonomy in making decisions [29]. A person who feels able to understand medical instructions and health information is more likely to make their own decisions than to rely on others [30]. While these findings support previous research, this study further highlights that the impact of health literacy may be constrained or facilitated by social and cultural contexts, reinforcing the importance of integrating individual and contextual approaches. These findings confirm that health

literacy is an important prerequisite for fostering autonomy in health decision-making, especially in culturally and socially complex societies.

The interplay between education, health literacy, and social values reflects a dynamic tension that strongly shapes women's autonomy in health decision-making [31]. Although higher education and advanced health literacy enhance women's cognitive ability to interpret medical information, these capabilities may still be constrained by deeply rooted social norms, customary expectations, and patriarchal structures within the community. In many rural settings, even well-educated women may hesitate to make independent health decisions due to family expectations or cultural prescriptions regarding gender roles [32]. Conversely, strong cultural conformity may limit opportunities for women to apply their health literacy skills in real-life decision-making situations. This interaction shows that cognitive empowerment alone is insufficient unless accompanied by supportive social environments that allow women to exercise the autonomy gained through education and health literacy.

Economic status had a positive and significant relationship with health decision-making autonomy. This suggests that individuals with higher economic status tend to have a greater degree of independence in making decisions related to their health. Individuals with higher incomes are more likely to access quality health services within their geographic reach, choose a service provider, and obtain adequate health information. Higher economic status reduces financial barriers, so individuals are freer and more confident in choosing health options according to their needs [33]. These findings are consistent with prior studies suggesting that economic status interacts with other determinants, such as access, education, and cultural norms, indicating that financial capacity alone may not fully determine autonomy [34].

This study provides an important contribution to the existing body of knowledge by demonstrating that women's healthcare decision-making autonomy is shaped by the interaction of structural, sociocultural, and individual-level factors, rather than by single determinants alone. While previous studies have often emphasized either access, education, or cultural norms independently, this study highlights how these dimensions operate simultaneously within rural contexts. The identification of geographic access as the strongest predictor, alongside the moderating role of sociocultural and familial influences, offers new insights into how autonomy is constructed in resource-limited settings. These findings underscore the need for integrated interventions that move beyond improving service availability to also addressing underlying social and cultural constraints.

CONCLUSION

This study shows that the autonomy of health decision-making in women in rural areas is significantly influenced by various socio-cultural, educational, and economic factors. The results of multivariate linear regression analysis indicated that all the variables tested, namely geographic access to health services, family dynamics, education level, health literacy, cultural norms, and economic status contributed positively and significantly to increasing women's autonomy in making health-related decisions.

LIMITATIONS

While this study offers valuable insights into the sociocultural, educational, and economic determinants of healthcare decision-making autonomy among women in rural Indonesia, several limitations should be acknowledged. First, this study focused on women residing in rural areas characterized by limited geographic access to health services and specific sociocultural contexts. While this approach allows for a more context-specific analysis, it may limit the generalizability of the findings to populations with different geographic or sociocultural conditions. Although the sample size was relatively large and included three diverse rural districts in East Java, the findings may not fully represent other rural or urban populations with differing structural and cultural characteristics. Some aspects of cultural influence may not have been directly observed but instead inferred from contextual characteristics, which may introduce measurement limitations. Future studies are recommended to incorporate qualitative or mixed method approaches to better explore how cultural norms shape decision-making processes in greater depth. This study did not include several potentially relevant variables, such as the quality of healthcare services, spousal communication patterns, and prior healthcare experiences, which may

also influence women's decision-making autonomy. The cross-sectional design of this study additionally limits the ability to establish causal relationships between variables. Future research is encouraged to address these limitations by incorporating broader contextual factors and longitudinal or mixed method designs for a more comprehensive understanding.

RECOMMENDATIONS

Based on the findings of this study, there are several strategic recommendations that can be considered by policy makers, health practitioners, and community empowerment institutions to increase the autonomy of health decision-making among rural women, including the government and health care providers need to expand the coverage and affordability of health facilities, especially in rural areas to ensure women have easy geographic access to health services, quality, as well as family education and counselling programs should be integrated into community health interventions, emphasizing the importance of family support in supporting women's independence in health decision-making.

AUTHORSHIP

The author confirms that this manuscript represents original work conceived, designed, executed, and interpreted solely by the undersigned. The author was fully responsible for the development of the research idea, data collection, analysis, and manuscript preparation. The final version of the manuscript has been reviewed and approved by the sole author.

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CONFLICTS OF INTEREST

The author declare that there is no conflict of interest.

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TRANSFORMING HEALTHCARE EFFICIENCY: THE ROLE OF TRAINING IN ENHANCING INSURANCE POLICY MANAGEMENT AND PATIENT SATISFACTION

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ABSTRACT

OBJECTIVE:

To improve healthcare workers' knowledge of mandatory health insurance and increase the accuracy and speed of insurance claims processing.

DESIGN:

An online survey was conducted to assess healthcare workers' experiences and knowledge regarding health insurance policies, followed by targeted training sessions.

SETTING:

The study involved 92 institutions under Administration of Regional Medical Divisions (TABIB) governance across Azerbaijan, with training sessions held in Baku, Gabala, and Lankaran.

MAIN OUTCOME MEASURES:

Knowledge improvement of healthcare staff, reduction in insurance claim processing times, and enhancement of patient satisfaction regarding insurance-related communication.

RESULTS:

A total of 686 survey responses identified significant training needs. Consequently, 168 healthcare workers (85% women, 15% men) from 47 regional hospitals participated in 2-day workshops designed to address these needs. Post-training assessments revealed that 80% of participants showed substantial improvement in understanding insurance policies and procedures. Insurance claim processing time decreased by 25%, from 10 to 7.5 minutes, and patient satisfaction with insurance-related communication increased by 30%. The training directly benefited the participants, and indirectly, over 10,000 patients experienced enhanced service quality and reduced waiting times.

CONCLUSIONS:

The structured training program significantly enhanced healthcare workers' knowledge and confidence in managing insurance policies. The observed improvements in efficiency and patient satisfaction indicate the program's long-term positive impact on healthcare service quality.

KEYWORDS

health insurance, health services accessibility, insurance claim review, patient satisfaction, quality improvement, training programs.

INTRODUCTION

Mandatory health insurance in the Republic of Azerbaijan was implemented as a pilot project in the cities of Mingachevir and Yevlakh, as well as the Aghdash district, between 2017 and 2019. Within this project, healthcare services covered by insurance were provided to the population of these areas by the Administration of Regional Medical Divisions (TABIB), based on a basic package that included 1,829 medical services. From January 1, 2020, the scope of health insurance services expanded, and as of April 1, 2021, mandatory health insurance covered the entire country [1, 2].

With the expansion of mandatory health insurance implementation, the variety of medical services provided to the population has also increased. The knowledge level of employees working in hospital registration and insurance departments plays a crucial role in delivering new diagnostic methods and medical services to the public [3, 4, 5].

Health workers' knowledge of insurance policies in regional hospitals not only enhances the quantity and quality of services covered by health insurance but also improves patient satisfaction and access to care. Regular training in insurance processes equips staff, particularly those in registration departments, to efficiently guide patients, increasing the accuracy and speed of insurance claims. This, in turn, reduces financial strain on healthcare facilities and strengthens collaboration with insurers [6, 7, 8].

The insufficient knowledge of health insurance policies among healthcare workers hinders efficient service delivery, leads to errors in insurance claims processing, and reduces patient satisfaction due to miscommunication and delays in care.

Aim of the study: to examine how training impacts patient satisfaction and the efficiency of insurance processes.

Main objectives of the study:

- a) Increase healthcare workers' knowledge of mandatory health insurance.
- b) Improve the accuracy and speed of insurance claims processing.

METHODS

We developed an online Likert-scale survey to evaluate the experiences and knowledge of medical workers regarding health insurance policies. Before distribution, the survey was reviewed and validated by a panel of five experts from TABIB's Health Insurance Department and Training and Research Department to ensure content validity, relevance, and clarity of the items. This survey included five questions, each designed to assess confidence and adequacy of training in handling health insurance-related responsibilities. Participants responded to each question using a five-point Likert scale with options: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree. The survey questions are as follows:

1. I feel confident in my understanding of health insurance policies and procedures.
2. I believe I receive adequate training to stay updated on healthcare service coverage and procedures.
3. I am confident in explaining insurance coverage and service limits to patients accurately and clearly.
4. I feel adequately trained to handle the registration and management of services for citizens with privileged benefits.
5. I have opportunities to provide feedback on training programs and identify areas where additional training is needed.

The survey was distributed via email to all medical institutions under TABIB governance, targeting healthcare staff in key patient-facing and administrative roles. We collected 686 responses from 92 institutions, with the largest group of respondents being from the Patient Services Department (362 personnel), followed by medical admissions staff (173), front desk registrars (129), and heads of registration departments (22).

SURVEY ANALYSIS AND TRAINING PROGRAM DEVELOPMENT:

The survey results highlighted varying knowledge levels across roles and pinpointed specific training needs. Based on these findings, a team of seven qualified instructors was assembled from TABIB's Training and Research, Health Insurance, International Relations, and Public Relations and Communication Departments to develop and lead a targeted training program.

The training materials were designed to address the gaps identified through the survey and included both pre- and post-training assessments. These materials covered key areas such as policy understanding, patient communication, and procedures for managing services for privileged citizens.

The training focused on interpersonal communication, procedural knowledge, and policy understanding rather than on digital tool proficiency.

TRAINING IMPLEMENTATION:

Training sessions were conducted with 168 healthcare workers (85% women, 15% men) from 47 regional hospitals. Each session was structured as a two-day workshop, held in Baku, Gabala, and Lankaran, providing hands-on practice and case-based learning tailored to the specific roles of participants.

DATA ANALYSIS:

To assess the effectiveness of the training, pre- and post-test results were analyzed using IBM SPSS Statistics 22. We applied the non-parametric Chi-Square test to identify significant differences in knowledge and confidence levels before and after the training, with significance set at $p < 0.05$.

RESULTS

We carefully analyzed the responses to the survey questions, which assessed participants' perceptions related to health insurance policies. A total of 686 responses were collected, with no missing data.

For the first question, the majority of respondents, 350 (51.0%), selected Disagree (2). The next highest category was Strongly Disagree (1), with 298 responses (43.4%). A smaller number of respondents, 22 (3.2%), chose Neutral (3), and only 7 respondents (1.0%) selected Strongly Agree (5). No responses were recorded for Agree (4). The cumulative percentage shows that 95.8% of respondents indicated some level of disagreement (either Strongly Disagree or Disagree), while the remaining responses fell within the Neutral or Strongly Agree categories. This distribution highlights that most participants expressed a lack of confidence or agreement with the topic assessed by this question, suggesting a potential need for further training or information.

For the second question, which measured participants' agreement levels regarding a statement on health insurance policies, disagree (2) received the highest number of responses, with 355 participants (51.7%), indicating a significant level of disagreement. Strongly Disagree (1) was selected by 286 participants (41.7%), showing a considerable portion of respondents expressing strong disagreement. A smaller percentage of respondents, 19 (2.8%), chose Neutral (3), while Agree (4) was selected by 22 participants (3.2%), and only 4 participants (0.6%) selected Strongly Agree (5). The cumulative percentage indicates that 93.4% of participants expressed some level of disagreement, with the remaining 6.6% of responses split among Neutral, Agree, and Strongly Agree. This distribution reveals a predominant trend of disagreement, suggesting a general lack of confidence or satisfaction with the aspect of health insurance policies assessed by this question.

For the third question, which assessed participants' responses regarding another aspect of health insurance policies, disagree (2) received the highest number of responses, with 313 participants (45.6%), indicating a significant level of disagreement. Strongly Disagree (1) was selected by 266 participants (38.8%), with a smaller number of respondents, 21 (3.1%), choosing Neutral (3). Agree (4) was selected by 86 participants (12.5%). The cumulative percentage shows that

84.4% of participants indicated some level of disagreement, while the remaining 15.6% of responses were divided between Neutral and Agree. This distribution reflects a predominant trend of disagreement, which may suggest general dissatisfaction or lack of confidence in the topic assessed.

For the fourth question, the frequency distribution of responses was as follows: Disagree (2) received the highest number of responses, with 307 participants (44.8%), indicating a substantial level of disagreement. Strongly Disagree (1) was chosen by 236 participants (34.4%), showing a considerable portion of respondents expressing strong disagreement. A smaller portion, 41 participants (6.0%), selected Neutral (3), while Agree (4) was chosen by 91 participants (13.3%), and only 11 participants (1.6%) selected Strongly Agree (5). Analysis shows that 79.2% of participants indicated some level of disagreement, with the remaining 20.8% of responses divided among Neutral, Agree, and Strongly Agree. This distribution indicates a dominant trend of disagreement, suggesting that most respondents are not satisfied with or confident in the aspect assessed by this question.

For the fifth question, which assessed participants' agreement levels with a specific statement on health insurance policies, agree (4) received the highest number of responses, with 306 participants (44.6%), indicating a substantial level of agreement. Strongly Agree (5) was chosen by 276 participants (40.2%), showing a significant portion of respondents expressing strong agreement. A smaller number, 51 participants (7.4%), selected Disagree (2), while Strongly Disagree (1) was chosen by 42 participants (6.1%), and only 11 participants (1.6%) selected Neutral (3). The cumulative percentage shows that 59.8% of participants expressed some level of agreement (either Agree or Strongly Agree), while 15.2% of participants expressed disagreement, and 1.6% remained Neutral. This distribution indicates a majority of respondents expressing positive agreement, suggesting general satisfaction or confidence in the aspect being evaluated by this question.

Based on survey recommendations, 168 healthcare professionals across 47 regions were successfully trained. Post-training assessments showed that 80% of participants demonstrated substantial improvement in understanding insurance policies and procedures, contributing to better insurance handling within institutions. Average insurance claim processing time decreased by 25%, from 10 to 7.5 minutes. Surveys revealed a 30% increase in patient satisfaction regarding insurance-related communication. Improved staff knowledge and communication led to a 20% rise in patients utilizing health insurance.

DISCUSSION

STATEMENT OF PRINCIPAL FINDINGS:

The survey results highlight a prevalent trend of disagreement among healthcare workers regarding their knowledge and confidence in health insurance policies. Most respondents expressed low confidence in understanding and communicating insurance policies effectively, underscoring significant gaps in training. Post-training assessments revealed a 25% reduction in claim processing times and a 30% increase in patient satisfaction related to insurance communication. These findings validate the importance of targeted training in improving healthcare service efficiency and patient outcomes.

STRENGTHS AND WEAKNESSES OF THE STUDY IN RELATION TO OTHER STUDIES:

Our study aligns with existing research demonstrating that healthcare staff's understanding of insurance policies is pivotal to patient satisfaction and quality of care. For example, Shure et al. [9] emphasized the role of claims management training in reducing processing times and improving patient satisfaction, which parallels our findings. Similarly, Duc Thanh et al. [10] showed that well-informed staff enhance patient experience through efficient insurance management.

STRENGTHS OF OUR STUDY INCLUDE:

Targeted Training Program: Training tailored to identified needs, benefiting 168 healthcare workers and enhancing their handling of insurance-related tasks.

Broad Impact on Patient Services: Over 10,000 patients indirectly benefited through improved service delivery and reduced waiting times, showcasing the broader implications of such interventions.

Rigorous Monitoring and Evaluation: Pre- and post-training surveys allowed for robust assessment, demonstrating measurable improvements in staff knowledge, confidence, and patient satisfaction.

LIMITATIONS:

Limited Sample Size: Training was conducted with 168 healthcare workers, representing only a portion of the TABIB workforce, potentially limiting the generalizability of the findings.

Short-term Evaluation: Post-training assessments focused on immediate outcomes, leaving the long-term impacts on knowledge retention and patient satisfaction unexplored.

Self-reported Data: Reliance on self-reported survey responses introduces potential biases, as participants may have over- or under-reported confidence and knowledge levels.

MEANING OF THE STUDY:

This study underscores the critical role of targeted training programs in addressing knowledge gaps among healthcare staff, particularly in regions implementing mandatory health insurance systems. For health and aged care service managers, the findings suggest that investing in structured training programs can lead to significant improvements in service delivery efficiency, patient satisfaction, and organizational performance. Policy makers should consider integrating continuous training initiatives into national health insurance rollouts to ensure sustained impact and adaptation to evolving healthcare demands.

UNANSWERED QUESTIONS AND FUTURE RESEARCH:

Future research should explore the long-term impacts of such training programs on knowledge retention, patient satisfaction, and healthcare system efficiency. Additionally, examining the scalability of this initiative to other regions and healthcare sectors would provide valuable insights. Investigating the specific challenges faced by various healthcare roles in insurance processes could also inform the development of more customized training solutions.

CONCLUSION

This study demonstrates that targeted training in health insurance policies can substantially improve service efficiency and patient satisfaction. By increasing healthcare workers' understanding and confidence in managing insurance claims, we observed a 25% reduction in claim processing times and a 30% increase in patient satisfaction with insurance-related communication. The training also led to a 20% rise in patient utilization of health insurance, indicating that better-informed staff enhance patient trust and engagement with healthcare services. Moving forward, expanding this training initiative to more regions could significantly improve the overall quality of healthcare service in Azerbaijan. The results underscore the importance of regular training programs to adapt to evolving healthcare needs and insurance policies, benefiting both healthcare providers and patients.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE:

Ethics approval for this study was not required as it involved anonymized survey responses and training outcome evaluations conducted within a professional capacity, without patient interaction or access to confidential patient data. This exemption is in accordance with the internal review policy of the Administration of Regional Medical Divisions (TABIB), which classifies such staff training and service improvement studies as quality assurance activities not subject to formal ethics committee review. Participation in the survey and training was voluntary, and informed consent was implied through voluntary completion of the survey and attendance at training sessions.

FUNDING:

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CONFLICT OF INTEREST STATEMENT:

The authors declare no conflicts of interest.

AVAILABILITY OF DATA:

Data supporting the findings of this study are available from the corresponding author, Emil Iskandarov, upon reasonable request.

AUTHORS' CONTRIBUTIONS:

Conceptualization EA, training program supervision EA, manuscript writing EA.; Survey implementation AK, data collection AK, data analysis AK, interpretation AK.

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- Ramil Maliyev, Leading Advisor of the Public Relations and Communication Department

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HOSPITAL PREPAREDNESS FOR DISASTER RISKS USING SWOT ANALYSIS AND THE HOSPITAL SAFETY INDEX (HSI)

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ABSTRACT

BACKGROUND:

West Java Indonesia is classified as high risk for disasters. The Cabangbungin Hospital is a type D health facility run by the Government of Bekasi Regency, West Java, Indonesia. A report by the Quality Committee of Cabangbungin Hospital revealed that the hospital has not yet satisfied all indicators on disaster mitigation team preparedness. For that reason, it is deemed necessary to perform a SWOT analysis on the result of the hospital safety index (HSI) concerning the hospital's disaster preparedness.

OBJECTIVE:

To determine the disaster preparedness of Cabangbungin Hospital based on the SWOT analysis on the HSI and to determine the service quality strategy of Cabangbungin Hospital in facing disasters.

METHODS:

Analytical observational research adopted a qualitative descriptive approach using primary and secondary data. The results of a group discussion on a SWOT analysis plan toward internal and external factors of Cabangbungin Hospital. The informants in this study consisted of the hospital's Occupational Health and Safety (OHS) team, the hospital facilities and infrastructure team, and the hospital management representatives. The secondary data utilized in this study were derived from the results of the hospital accreditation previously conducted.

RESULTS:

Based on the SWOT analysis, the Cabangbungin Hospital scored 1,465 on the internal factor and 1,55 on the external factor. The hospital is required to be aggressive in its service quality strategy.

CONCLUSION:

Aggressive action is necessary as regards the improvement of the fire safety system, the emergency response activities and disaster management in the Cabangbungin Hospital.

KEYWORDS

hospital safety index, service quality strategy, disaster

INTRODUCTION

Cabangbungin Regional General Hospital (RSUD) is a type D hospital run by the government of Bekasi Regency, West Java, Indonesia. The hospital was founded in 2017 and was operational thenceforward despite lacking certain facilities, infrastructure, and human resources. By the end of 2019, Cabangbungin Hospital applied for accreditation to the Indonesian Commission on Accreditation of Hospital (KARS) which had used a new standard: the National Standards for Accreditation of Hospital (SNARS).

Accreditation is carried out to ensure the quality of the hospital.[1] The hospital was accredited with an intermediate three-star rating in November 2019. During the COVID-19 pandemic, Cabangbungin Hospital was appointed a Covid-19 referral hospital and was only restricted to Covid-19 referred patients. The Cabangbungin Subdistrict was inundated by floodwaters in 2021, but Cabangbungin Hospital had yet any role in tackling the paralyzing event as it did not have disaster preparedness.[2]. The Quality Committee of Cabangbungin Hospital received a report on the quality indicators of its emergency room (IGD), showing that during the first and second quarters of 2022 the hospital failed to meet the disaster mitigation team preparedness. Emergency and disaster handling in hospital accreditation standards are kept under the category facility and safety management standards. The latter represents the Hospital Safety Index (HSI) which assesses hospitals' safety and vulnerabilities in the event of disasters. [3] The Hospital Safety Index consists of various elements, including multi-hazards faced by hospital facilities, resilience of hospital building structure that will ensure the safety of workers, patients, and visitors, non-structural safety i.e. hospital facilities and utilities such as water, electricity, communication, and medical gas, remain operational during or after a disaster and disaster management that manages various types of hazards, including the existence of disaster management committees and hospitals, as well as relevant procedures to address all hazards by hospitals.[4] The Hospital Safety Index encompasses all information from all modules and indicators to present an overall picture of a hospital's disaster preparedness and resilience.[4] Different aspects, such as hospitals' commitment to set up a disaster management organization, provision of facilities and infrastructure, implementation of procedure management, management of disaster management resources, and organization of training and education related to disaster management, are very important. Hospital disaster preparedness, supported by trained personnel and appropriate procedures, aims to ensure rapid response and proper actions, which represent the key objectives of hospital disaster management. [5]

METHODS

INFORMANTS

A discussion group forum to perform SWOT analysis on the HSI instrument was held, involving 10 managers of the Cabangbungin Hospital: two from the emergency room team, two from the governance management division, two infrastructure managers, two hospital safety managers, two hospital quality managers. The selection of respondents was due to their knowledge of Cabangbungin Hospital in respect of their duties.

MEASURES

This research uses a qualitative descriptive approach to perform SWOT analysis. In this study, the HSI SWOT analysis used a SWOT analysis table according to the HSI results.

TABLE 1. SWOT ANALYSIS ON HOSPITAL SAFETY INDEX

No	Aspect	Strengths	Weaknesses	Opportunities	Threats
1	Structural Safety	HSI Result	HSI Result	HSI Result	HSI Result
2	Non-structural safety	HSI Result	HSI Result	HSI Result	HSI Result
3	Emergency and Disaster Management	HSI Result	HSI Result	HSI Result	HSI Result

The weighted value was assessed based on the internal factor analysis strategy (IFAS) which combined strength (S) and weakness (W), with a total value of 1. (The calculation of the weighted value, which was based on the external factor analysis strategy (EFAS) combining opportunity (O), threat (T) with a total value of 1. 1.0 indicates substantial and 0.0 suggests insignificant.[6]

TABLE 2. RATING WEIGHTED VALUE.

No	Score	Details on Strengths and Opportunities Factors	Details on Weaknesses and Threats Factors
1	1	Factor Has weak influence rate on planning	Factor has very strong influence rate on hindering planning
2	2	Factor has moderate influence rate on planning	Factor has strong influence rate on hindering planning
3	3	Factor has strong influence rate on planning	Factor has moderate influence rate on hindering planning
4	4	Factor has very strong influence rate on planning	Factor has weak influence rate on hindering planning

DATA ANALYSIS

SWOT analysis was carried out to measure Internal Strategy Factors (IFAS) and External Strategy Factors (EFAS) through discussion group forum activities which brought up issues on the hospital safety index (HSI) based on SWOT analysis for Internal Strategy Factors (IFAS) and External strategy factors (EFAS).

RESULTS

Results of the SWOT analysis through a discussion group forum in Cabangbungin Hospital as regards Internal Strategy Factors (IFAS) are available on table 3 below:

TABEL 3. SWOT ANALYSIS: IFAS

Internal Strategy Factors (IFAS)		Weight	Rating	Sum
1	Infrastructure protection, access and physical security	0.07	4	0.28
2	Telecommunication systems	0.07	4	0.28
3	Fire protection system	0.09	4	0.36
4	Fuel storage systems	0.07	3	0.21
5	Heating, ventilation, and air-conditioning (HVAC) systems	0.07	3	0.21
6	Office and storeroom furnishings and equipment (fixed and movable)	0.025	3	0.075
7	Medical and laboratory equipment and supplies used for diagnosis and treatment	0.025	2	0.05
8	Coordination of emergency and disaster management activities	0.09	4	0.36
9	Human resources	0.07	4	0.28
10	Patient care and support services	0.04	1	0.04
		0.62		2.145
	Weaknesses Factors			
1	Building integrity	0.03	2	0.06
2	Architectural safety	0.04	1	0.04
3	Electrical systems	0.04	2	0.08
4	Water supply system	0.04	2	0.08
5	Waste management systems	0.04	2	0.08
6	Medical gases systems	0.04	2	0.08
7	Hospital emergency and disaster response planning	0.04	1	0.04
8	Communication and information management	0.04	1	0.04

Internal Strategy Factors (IFAS)		Weight	Rating	Sum
9	Logistics and finance	0.03	2	0.06
10	Evacuation, decontamination and security	0.04	1	0.04

Results of the SWOT analysis through a discussion group forum in Cabangbungin Hospital as regards External Strategy Factors (EFAS) are available on table 4 below:

TABLE 4. SWOT ANALYSIS: EFAS

External Strategy Factors (EFAS)		Weight	Rating	Sum
Opportunities (O)				
1	Human resources	0.3	4	1.2
2	Funding	0.25	2	0.5
3	Geographic (Higher than its surroundings)	0.15	3	0.45
		0.7		2.15
Threats (T)				
1	Flood	0.1	3	0.3
2	Tsunami	0.1	1	0.1
3	Earthquake	0.1	2	0.2
		0.3		0.6

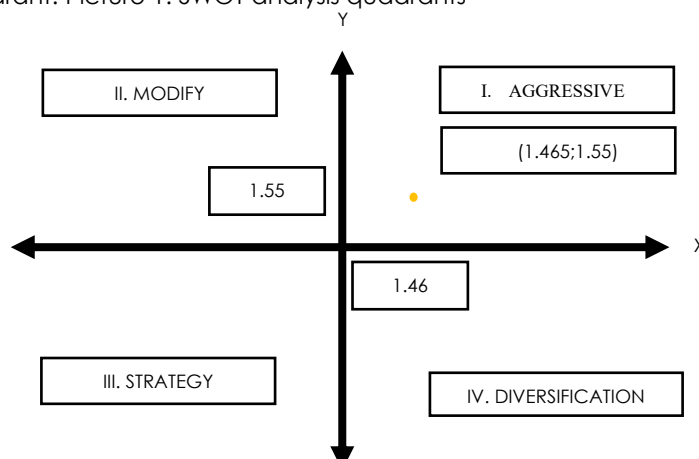
The analysis results of both SWOT IFAS and EFAS were equally assessed and yielded coordinate values as shown on table 5. The assessed values from Internal Factors and External Factors Tables were included in the SWOT analysis quadrants as shown in picture 1 of SWOT Analysis Quadrants.

TABLE 5. ASSESSMENT TABLE OF INTERNAL EXTERNAL FACTORS

Internal Factors	External Factors
X= strengths - weaknesses	Y= Opportunities - threats
$X = 2.145 - 0.68 = 1.465$	$Y = 2.15 - 0.6 = 1.55$
$X = 1.465$	$Y = 1.55$

CONCLUSION

Results of SWOT analysis on IFAS and EFAS were included in X quadrant (1.465) and Y (1.55) so as to project the picture shown on right upper quadrant. Picture 1. SWOT analysis quadrants



Results of the SWOT analysis on Hospital Safety Index of Cabangbungin Hospital reveals 10 strength factors, 10 weakness factors, 3 opportunity factors, and 3 threat factors. Weighting and rating processes generated the values of internal factors at 1.465 and external factors at 1.55, leading to a position on right upper quadrant as a result. Thus, it means that Cabangbungin Hospital must be more aggressive in improving its qualities. Within a short term, intervening measures are recommended. In line with this recommendation, there is a need for the aggressive strengthening of internal factors, such as infrastructure, communication systems, fire protection systems, the provision of fuel for power generators in the event of outages, continuity of patient services during disasters, and the availability of disaster-trained healthcare professionals

ACKNOWLEDGMENTS

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This research has an ethics clearance letter by Health Research Ethics Committee Binawan University with the number 256/KEPK-UBN/I/2025. Ethical review was conducted to ensure that the research does not violate ethical principles.

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HYPERTENSION PREVALENCE AND UNDIAGNOSED CASES IN SUDAN: AN ANALYSIS OF ASSOCIATED RISK FACTORS

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ABSTRACT

PURPOSE

The prevalence of hypertension has escalated globally, affecting approximately 1.39 billion people worldwide out of an estimated global population of 8 billion, with two-thirds residing in low- and middle-income countries. This study aimed to estimate the prevalence of hypertension among adults in Sudan, assess hypertension control, determine the frequency of undiagnosed hypertension, and identify associated risk factors.

METHOD

A cross-sectional facility-based study was conducted at Primary Health Care centers in Karrari Locality, Khartoum State, Sudan, between April 2022 and January 2023, using a multistage sampling method. Two primary methods for data collection are direct interviews and anthropometric measurements. A P-value equal to or less than 0.05 was considered indicative of statistical significance, where the level of confidence was 95%.

FINDINGS

The study involved 385 participants, with 48.6% diagnosed with hypertension, 58.2% having controlled blood pressure, 41.8% uncontrolled, and 6.5% undiagnosed, resulting in a total HTN prevalence of 55.1%. Notably, 44.4% of those with diagnosed HTN were non-smokers, and 37.9% reported never exercising. Central obesity was more prevalent among those diagnosed (63.3%). Increasing age ($B = 0.030$, $p = 0.002$) and male sex ($B = 0.087$, $p = 0.029$), higher waist circumference ($B = 0.132$, $p = 0.002$), were significant risk factors, while exercise frequency ($B = -0.172$, $p = 0.001$) and lower salt intake ($B = 0.327$, $p = 0.001$) were linked with reduced risk. Overall, the findings highlight a significant burden of HTN and its risk factors in the population studied.

CONCLUSION

This study underlines the high prevalence of hypertension in Khartoum, Sudan, with age, male sex, and central obesity as important risk factors, urging the need for improved measures.

KEYWORDS:

undiagnosed, diagnosed, hypertension, prevalence, control, low- and middle-income countries

INTRODUCTION

Hypertension (HTN) is characterized by elevated blood pressure, defined as a systolic blood pressure (SBP) of 140 mm Hg or more or a diastolic blood pressure (DBP) of 90 mm Hg or more [1]. It is a major chronic condition and represents a significant global public health challenge [2]. In 2019, it was estimated that 1.39 billion individuals in the productive age range of 30 to 79 years had HTN living in low and middle-income countries (LMICs) [3, 4]. The literature has revealed that there is a growing risk of HTN in individuals living in Sub-Saharan Africa. This risk may be caused by a poor health system, lack of physical activity, inadequate nutrition, a growing urbanization rate, and low socioeconomic circumstances [5, 6]. There are two types according to which risk factors for developing HTN can be categorized, which include modifiable and non-modifiable factors. Age, gender, family history, genetic features, and ethnicity are non-modifiable factors, while physical inactivity, smoking, alcohol consumption, high salt intake, dietary choices, and body mass index (BMI) are modifiable factors [7, 8]. These risk factors are also universally known and are termed Classical risk factors (CRFs). Family records of HTN, poor physical activity levels, obesity, high sodium intake, smoking, high alcohol consumption, older age, and male gender are known as CRFs [9]. In contrast, NCRFs may encompass electronic cigarette use, exposure to secondhand smoke, irregular sleep patterns, obstructive sleep apnea, and others.

Undiagnosed hypertension presents a significant concern, as most cases are without symptoms and are often discovered accidentally during routine blood pressure screenings [10]. However, some individuals may exhibit symptoms indicative of end-organ damage, such as stroke-like signs, chest pain, shortness of breath, or acute pulmonary edema [11]. According to 33 surveys, only 27% of people in sub-Saharan Africa knew they had hypertension [12]. For instance, it was reported that 38.2% of the Sudanese population had a prevalence of undiagnosed HTN [13]. South Africa had 49% of the entire HTN [14], and 12.3% in Hawela Tula Sub-City, Hawassa, Southern Ethiopia [15]. Overall, 49.4% of Nubas in North Sudan who were not previously diagnosed with HTN had undiagnosed HTN, according to a trivial population study [16]. National statistics on the prevalence of undetected HTN and the variables that contribute to it in Sudan's general adult citizens are lacking.

Similar to some LMICs, Sudan has a notable gap in the multifaceted management of HTN, encompassing screening awareness, medication, and administration. Because of this, patients and healthcare professionals are burdened with uncontrolled HTN. Moreover, most hypertensive individuals are asymptomatic, and there is a gap in the literature in Sudan that studied the prevalence of undiagnosed HTN.

Therefore, the objective of this study is to investigate hypertension, along with the related risk factors, among adults attending primary health care centers in Karrari Locality, Khartoum state, Sudan. Specifically, the study aims to measure the prevalence of hypertension among adults in this region, evaluate the level of hypertension control, determine the frequency of undiagnosed hypertension, and identify risk factors related to hypertension.

MATERIALS AND METHODS

STUDY DESIGN

To examine the prevalence of hypertension (HTN) and undiagnosed HTN in adult residents who visited primary healthcare centers (PHCs) in Karrari, located in the northern part of Khartoum State, Sudan, a cross-sectional study was carried out

from April 2022 to January 2023. The study was grounded in descriptive epidemiological theory, which is commonly used to quantify disease prevalence, describe population health patterns, and estimate the burden of undiagnosed conditions within defined populations [17]. Accordingly, this design was selected to estimate the prevalence of hypertension, assess the proportion of previously undiagnosed hypertension, and examine associated risk factors among adults attending primary healthcare facilities.

Ethical guidelines were followed in accordance with the Declaration of Helsinki and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies. This research was reviewed and approved by the Khartoum State Ministry of Health, General Directorate of Strategy and Information, Department of Innovation, Development, and Scientific Research, with written approval granted on 12 September 2022. The study was conducted in accordance with the ethical requirements of the approving authority, and no formal approval reference number was issued. Informed consent was obtained from the administrations of the health centers, as well as from all participants prior to inclusion in the study. This process ensured that both institutions and individuals were fully aware of the study's purpose, procedures, and their rights regarding participation, thereby adhering to ethical research standards.

PARTICIPANT AND DATA COLLECTION

Inclusion and Exclusion Criteria

The study involved adults aged 18 years and older. Participants with secondary HTN were excluded to focus on primary HTN prevalence. Pregnant women were also excluded due to the physiological variations linked to pregnancy.

SAMPLING FRAME AND TECHNIQUE

The sampling frame consisted of all adult residents visiting PHC centers in Karrari, with samples drawn through a multistage sampling method.

Stage 1: Selection of PHC Centers

In the Karrari locality, which contains eight healthcare centers, a systematic random sampling method was used to select six centers for the study.

Stage 2: Participant Selection

Participants were chosen using a simple random sampling method from the selected healthcare centers to guarantee unbiased representation. All individuals who met the inclusion criteria were included in the survey.

SAMPLE SIZE CALCULATION

The sample size was computed using the formula $n = N / (1 + N(e)^2)$, where N is the total adult population in Karrari (42,224) and a confidence level of 0.05. This yielded an estimated sample size of 385 participants.

DISTRIBUTION OF PARTICIPANTS

The total sample of 385 participants was distributed proportionally among the selected six PHCs on the basis of their respective population sizes, as shown below in **Table 1**.

TABLE 1: POPULATION AND SAMPLE SIZE DISTRIBUTION ACROSS SELECTED PHCS

PHC Center	Total population	Sample Size Selected
Aboud	15,699	143
Hara 2	4,899	46
Hara 17	7,839	71
Hara 28	4,330	39
Hara 39	5,573	51
Alwihda	3,884	35
Total	42,224	385

DATA COLLECTION METHODS AND TOOLS

This study employed two primary methods for data collection: direct interviews and anthropometric measurements. A tailored, semi-structured questionnaire on the basis of existing studies (references 9-12) was used during interviews to gather data on sociodemographic factors, risk factors related to HTN, and information on HTN control.

ANTHROPOMETRIC MEASUREMENTS

Height and Body weight were calculated utilizing uniform and calibrated equipment. Body mass index (BMI) was computed using the formula: weight (kg) divided by height (m²). BMI categories were classified as per the National Institute of Health (NIH) guidelines as follows:

- Underweight: BMI < 18.5 kg/m²
- Normal: BMI 18.5–24.9 kg/m²
- Overweight: BMI 25–29.9 kg/m²
- Obesity: BMI ≥ 30 kg/m²

Central obesity (CO) was assessed using the waist circumference, which was computed at the narrowest point between the rib cage and the iliac crest. A waist circumference of ≥ 94 cm for men and ≥ 80 cm for women indicated central obesity.

BLOOD PRESSURE MEASUREMENT

Blood pressure (BP) was measured using a calibrated portable mercury sphygmomanometer, with the right cuff size for each individual. Measurements were collected in a sitting position, with the arm at the level of the heart, following 15 minutes of rest. The average of three BP readings was recorded for each individual. These readings were classified according to the Joint National Committee (JNC) 8 guidelines [18].

- Normal Blood Pressure: Defined as systolic BP < 120 mmHg and diastolic < 80 mmHg.
- Prehypertensive: Defined as systolic BP 120–139 mmHg and diastolic BP 80–89 mmHg.
- Stage 1 Hypertension: Defined as systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg.
- Stage 2 Hypertension: -For adults aged < 60 years: Target BP < 140/90 mmHg.

-For adults aged ≥ 60 years: Target BP < 150/90 mmHg.

-For patients with diabetes or chronic kidney disease: Target BP < 140/90 mmHg, regardless of age.

SAMPLE SIZE CALCULATION

The size of the sample was measured with the help of the formula, the same as used in previous literature, by supposing a 30% prevalence of risk factors like high salt and sugar intake. Using a 95% confidence interval and a margin of error of 5%, and 385 was the size of the sample of participants was determined.

STATISTICAL ANALYSIS

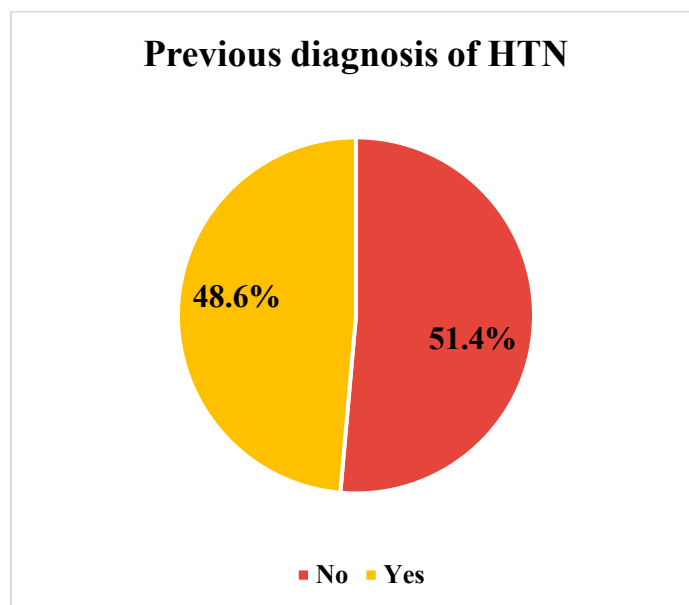
Data entry and statistical analysis were conducted by a researcher using the Statistical Package for Social Sciences IBM-SPSS software for Windows version 27.0 (SPSS Inc., Chicago, IL). Continuous data were expressed as the mean ± standard deviation (SD) after confirming the normality of the distribution. Logistic regression was employed to study the risk factors linked with elevated BP (HTN, whether known or unknown). A P-value of 0.05 or less was considered indicative of statistical significance, with a confidence level set at 95%.

RESULTS

PREVALENCE OF HYPERTENSION DIAGNOSIS

The results of this study showed that 187 participants (48.6%) were previously diagnosed with HTN out of the total 385 participants as depicted in Figure 1. This reveals that before this investigation, about half of the population studied had been diagnosed with HTN.

FIGURE 1: PREVALENCE OF HTN DIAGNOSIS (N=385)



HYPERTENSION CONTROL AND PREVALENCE OF UNDIAGNOSED CASES

Table 2 presents data on HTN among adults without previous HTN diagnosis and the control of those with diagnosed HTN according to the JNC-8 guidelines. The prevalence of HTN diagnosis was 48.8%. Among participants with a previous HTN diagnosis, 58.2% had controlled BP (102 for systolic and 116 for diastolic). In comparison, 41.8% were categorized as uncontrolled (85 for systolic and 71 for diastolic), showing the need for better management in the uncontrolled group. Among those with no previous diagnosis of HTN, 81.9% (312 for systolic and 318 for diastolic) had normal BP. In comparison, 11.6% (47 for systolic and 42 for diastolic) were classified as prehypertensive, and 6.5% (26 for systolic and 25 for diastolic) had undiagnosed or unknown HTN, showing the need for improved testing measures.

TABLE 2: HYPERTENSION CONTROL AND PREVALENCE OF UNKNOWN HYPERTENSION (N=385)

Prevalence	SBP	DBP	%
BP control among participants with previous HTN diagnosis			
Controlled	102 (54.5)	116 (62.0)	58.2
Uncontrolled	85 (45.5)	71 (38.0)	41.8
BP among adults with no previous HTN diagnosis			
Normal BP	312 (81.1)	318 (82.6)	81.9
Prehypertension	47 (12.2)	42 (11.0)	11.6
Undiagnosed/unknown HTN	26 (6.7)	25 (6.4)	6.5

DEMOGRAPHIC CHARACTERISTICS

Table 3 presents the distribution of demographic data among participants with and without a previous HTN diagnosis, totaling 385 individuals. This demographic distribution provides knowledge about the prevalence of HTN in different gender and marital status classifications within the study sample size. Overall, the total number of participants with diagnosed HTN was 187, while 198 had no previous diagnosis. In terms of sex, the study included 120 females and 265 males. 60.1% of those with diagnosed HTN were male, while 77.3% of those without a previous diagnosis were also males.

The age of participants varied from 24 to 73, with a mean age of 44 years (standard deviation ± 8 years). Regarding marital status, all the participants with prior HTN diagnoses were either married or widowed. Among married participants, 87.2% were diagnosed with HTN, and 12.8% of participants with diagnosed HTN were widowed. In contrast, none of the participants with diagnosed HTN were single, whereas 18.6% of those without a previous HTN diagnosis were single. Among married participants, 78.3% of those without a diagnosis prior were married, and 3.1% were widowed.

TABLE 3: DISTRIBUTION OF DEMOGRAPHIC DATA AMONG PARTICIPANTS WITH AND WITHOUT PREVIOUS HTN DIAGNOSIS (N=385)

Variable	Diagnosed HTN		No previous HTN diagnosis		Total
	F	%	F	%	
Sex					
Female	75	39.9	45	22.7	120
Male	112	60.1	153	77.3	265
Age (years)					
24 – 73, mean ± standard deviation = 44 ± 8 years					385
Marital status					
Single	0	0	37	18.6	37
Married	163	87.2	155	78.3	318
Widowed	24	12.8	6	3.1	30
TOTAL	187	100.0	198	100.0	385

DISTRIBUTION OF RISK FACTORS IN PARTICIPANTS BY HYPERTENSION DIAGNOSIS

Table 4 presents the allocation of risk factors among participants with and without a previous HTN diagnosis. Regarding the family history of HTN, 9.2% of participants with diagnosed HTN reported no family history, compared to 27.2% of those without a previous diagnosis. Most participants had a first-degree family history (68.9% with diagnosed HTN vs. 65.7% without), while 21.9% of those with diagnosed HTN had a second-degree family history, compared to 7.1% of those without. Regarding smoking status, 44.4% of participants with diagnosed HTN were not smokers, while 51.2% of those without a previous diagnosis were non-smokers. Current smokers made up 29.9% of the diagnosed group and 7.5% of the non-diagnosed group.

Regarding exercise frequency, 37.9% of participants with diagnosed HTN reported never exercising, compared to 62.1% of those without. A higher percentage of participants with diagnosed HTN exercised 1-3 times a week (41.2%) compared to the non-diagnosed group (18.6%). Regarding fatty food consumption, 75.4% of participants with diagnosed HTN reported eating fatty foods sometimes, while 49% of those without a previous diagnosis reported the same. Salt consumption showed that 55.7% of participants with diagnosed HTN consumed $\leq$ 2,300 mg per day, compared to 66.2% of those without. Regarding BMI, 18.6% of those with diagnosed HTN were underweight, while 13% of those without were underweight. Normal weight was reported by 38% of those with diagnosed HTN and 55.4% of those without. Obesity was present in 15.1% of participants with diagnosed HTN and 4.1% of those without.

Lastly, central obesity was more prevalent in participants with diagnosed HTN (63.3%) compared to 51.1% of those without a diagnosis. Overall, the data indicates significant differences in risk factors between the two groups.

TABLE 4: DISTRIBUTION OF RISK FACTORS AMONG PARTICIPANTS WITH AND WITHOUT PREVIOUS HTN DIAGNOSIS (N=385)

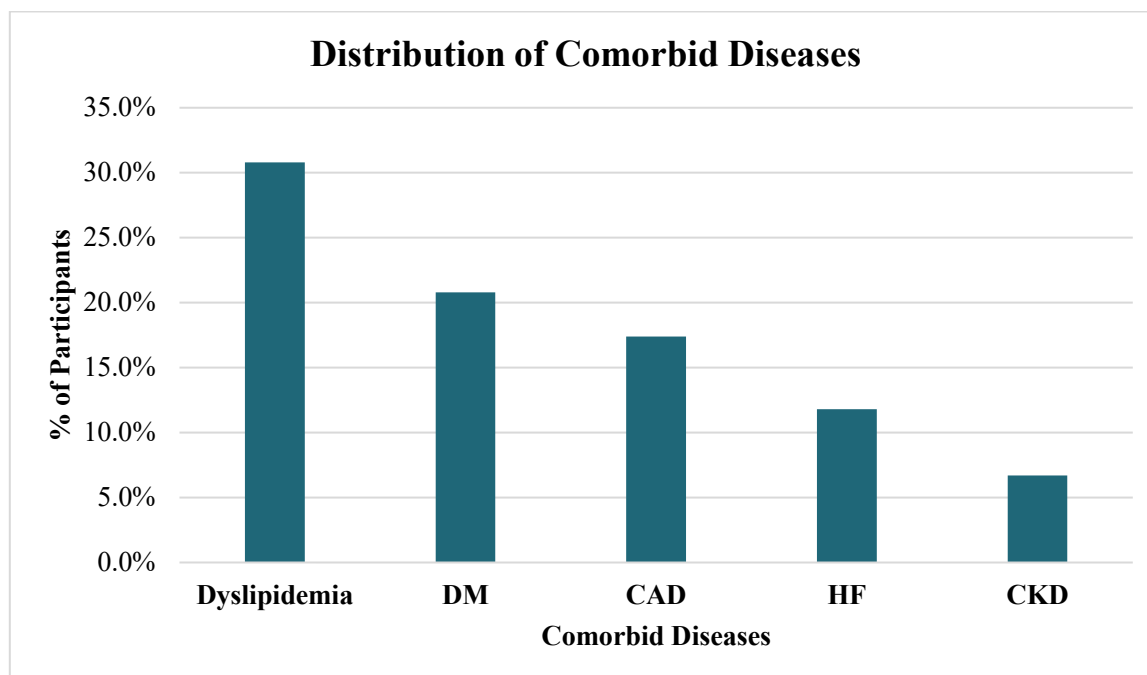
Variable	Diagnosed HTN 187		No previous HTN diagnosis 198		Total
	F	%	F	%	
Family History of HTN					
None	17	9.2	54	27.2	71
First degree	129	68.9	130	65.7	259

Second degree	41	21.9	14	7.1	55
Smoking status					
Not a smoker	83	44.4	101	51.2	184
Quit > 10 years	31	16.6	39	19.6	70
Quit < 10 years	17	9.1	43	21.7	60
Current smoker	56	29.9	15	7.5	71
Exercise frequency (30-40 minutes sessions)					
Never	71	37.9	123	62.1	194
1-3 times/week	77	41.2	37	18.6	114
4-6 times/week	33	17.6	16	8.2	49
Everyday	6	3.3	22	11.1	28
Fatty food consumption					
Never	0	0	0	0	0
Seldom	24	12.8	35	17.6	59
Sometimes	141	75.4	97	49	238
Often	22	11.8	42	21.2	64
Always	0	0	24	12.2	24
Salt consumption per day					
≤Tablespoon/2,300 mg	104	55.7	131	66.2	235
>Tablespoon/2,300 mg	83	44.3	67	33.8	150
BMI					
Underweight	35	18.6	26	13	61
Normal	71	38.0	110	55.4	181
Overweight	53	28.3	54	27.5	107
Obesity	28	15.1	8	4.1	36
Central obesity					
Absent	78	41.7	97	48.9	175
Present	109	63.3	101	51.1	210
TOTAL	187	100.0	198	100.0	385

PREVALENCE OF COMORBID DISEASES AMONG PATIENTS

Figure 2 presents the distribution of comorbid diseases among participants; 116 participants (30.1%) reported having no chronic diseases, excluding hypertension for some individuals. Conversely, 269 participants (69.9%) indicated the presence of chronic conditions other than hypertension. Among those with chronic diseases, the distribution includes 83 individuals (30.8%) with dyslipidemia, 56 (20.9%) with diabetes mellitus, 47 (17.4%) with coronary artery disease, 32 (11.8%) with heart failure, and 18 (6.7%) with chronic kidney disease. This data highlights the significant burden of chronic diseases in the population studied.

FIGURE 2: DISTRIBUTION OF COMORBID DISEASES AMONG PARTICIPANTS



RISK FACTORS ASSOCIATED WITH HYPERTENSION

Table 5 presents the findings of a statistical analysis of various risk factors associated with HTN (diagnosed and undiagnosed). Age showed a positive coefficient of 0.030 with a p-value of 0.002, indicating that as age progresses, the risk of HTN also rises. Sex was also a significant factor, with a coefficient of 0.087 (p-value 0.029), suggesting that being male is correlated with a higher risk of HTN. Moreover, for a family history of HTN, a coefficient of -0.045 (p-value 0.024) indicates that having a family history of HTN is associated with a lower risk, suggesting that other factors might be influencing this result. This unpredicted result indicates the presence of other mediating factors impacting HTN risk within this sample size. Regular exercise was found to be protective against hypertension, with a coefficient of -0.172 and a p-value of 0.001; increased exercise frequency is significantly associated with lower hypertension risk.

Dietary habits also played a significant role. A strong positive association is indicated by the coefficient of 0.212 (p-value 0.001), showing that higher consumption of fatty foods significantly increases hypertension risk. Another risk factor was daily high salt intake. The coefficient of 0.327 with a p-value of 0.001 indicates a significant positive association, meaning that higher salt consumption significantly raises the risk of hypertension. In addition, a coefficient of 0.132 (p-value 0.002) indicates a significant positive association, suggesting that higher WC increases hypertension risk. Other factors, including marital status, with a coefficient of -0.050 but with a p-value of 0.109, this factor is not statistically significant. The presence of comorbidities with a coefficient of -0.065 (p-value 0.131) indicates no significant effect on hypertension risk. Smoking status with a coefficient of -0.019 and p-value of 0.499 indicates that smoking status does not significantly affect hypertension risk, and BMI with a coefficient of -0.011 (p-value 0.051) suggests an insignificant effect.

TABLE 5: LOGISTIC REGRESSION ANALYSIS OF RISK FACTORS

Risk factors	B	Std. Error	P. value	95.0% Confidence Interval	
				Lower Bound	Upper Bound
Age	.030	.002	.002*	.026	.033
Sex	.087	.039	.029*	.009	.165
Marital status	-.050	.031	.109	-.112	.011
Family history of HTN	-.045	.020	.024*	-.084	-.006
Presence of comorbidity	-.065	.010	.131	-.085	-.046
Smoking status	-.019	.029	.499	-.076	.037
Exercise frequency	-.172	.012	.032*	-.196	-.149

Consumption of fatty food	.212	.013	.001*	.187	.238
Consumption of salt	.327	.032	.001*	.390	.264
Body mass index	-.011	.025	.051	-.059	.038
Central obesity	.132	.043	.002*	.215	.048

DISCUSSION

HTN PREVALENCE AND CONTROL

This study revealed a high prevalence of hypertension (HTN) among adults attending primary health care centers in Karrari Locality, Khartoum State, Sudan, with a total prevalence of 55.1%, including 6.5% undiagnosed cases. This figure is significantly higher than the 20-38.4% prevalence reported in previous international studies [19, 20]. For instance, in Sudan, Omar et al. found an overall prevalence of 40.8%, where 7.3% had been previously diagnosed with HTN, and 33.5% were newly diagnosed [21]. This is higher than our 6.5% of unknown cases but lower than our overall prevalence of 55.1%. This difference is because of factors such as dissimilarities in the demographic configuration and way of life of the populations studied, mostly in international and national studies conducted in different cities. Each region may also have a unique environmental, genetic, or socioeconomic impact that leads to changes in increased blood pressure. For example, high levels of stress, limited access to healthcare, and traditional diets rich in salt and saturated fats prevalent in Sudan may exacerbate the risk of HTN [22]. On the other hand, other countries may experience better health facilities and different related lifestyles. Moreover, existing discrepancies in HC systems could explain the differences; superior HTN detection and diagnosis in some populations may lead to lower prevalence rates [23].

Although hypertensive treatments are present, controlling HTN is still a major challenge across many populations. The associated factors are insufficient follow-up to treatment, poor follow-up care access, or poor interaction between patients and providers about the significance of strict blood pressure control. Cultural factors may also play a role, with some patients depending more on conventional medicine or altering advised treatment procedures based on non-scientific judgements rather than following clinical guidelines.

Mouhtadi et al. found an uncontrolled HTN prevalence of 45% [18], and Balouch et al. reported an increased rate of 56.9%, which is higher than the results of our study as 41.1% of participants had uncontrolled HTN [24, 25]. In addition, other studies conducted by Alawneh et al. and Mirzaei et al. found increased rates at 60% [26] and 61.1% [27], and Calas et al. observed a rate of 69.8% [28]. These results showed that the population of our study is likely to have improved management of HTN as compared to previously reported studies, and it is because of better treatment approaches or careful following of prescribed treatments [22, 25, 26, 28]. More research is needed to find the reasons for these variations and examine the influence of healthcare measures on HTN control.

In our study, we found that 6.5% of the participants had a prevalence of undiagnosed HTN. The prevalence of undiagnosed HTN in our study was found to be 6.5%. This can be due to inadequate health education, less accessibility of checkups, or extra expense problems that rarely allow individuals to get annual checkups. Because of the lack of regular screenings and community-based treatment, underprivileged regions like Sudan ignore undiagnosed illnesses like HTN. This emphasizes the need for stronger healthcare strategies and campaigns for awareness.

HTN RISK FACTORS

In this study, logistic regression analysis shows that age was a significant determinant of HTN with a p-value of 0.002, indicating that the chances of developing HTN increase with age ($B = 0.030$). This finding aligns with broader literature, including studies by Calas et al. [28], Rahman et al. [29], Godara et al. [19], Nimi et al. [30], Mekonene et al. [20], and Omar et al. [21], all of which identified age as a significant risk factor. The physiological changes in vascular structure, such as arterial stiffness, may explain the consistent association between advancing age and HTN.

Sex also demonstrated a significant relationship with HTN in our study ($p = 0.029$), with men at slightly higher risk than women ($B = 0.087$). This finding is consistent with Balouchi et al. [24], who reported higher HTN prevalence among men, and Santosa et al. [31], who noted that men had higher prevalence rates (43% in Sweden and 39% in China) compared to women (29% in Sweden and 36% in China). This is further supported by Godara et al. [19] and Mekonene et al. [20]. In contrast, marital status was not significantly associated with HTN, diverging from studies like those of Calas et al. [28] and Noor [16], which identified being single as a risk factor. This discrepancy may stem from cultural or social differences in the populations studied.

Surprisingly, family history exhibited an inverse relationship with HTN ($p = 0.024$), which contradicts existing literature where family history is generally considered a risk factor. One possible explanation is that individuals with a known family history of HTN may be more vigilant about their health, leading to early interventions and better management of their condition. Exercise frequency was strongly associated with a reduced risk of HTN ($B = -0.172$, $p < 0.032$), supporting the well-documented benefits of physical activity in lowering blood pressure, as noted by Calas et al. [28]. Conversely, consumption of fatty foods emerged as a significant risk factor for HTN ($B = 0.212$, $p < 0.001$), aligning with previous studies linking high-fat diets to elevated blood pressure. This underscores the necessity of dietary interventions in HTN management. Similarly, salt consumption was identified as a significant risk factor for HTN ($B = 0.327$, $p < 0.001$), consistent with extensive evidence linking high salt intake to increased blood pressure. This finding reinforces ongoing recommendations to reduce salt consumption as a key strategy in preventing and managing HTN.

Interestingly, our study found that BMI was not a significant predictor of HTN ($p = 0.051$), diverging from most studies that link higher BMI to increased HTN risk. This difference may arise from the comparable BMI levels among participants with diagnosed and undiagnosed HTN, which could lead to similar risks [32]. Additionally, other lifestyle factors, such as dietary habits or physical activity levels, may have influenced this relationship, potentially masking the impact of BMI on HTN outcomes.

While the presence of chronic diseases was statistically insignificant, this may be due to individuals with chronic conditions being more likely to receive medical care, including HTN. This contrasts with studies that typically link chronic diseases to higher HTN prevalence [33, 34]. Similarly, smoking status did not show a significant association with HTN, which also differs from previously established risk factors and is supported by Gao et al. [35].

Notably, our analysis revealed that central obesity, as measured by WC, was related to HTN, with a regression coefficient of $B = 0.132$ and a significance level of $p = 0.002$. This finding aligns with the known positive correlation between central obesity and HTN. A related study in Sudan by Noor [16] found that central and gross obesity was linked to uncontrolled blood pressure, while another study by Omar et al. [21] reported that being overweight was not a significant risk factor for HTN among their participants. This challenges the conventional understanding that higher body weight directly contributes to increased blood pressure. The differing results suggest that the relationship between obesity, both overall and central and HTN may not be straightforward. Cultural, environmental, or genetic factors may impact weight and obesity in the Sudanese population, and for that reason, blood pressure regulation is affected. More research is required to understand the intricate relations between the composition of the body, lifestyle factors, and HTN, allowing targeted measures for different populations.

Our findings underscore the need for targeted hypertension screening and control strategies in Sudan, particularly among older adults, men, and those with central obesity. Public health policies should prioritize raising awareness about HTN risk factors, promoting healthy lifestyles, and ensuring regular blood pressure screening in primary healthcare settings. Given the relatively low proportion of undiagnosed cases, ongoing community-based screening programs seem effective but should be expanded. Additionally, policy makers should consider developing culturally tailored health education campaigns to improve dietary habits and physical activity levels. Strengthening healthcare infrastructure, training providers in risk-based patient management, and integrating non-pharmacological interventions into HTN care can contribute to better long-term outcomes.

This study raises several important questions for further exploration. First, the observed inverse relationship between family history and HTN warrants deeper investigation to understand behavioral adaptations or healthcare-seeking tendencies. Second, the insignificant association of BMI with HTN contradicts many established findings, suggesting that local dietary patterns or genetic factors may modulate obesity-related risk. Longitudinal studies are needed to assess causal relationships and clarify these unexpected results. Future research should also evaluate the effectiveness of current HTN management programs, examine barriers to treatment adherence, and explore how cultural beliefs influence HTN diagnosis and control. Additionally, national-level studies with larger and more diverse samples could provide a clearer picture of HTN patterns across Sudan.

CONCLUSION

In this study, the prevalence of HTN was found to be high in the Karrari Locality of Sudan. The results of this study reveal that there is an urgent need for better public health measures on early diagnosis, awareness, and practical management of HTN. Age, sex, lifestyle preferences, dietary habits, and physical activity are the main factors that contribute to HTN. Health outcomes can be improved, and the burden of HTN in various populations can be decreased by resolving these factors. Future research is essential to elucidate further the complex relationships between obesity, lifestyle, and hypertension, ultimately informing strategies to combat this growing health challenge.

STRENGTHS AND LIMITATIONS

This study provides recent and context-specific data on hypertension prevalence, control, and undiagnosed cases among adults attending primary healthcare centers in Sudan, addressing a major evidence gap in a low-resource setting. The use of standardized blood pressure measurements, JNC-8 criteria, and multistage random sampling across multiple PHCs strengthens the internal validity of the findings. However, the cross-sectional design limits causal interpretation. In addition, the relatively small sample size ($n = 385$) and the single-locality setting within Khartoum State may restrict the generalizability of the results to the wider metropolitan population or rural regions. Self-reported lifestyle data may also be subject to reporting bias.

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COMPETING INTEREST

The authors declare no competing interest in relation to this study.

INFORMED CONSENT

Informed consent was obtained from the administrations of the health centers, as well as from all participants involved in the study. This process ensured that both the institutions and individuals were fully aware of the study's purpose, procedures, and their rights regarding participation, thereby adhering to ethical research standards.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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AUTHOR CONTRIBUTIONS

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by SMBE, SKF, RA, RASH, RAAE, AH, MH, and EAA. The first draft of the manuscript was written by SMBE, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

LIST OF ABBREVIATIONS

BMI: Body mass index
 CO: Central obesity
 CRF: Classical risk factors
 DBP: diastolic blood pressure
 HTN: Hypertension
 JNC: Joint National Committee
 LMIC: Low- and middle-income countries
 NCRFs: Non-classical risk factors
 PHC: Primary Health Care
 SBP: Systolic blood pressure
 SD: Standard deviation
 SPSS: Statistical Package for Social Sciences

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FACTORS AFFECTING THE RECOMMENDATION INTENTION OF TELEMEDICINE APP AMONG GENERATION Z

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ABSTRACT

PURPOSE:

This study aims to identify the factors influencing the recommendation intention and continued use of telemedicine services, focusing specifically on Generation Z users.

DESIGN/METHODOLOGY/APPROACH:

A quantitative, positivist approach was adopted, integrating the UTAUT and the DOI model. The study used a cross-sectional survey with a sample size of 580 respondents to objectively measure and analyze the factors influencing telemedicine adoption.

FINDINGS:

The findings indicate that perceived usefulness, perceived trust, openness to change, and actual use are significantly associated with users' recommendation intention toward telemedicine services, whereas social influence does not show a significant direct relationship with recommendation intention.

RESEARCH LIMITATIONS/IMPLICATIONS:

The study's reliance on self-reported data may introduce bias, and the cross-sectional design limits causal inferences. Future research should consider longitudinal studies for deeper insights.

PRACTICAL IMPLICATIONS:

The findings provide actionable insights for healthcare providers to enhance telemedicine services tailored to Generation Z's preferences, ultimately improving patient engagement and satisfaction.

ORIGINALITY/VALUE:

This study contributes original evidence on telemedicine adoption by showing that recommendation intention among Generation Z users is shaped more by openness to change and post-adoption evaluations than by traditional cost- or trust-based usage drivers.

OBJECTIVE:

To explore how various factors influence Generation Z's intention to recommend telemedicine services.

KEYWORDS

Telemedicine, Generation Z, Technology Acceptance, Healthcare Delivery

INTRODUCTION

Telemedicine, characterized by the remote diagnosis and treatment of patients via telecommunications technology, has emerged as an influential force in healthcare. The importance has intensified in recent years owing to technological breakthroughs, global health problems like the COVID-19 pandemic, and the rising need for comprehensive healthcare services. According to [1], telemedicine addresses critical challenges in modern healthcare, including geographical barriers and healthcare professional shortages. Despite its growth, gaps remain in understanding user acceptance, particularly among Generation Z, who are digital natives and increasingly reliant on technology for health-related needs. Generation Z, often referred to as Gen Z, encompasses individuals born roughly between 1997 and 2012. This demographic cohort follows the Millennials and precedes Generation Alpha. The defining characteristics of Gen Z are shaped by their experiences growing up in a digitally connected world, with the internet and smartphones being integral parts of their lives from a young age [2]. This study aims to fill that gap by exploring factors influencing Generation Z's adoption with telemedicine services. Initial research on telemedicine primarily aimed to assess the viability of remote consultations. [3] investigated how telemedicine could connect rural patients with specialists, highlighting its potential benefits for underserved communities. However, they also pointed out significant challenges, such as inadequate internet infrastructure and the high costs of technology, which impeded early adoption [3]. As telemedicine evolved, studies shifted focus to managing chronic diseases. [4] discovered that telemedicine could improve care for patients with conditions like diabetes and heart disease by facilitating real-time monitoring and enhancing self-management strategies. Nevertheless, issues such as patient adherence and technology usage, particularly among older adults, limited its effectiveness in this demographic [4]. The COVID-19 accelerated the growth of telemedicine, with [5] demonstrating its crucial role in maintaining healthcare access while reducing virus exposure, particularly for vulnerable populations. However, this rapid transition also revealed disparities in digital access; individuals in rural or low-income areas encountered significant barriers to obtaining the necessary technology and reliable internet connections [5]. Previous research has not adequately addressed the specific factors that drive telemedicine adoption among Generation Z users. While studies have explored general telemedicine usage, [6] they often overlook the unique perspectives of this demographic. Prior studies indicated that social influence and perceived usefulness significantly impact user satisfaction in telemedicine [7]. However, existing literature lacks a focused examination of these factors within the context of Generation Z. Considering this, the study seeks to answer the following research question:

RQ: What factors influence Generation Z's recommendation intention of telemedicine applications, and how does their adoption behavior shape this intention?

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

The theoretical framework provides the foundation for understanding the factors affecting the recommendation intention of telemedicine applications among Generation Z users. This study integrates two key theoretical models: the UTAUT and the DOI Model. By leveraging these theories, we explore the relationships between social influence, perceived usefulness, perceived trust, price value, openness to change, and actual use, assessing their impact on recommendation intention. The UTAUT model [8] posits that user acceptance of technology is driven by four key determinants: performance expectancy, effort expectancy, social influence, and facilitating conditions. [9] DOI Model explains how new technologies gain traction within a population. The model emphasizes five attributes influencing adoption: relative advantage, compatibility, complexity, trialability, and observability. This study incorporates the concept of openness to change from the DOI model to assess its influence on telemedicine adoption.

THEORETICAL INTEGRATION OF UTAUT AND DOI

While UTAUT effectively explains technology adoption through performance, effort, and social mechanisms, it primarily models adoption as a rational evaluation process. In contrast, DOI emphasizes users' broader orientation toward innovation and change. In this study, DOI is not employed as a parallel acceptance model but as a complementary lens

that captures individuals' predisposition to embrace novel healthcare delivery mechanisms. By operationalizing DOI through openness to change, the model extends UTAUT by incorporating a dispositional innovation mindset, which is particularly salient for Generation Z users who are accustomed to rapid technological evolution and institutional transformation.

Other DOI attributes such as compatibility, trialability, and observability were not included to avoid conceptual overlap and model redundancy. Compatibility and complexity partially overlap with UTAUT's effort expectancy, while trialability and observability are less relevant in a telemedicine context where services are already widely accessible and frequently used. Openness to change, however, captures a higher-order psychological readiness for innovation that is not explicitly addressed by UTAUT constructs.

SOCIAL INFLUENCE (SI)

Social influence measures to what extent users perceived that health care personnel or friends and family expect them to use a mobile-app based telemedicine solution. Study finds the direct effect of social influence on e-health literacy or on perceived usefulness with TAM framework [10]. Therefore, we posit the following hypothesis:

H1: Social Influence has positive and significant relation on actual use of Telemedicine App.

H2: Social Influence use has positive impact on user Recommendation Intention of Telemedicine app.

PERCEIVED USEFULNESS (PU)

Perceived usefulness is a critical factor in measuring user intention to actual use of telemedicine. It reflects the degree to which users perceive that using a telemedicine service enhances their healthcare experience. Research consistently shows that PU significantly influences user satisfaction, which is important for the continued adoption and use of telemedicine services [10]. Therefore, we posit the following hypothesis:

H3: Perceived usefulness has a positive impact on actual use of Telemedicine app.

H4: Perceived usefulness has positive impact on user Recommendation Intention of Telemedicine app.

PERCEIVED TRUST (PT)

Perceived trust is a vital factor in measuring user intention to actual use of telemedicine. Trust influences how patients perceive the quality and reliability of care they receive through telemedicine, impacting their overall satisfaction and willingness to continue using these services [11]. Although studies have found that perceived trust is a particularly significant factor in user intention to actual use [12]. Therefore, we can posit the following hypothesis.

H5: Perceived Trust positively impacts on actual use of Telemedicine app.

H6: Perceived Trust has positive impact on user Recommendation Intention of Telemedicine app.

PRICE VALUE (PV)

Customers' cognitive trade-off between the applications' alleged benefits and the financial expense of using them is known as price value. [13]. Although there is direct connection with recommendations but not with actual use in telemedicine, further study is needed. Therefore, we hypothesize the following:

H7: Price value has positive and significant relation on actual use of Telemedicine App.

H8: Price Value has positive impact on user Recommendation Intention of Telemedicine app.

OPENNESS TO CHANGE (OC)

Openness to change is an essential factor influencing user intention to actual use of telemedicine. It reflects individuals' willingness to adopt new technologies and adapt to changes in healthcare delivery methods. [10]. While openness to change is a significant factor influencing user intention to actual use of telemedicine, there is no direct study on telemedicine that measures effect of openness to change to measure user intention to actual use. Therefore, we posit the following hypothesis:

H9: Openness to change has potential impact on actual use of Telemedicine app.

H10: Openness to change has positive impact on user Recommendation Intention of Telemedicine app.

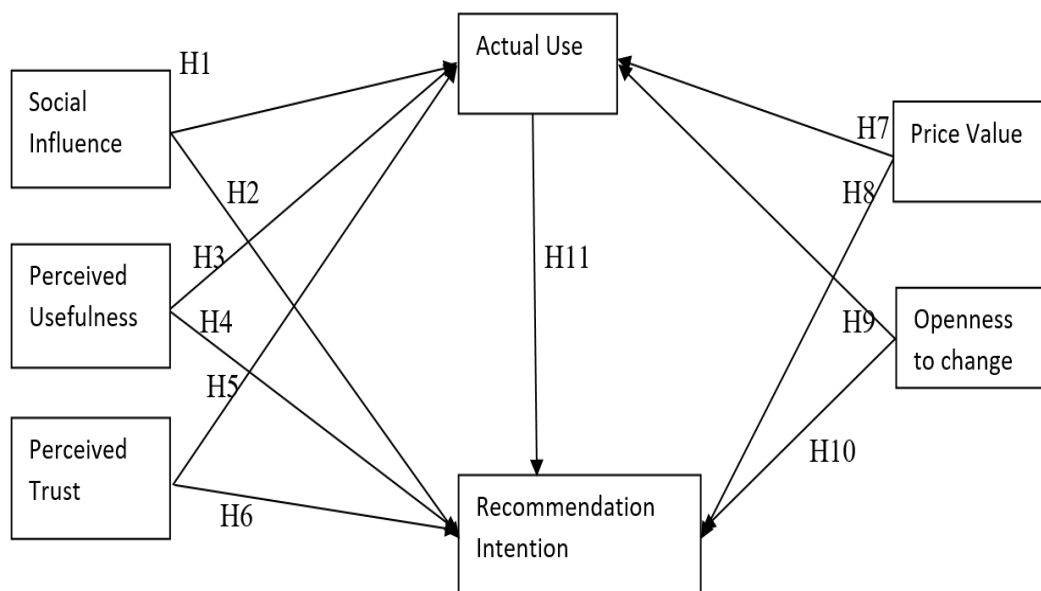
ACTUAL USE (AU)

There is a strong positive correlation between user's actual use of telemedicine and their subsequent satisfaction is significant, with research indicating that positive intentions often lead to higher satisfaction levels after using the service. Studies indicate that satisfaction derived from actual use significantly influences users' attitudes towards recommending telemedicine services [14]. However, measurement limitations highlight the need for more standardized, comprehensive, and longitudinal research to fully understand this relationship.

Therefore, we hypothesize the following:

H11: Actual use has positive impact on user Recommendation Intention of Telemedicine app.

FIGURE 1: CONCEPTUAL FRAMEWORK AND HYPOTHESIS



RESEARCH DESIGN AND METHODOLOGY

This study employed a cross-sectional survey research design to examine factors influencing telemedicine utilization, such as social influence, perceived usefulness, trust, price value, openness to change, and actual usage. A purposive sampling strategy was employed to ensure that respondents met the study's specific inclusion criteria, namely belonging to Generation Z and having prior experience or familiarity with telemedicine services. This approach was appropriate given the study's theory-driven objective of examining technology adoption behavior within a clearly defined user group rather than estimating population parameters. Although purposive sampling limits statistical generalisability, it is commonly used in technology acceptance research where access to relevant users is essential and where theoretical explanation rather than population inference is the primary goal. A total of 580 responses were initially collected. Following data screening and cleaning procedures, 282 responses were retained for final analysis. Responses were excluded due to incomplete questionnaires, failed attention checks, duplicate submissions, and responses that did not meet the predefined inclusion criteria (e.g., lack of telemedicine experience or Generation Z age range). The final sample size exceeded the minimum requirements for PLS-SEM analysis and was adequate for estimating the proposed model. A structured online questionnaire was developed by adapting validated multi-item scales from prior telemedicine and technology acceptance studies. The instrument measured social influence, perceived usefulness, perceived trust, price value, openness to change, actual use, and recommendation intention using a six-point Likert scale, and its reliability and validity were confirmed during PLS-SEM analysis.

DATA ANALYSIS

This study adopts a positivist research paradigm and employs a quantitative, cross-sectional survey design to examine the factors influencing Generation Z users' adoption and recommendation intention of telemedicine services. A structured questionnaire was used to collect numerical data suitable for statistical analysis and hypothesis testing. The quantitative

approach is appropriate given the study's objective of examining causal relationships among latent constructs derived from established technology adoption theories. The study employed a purposive sampling method to choose participants according to particular criteria pertinent to the aims, concentrating on adults from Generation Z who have used or are knowledgeable with telemedicine services. Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) through SmartPLS 4. PLS-SEM was selected due to its suitability for theory testing, prediction-oriented research, and complex models involving multiple latent constructs. The analysis followed a two-step procedure: (1) assessment of the measurement model to evaluate reliability and validity, and (2) assessment of the structural model to test the hypothesized relationships among constructs. Statistical significance was evaluated using bootstrapping procedures.

TABLE 1: OUTER LOADINGS MATRIX

Constructs	Outer loadings values	Constructs	Outer loadings values
AU-1 -> AU	0.774	PEU-1 -> PEU	0.766
AU-2 -> AU	0.871	PEU-4 -> PEU	0.793
AU-3 -> AU	0.769	PEU-6 -> PEU	0.711
AU-4 -> AU	0.770	PEU-7 -> PEU	0.775
OC-4 -> OC	0.814	PT-1 -> PT	0.749
OC-5 -> OC	0.812	PT-2 -> PT	0.817
OC-6 -> OC	0.804	PT-3 -> PT	0.759
OC-7 -> OC	0.847	PT-4 -> PT	0.762
PU-2 -> PU	0.778	SI-1 -> SI	0.784
PU-3 -> PU	0.815	SI-2 -> SI	0.784
PU-4 -> PU	0.793	SI-2 -> SI	0.838
RI-1 -> RI	0.818	RI-5 -> RI	0.761
RI-2 -> RI	0.819		
RI-3 -> RI	0.858		
RI-4 -> RI	0.824		

RESULTS AND DISCUSSIONS

The data has been cleansed, processed, and prepared utilizing MS Excel prior to testing. This work employs structural equation modeling (SEM) to evaluate and analyze the interactions among the components, highlighting their significance within the suggested model. Analysis of the measurement model and estimation of structural model have been done in Smart-PLS4. After importing the data in Smart-PLS4, a path diagram of conceptual model (Fig 2) was drawn, and then PLS-SEM algorithm was commanded to initiate the analysis process. The Construct Reliability and Validity table evaluates the internal consistency and validity of the constructs used in the study. Three key metrics were analyzed: Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). Cronbach's Alpha scores for all constructs exceeded the acceptable level of 0.7, signifying strong internal consistency. The Composite Reliability (CR) scores above 0.7, so affirming the constructs' reliability.

The Average Variance Extracted (AVE), which evaluates convergent validity, exhibited values over 0.5 for all constructs, signifying that over 50% of the variance in the observed variables is accounted for by the constructs. This indicates that the constructions accurately assess their intended objectives.

TABLE 2: CONSTRUCT RELIABILITY AND VALIDITY

Constructs	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
AU	0.808	0.816	0.874	0.636
OC	0.837	0.840	0.891	0.671
PT	0.776	0.782	0.855	0.596
PU	0.710	0.713	0.838	0.633
RI	0.875	0.876	0.909	0.667
SI	0.723	0.723	0.844	0.643

The study's values elucidate the strength and relevance of the interactions between numerous variables and their corresponding indicators about telemedicine adoption among Generation Z consumers. The mean values represent the average strength of relationships between constructs. For instance, the path from Actual Use (AU) to Recommendation Intention (RI) has a mean of 0.145 and a standard deviation of 0.068, reflecting a moderate positive relationship with low variability among the participants. Similarly, the path from Openness to Change (OC) to Actual Use (AU) shows a mean of 0.205 and a standard deviation of 0.079, suggesting that those open to new technology are more likely to use telemedicine apps, with this relationship being consistent across respondents. Lower standard deviations indicate greater consistency, while higher standard deviations suggest more variation in how respondents experience these relationships. The T-values in Table 3 are used to assess the strength and statistical significance of the relationships between the variables. A T-value greater than 1.96 indicates that the relationship is statistically significant at the 5% level, meaning there is less than a 5% chance that the relationship occurred by random chance. For example, the relationship between Openness to Change (OC) and Recommendation Intention (RI) has a T-value of 3.535, well above the 1.96 threshold, showing a strong and significant impact of openness to change on users' willingness to recommend telemedicine apps. Similarly, Actual Use (AU) to Recommendation Intention (RI) has a T-value of 2.078, indicating that the more frequently users engage with telemedicine, the more likely they are to recommend it to others. However, not all relationships are significant. For instance, Perceived Trust (PT) to Actual Use (AU) has a T-value of 1.341, suggesting that perceived trust does not have a statistically significant influence on actual use in this context.

The P-values measure the probability that the observed relationship between two variables occurred by chance. A P-value below 0.05 indicates that the relationship is statistically significant. In this study, several relationships were found to be significant based on their P-values. For instance, the relationship between Actual Use (AU) and Recommendation Intention (RI) has a P-value of 0.038, meaning the impact of actual use on users' intention to recommend telemedicine is statistically significant. Similarly, Openness to Change (OC) to Recommendation Intention (RI) is highly significant with a P-value of less than 0.001, suggesting that individuals open to adopting new technologies are much more likely to recommend telemedicine. Another significant relationship is Perceived Usefulness (PU) to Recommendation Intention (RI), with a P-value of 0.030, showing that users who perceive telemedicine as useful are more inclined to recommend it to others. On the other hand, relationships like Perceived Trust (PT) to Actual Use (AU), with a P-value of 0.180, are not statistically significant, indicating that trust in telemedicine services does not directly affect the frequency of use in this study.

Overall, Table 3 highlights important insights into the relationships between key constructs in the study. The findings suggest that users who frequently use telemedicine, are open to technological change, and find the service useful are more likely to recommend it to others. Several hypothesised relationships were not supported by the structural model, highlighting the importance of avoiding over generalisation of technology adoption drivers. These non-significant findings provide meaningful insights by indicating which commonly assumed predictors may be less relevant for Generation Z in the telemedicine context. Although perceived trust and price value are frequently cited as important drivers of technology adoption, the present findings indicate that neither construct has a statistically significant direct effect on actual use of telemedicine among Generation Z users. This suggests that, for this cohort, continued usage decisions may be less influenced by cost considerations or trust perceptions alone and more strongly shaped by factors such as openness to

change and social influence. However, perceived trust remains a significant predictor of recommendation intention, indicating that trust plays a more prominent role in post-adoption evaluative judgments rather than in initial or continued usage behavior. Similarly, the non-significant effect of price value on both actual use and recommendation intention suggests that telemedicine adoption among Generation Z may be relatively price-insensitive, possibly due to low switching costs, promotional access, or the prioritisation of convenience over monetary considerations.

TABLE 3: HYPOTHESIS TESTING

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values	Findings
AU -> RI	0.142	0.145	0.068	2.078	0.038	Supported
OC -> AU	0.202	0.205	0.079	2.552	0.011	Supported
OC -> RI	0.273	0.271	0.077	3.535	0.000	Supported
PT -> AU	0.129	0.129	0.096	1.341	0.180	Not Supported
PT -> RI	0.253	0.258	0.083	3.041	0.002	Supported
PU -> AU	0.093	0.097	0.082	1.138	0.255	Not Supported
PU -> RI	0.160	0.157	0.073	2.177	0.030	Supported
PV -> AU	0.152	0.149	0.098	1.557	0.120	Not Supported
PV -> RI	-0.011	-0.007	0.089	0.121	0.904	Not Supported
SI -> AU	0.150	0.151	0.064	2.359	0.018	Supported
SI -> RI	0.069	0.065	0.079	0.877	0.381	Not Supported

Table 4 displays the R-squared values. The R-squared value is an essential parameter in regression analysis, quantifying the proportion of variance in the dependent variable elucidated by the independent variables. The range is from 0 to 1, with elevated values signifying more explanatory power of the model. Essentially, it helps determine how well the model fits the data. In research, an R-squared value closer to 1 means that the model accounts for most of the variability in the data, while a lower value suggests that there are other factors influencing the dependent variable that are not captured by the model.

In this paper R-squared value, which indicate the proportion of variance explained by the independent variables. The R-squared value for Actual Use (AU) is 0.315, meaning that 31.5% of the variance in Actual Use can be explained by variables like Openness to Change, Perceived Usefulness, and Social Influence. This demonstrates that while these factors play a role in driving telemedicine usage, there may be other unexplored factors contributing to the decision to use telemedicine.

The R-squared value for Recommendation Intention (RI) is 0.484, indicating that 48.4% of the variance in users' intention to recommend telemedicine is accounted for by the variables in the model. This signifies a robust model, since around fifty percent of the variance in recommended behavior can be ascribed to characteristics like Actual Use, Openness to Change, Perceived Trust, and Perceived Usefulness. While R-square reflects the proportion of explained variance, Adjusted R-square corrects for model complexity. The minimal differences between these values in this study suggest that the model maintains explanatory power without overfitting, supporting the robustness of the structural relationships.

TABLE 4: R-SQUARE AND R-SQUARE ADJUSTED.

Item	R-square	R-square adjusted
AU	0.315	0.302
RI	0.484	0.472

Figure 2 provides a visual depiction of the structural equation model, illustrating the relationships between the constructs and their respective path coefficients. The significant relationships between Openness to Change and both Actual Use

and Recommendation Intention underscore the importance of adaptability to new technologies among Generation Z users in driving both the use and advocacy of telemedicine. The path from Perceived Trust to Recommendation Intention highlights the critical role trust plays in motivating users to recommend telemedicine services to others.

FIGURE 2: STRUCTURAL EQUATION MODEL

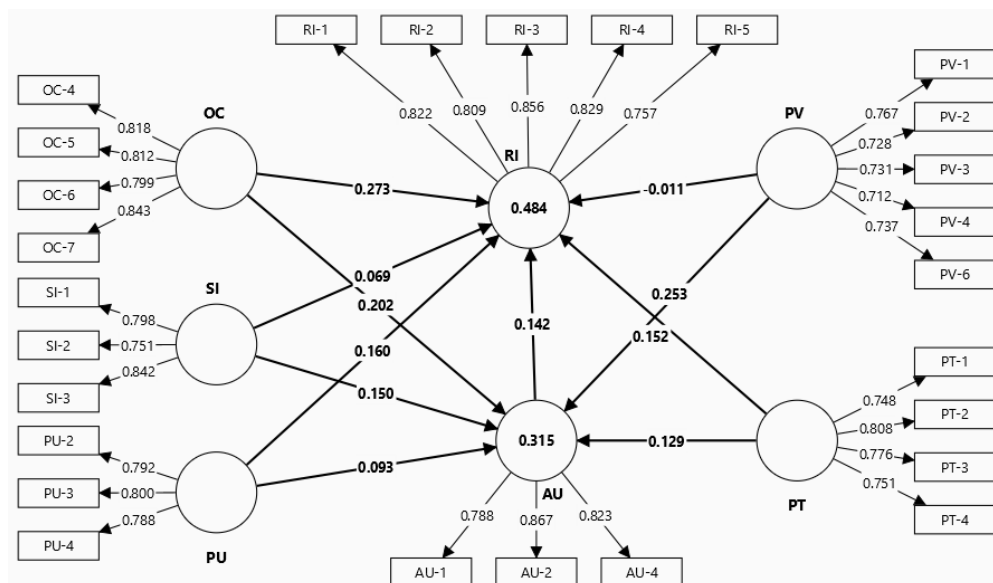


Table 3 provides a concise overview of the key hypotheses tested in the study and their corresponding outcomes. The table confirms that several factors positively and significantly impact the Actual Use and Recommendation Intention of telemedicine apps among Generation Z users. Specifically, it shows that Social Influence and Openness to Change significantly influence Actual Use, also Perceived Usefulness and Openness to Change positively impacts the Recommendation Intention of telemedicine services. These findings validate the hypotheses that users who perceive Social Influence and are open to adopting new technologies are more likely to engage with telemedicine and recommend it to others.

For hypotheses that are not supported, such as when perceived trust or perceived usefulness does not significantly impact actual use.

LIMITATION

In spite of the insightful observations, the study's cross-sectional design, dependence on self-reported data, and Generation Z focus are limitations that could restrict how broadly the results can be applied. As the study employed a non-probability sampling approach and relied on self-administered online surveys, the possibility of non-response bias cannot be entirely ruled out. Although standard data screening procedures were applied, future studies are encouraged to conduct formal non-response or attrition bias analyses and to employ probability-based sampling techniques to enhance generalisability.

CONCLUSION

The study on the recommendation intention of telemedicine, utilizing an integrated framework of the DOI and the UTAUT, reveals critical insights into the evolving doctor-patient relationship in a digital context. By demonstrating that factors such as openness to change, perceived trust, social influence, and actual intention to use telemedicine apps significantly influence recommendation intentions, the research underscores the importance of fostering an environment conducive to change and building trust among healthcare providers and patients. This integration enriches our understanding of technology acceptance in healthcare, facilitating a more accessible and efficient healthcare delivery system.

Moreover, the study's implications suggest that healthcare organizations should develop targeted marketing strategies and invest in training programs for professionals to improve confidence in telemedicine technologies. This approach not only aligns with the study's insights but also supports broader digital transformation efforts in healthcare, ultimately leading to improved patient outcomes.

ETHICAL APPROVAL

The study's survey approach complied with ethical guidelines and featured human participants. The American International University Bangladesh authorities, where the study was carried out, duly approved the method.

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No funding was received for this study.

CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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INTEGRATING DIGITAL HEALTH INNOVATIONS WITH AYUSH IN INDIA'S PUBLIC HOSPITALS: A MANAGEMENT FRAMEWORK FOR HOLISTIC AND SCALABLE HEALTHCARE

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ABSTRACT

India's pluralistic health system officially recognizes both modern medicine and AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha, Homoeopathy). The Ayushman Bharat initiatives now seek to combine these traditions with nationwide digital health infrastructure. This study develops a management framework for integrating AYUSH services into digital platforms in public hospitals.

We review policies and data on AYUSH utilization (e.g. over 755,780 registered AYUSH practitioners and 3,844 AYUSH hospitals nationwide [1]), and assess digital health progress (e.g. Ayush Grid EHR systems and eSanjeevani telemedicine). We examine integration efforts: currently AYUSH units are co-located in many PHCs and CHCs – for example, as of 2023 AYUSH doctors were posted in 6,891 PHCs, 3,149 CHCs, and 470 district hospitals [2] (roughly 30–70% coverage) – enabling local patients to choose traditional care. The Ayush Grid digital platform and ABDM (Ayushman Bharat Digital Mission) have begun linking AYUSH records with national health IDs. By early 2025, India's digital health ecosystem had registered on the order of hundreds of millions of health IDs and integrated AYUSH providers and facilities into its registries[3]. Telehealth has surged: the government's eSanjeevani service has delivered over 276 million teleconsultations to date [3], and AYUSH practitioners were brought online through dedicated telemedicine guidelines issued in 2020[4]. Pilots show promise: a Ministry of AYUSH telemedicine service launched in late 2019 (initially for Siddha) rapidly expanded to include Ayurveda and Homeopathy, yielding over 20,000 AYUSH tele-consults in early phases, and 1,518 AYUSH Health & Wellness Centres (AHWCs) are now functional [5]. However, integration is uneven. Only 37 of 137 planned “integrated AYUSH hospitals” were fully operational by 2023[6]. Barriers include technical gaps (inconsistent EHR usage, lack of interoperability), standards issues (limited AYUSH vocabularies in mainstream systems), workforce challenges (low digital literacy, professional silos), and organizational hurdles (fragmented governance and budgets).

Drawing on thematic analysis of these findings, we propose a framework with four pillars: (1) Technology Infrastructure: Expand unified IT platforms (building out ABDM-compatible EHRs like AHMIS in all AYUSH units); (2) Standards & Data Integration: Develop common terminologies and data protocols (e.g. map AYUSH diagnoses into ICD-11's Traditional Medicine chapter[7]); (3) Capacity Building: Train AYUSH and allopathic staff jointly in digital tools and integrative care pathways; (4) Governance and Policy Alignment: Create joint leadership forums (e.g. inter-ministerial committees) and funding mandates to ensure AYUSH digitalization. Hospital managers should champion cross-disciplinary teams and data-sharing, while policymakers should mandate AYUSH inclusion in digital health programs and allocate resources accordingly. Implemented well, this can extend holistic, patient-centered care at scale, leveraging technology to make India's healthcare more equitable, pluralistic and integrated.

KEYWORDS

Digital Health; AYUSH; Integrative Medicine; Telemedicine; Health Systems; India

INTRODUCTION

India's public health system has a unique pluralistic character, officially recognizing both biomedical and traditional AYUSH systems. AYUSH (Ayurveda, Yoga & Naturopathy, Unani, Siddha, Homeopathy) plays a vital role in preventive, promotive, and chronic care. As of 2024, there are 755,780 registered AYUSH practitioners nationwide [1]. The government maintains a parallel network of AYUSH facilities: approximately 3,844 AYUSH hospitals (about 50,000 beds) and 36,848 dispensaries, most funded by public programs [1]. To increase patient access, India has long co-located AYUSH units in general public facilities. Under the National Health Mission, many Primary Health Centres (PHCs), Community Health Centres (CHCs), and District Hospitals (DHs) now have an AYUSH clinic or physician on site, jointly funded by the Ministry of Health (for staff) and Ministry of AYUSH (for medicines and equipment). For example, as of late 2023 AYUSH practitioners were posted at 6,891 PHCs and 3,149 CHCs [2]—roughly 30% of PHCs and 50% of CHCs in India—plus 470 district hospitals. This “one-stop” model allows patients to choose traditional and/or modern treatment during the same visit, embodying a pluralistic vision. Indeed, national policy (e.g. the National Health Policy 2017) explicitly advocates this integration of AYUSH into the general health system to expand holistic care [8].

Parallel to AYUSH mainstreaming is a rapid digital revolution in healthcare. India's government has built a unified health IT architecture: key initiatives include the National Digital Health Blueprint (2019) [46] and the Ayushman Bharat Digital Mission (launched 2020, later rebranded as ABDM) [47]. This digital health ecosystem provides core elements like unique Health IDs (ABHA) for citizens, electronic health records, and provider/facility registries. As of early 2025, hundreds of millions of Indians have been issued ABHA IDs, and a comparable number of health professionals and institutions (now including AYUSH doctors and clinics) are registered in the central system. Thus, in theory, all patient encounters—AYUSH or allopathic—can be linked through a common digital platform. COVID-19 accelerated these technologies: the government's eSanjeevani telemedicine service, originally for allopathic care, conducted 276 million consultations by 2023[3]. Recognizing demand, the Ministry of AYUSH released parallel Telemedicine Practice Guidelines in April 2020, enabling Ayurveda, Siddha, Unani, etc. practitioners to legally consult via video/phone. New apps like AYUSH Sanjivani (for tracking traditional remedy use) also reached large audiences. In short, India is uniquely positioned with both policy support for integrative medicine and an unprecedented digital health backbone.

Yet, despite this potential, AYUSH and digital health have largely advanced as parallel tracks. Traditional AYUSH practice has historically relied on paper records and vernacular terminology (e.g. Ayurvedic concepts like *vāta-pitta*). These do not easily align with standard electronic medical records (EMRs) used in hospitals, leading to fragmented records. For instance, a rural patient's herbal prescription may not appear in the hospital's computerized file. Telemedicine guidelines cover AYUSH broadly, but practical integration of AYUSH on platforms like eSanjeevani has been piecemeal. Cultural gaps also persist: some modern doctors remain skeptical of AYUSH data, while some AYUSH practitioners feel burdened by unfamiliar digital tools. Hospital administrators face logistical issues too: many AYUSH units have smaller budgets, so adding computers or Wi-Fi can be hard. Additionally, emerging laws (e.g. India's Digital Personal Data Protection Act, and ABDM's health data policy) apply uniformly, raising questions about consent and liability specifically for AYUSH digital data.

Meanwhile, global and regional trends underscore the opportunity. WHO resolutions (e.g. Astana Declaration 2018) and strategies (WHO Traditional Medicine Strategy 2014–2023) encourage integrating traditional medicine into primary care [6]. Countries like China offer a model: 89% of China's large public hospitals now have Traditional Chinese Medicine (TCM) clinics [9], supported by national standards and data systems. Other Asia-Pacific nations (e.g. Thailand, Sri Lanka) also blend herbal and modern care. India's pioneering Ayush Grid platform (an IT backbone for AYUSH) has even contributed to WHO's ICD-11 by helping create a “Traditional Medicine” module⁷, paving the way for coding of AYUSH diagnoses.

GAP AND OBJECTIVES

Current literature on this topic is sparse and fragmented, often focused on isolated pilots or policy descriptions. There is no comprehensive guide for how hospital managers can systematically integrate digital health with AYUSH.

This study aims to fill that gap by: (1) Assessing how AYUSH is currently embedded in India's public health infrastructure and how digital health tools are being deployed (drawing from government data, policies, and case reports); (2) Identifying key technological, organizational, and policy challenges in merging these domains; (3) Developing a management framework that addresses these factors for effective integration; and (4) Providing actionable recommendations for managers and policymakers.

METHODS

We undertook a qualitative, policy-oriented analysis using secondary data sources. Data were gathered from official reports, peer-reviewed articles, and case studies, following these steps:

GOVERNMENT AND POLICY DOCUMENTS

We reviewed Ministry of AYUSH and Ministry of Health & Family Welfare press releases, annual reports, and parliamentary answers (e.g. PIB releases and Rajya Sabha reports). We conducted a systematic search of literature and policy documents published between January 2017 (coinciding with the National Health Policy) and February 2025, including official government reports (Ministry of AYUSH, MoHFW, NITI Aayog), peer-reviewed studies on integrative health systems, and operational guidelines for the Ayushman Bharat Digital Mission; purely clinical trials unrelated to health systems management and studies predating the 2017 digital health mandate were excluded. This yielded statistics on AYUSH workforce/infrastructure and digital health rollout (such as the count of ABHA IDs and registered AYUSH facilities). Key policy texts like the *National Health Policy 2017* and ABDM guidelines were examined to understand official integration mandates. We also analyzed national program documents (e.g. *National AYUSH Mission* guidelines) to track co-location and Health & Wellness Centres (HWCs) progress [6,8].

REGULATORY REVIEW

We examined Indian laws and rules affecting integration: the *National Commission Acts (2020)*, the *2020 Telemedicine Guidelines for AYUSH*, and India's emerging data privacy laws. These highlight enablers (e.g. legal teleconsultation allowance for AYUSH) and constraints (e.g. data handling requirements under ABDM's *Health Data Management Policy*).

INTERNATIONAL CONTEXT

We consulted WHO and Asia-Pacific sources. The WHO's *Traditional Medicine Strategy (2014–2023)* and *Astana Declaration* were reviewed to contextualize India's approach internationally. We searched for comparative data (e.g. China's integration of TCM [9]) to benchmark best practices.

ACADEMIC LITERATURE AND CASE STUDIES

We performed a systematic search in databases (PubMed, Google Scholar) for terms such as “AYUSH digital health integration”, “telemedicine traditional medicine”, and “India integrative medicine policy”. Relevant studies (e.g. Ram 2023 on Ayush Grid[3], implementation research by CCRAS, and evaluations of tele-AYUSH pilots) were included. We also examined grey literature: news articles (e.g. *Business Today* reports of AYUSH mission progress[6]), government reviews, and project documentation.

Data extraction was iterative. We organized findings into themes: AYUSH public infrastructure, digital health deployments, integration initiatives, and barriers/enablers. Qualitative data (quotes, descriptions) and key figures (counts of facilities, consultations, IDs) were annotated with sources. Where available, we noted trends over time (e.g. rise in ABHA IDs or AYUSH uptake). These insights informed a conceptual framework. Given the management focus, we also consulted public health management literature to ground our framework in implementation theory, while mostly letting empirical themes drive the model.

ETHICS STATEMENT

This study was based solely on secondary sources and did not involve human participants or identifiable private data. Therefore, ethics committee approval was not required. The procedures followed were in accordance with the National Health and Medical Research Council ethical standards and institutional/national guidelines on research integrity.

RESULTS

1. STATUS OF AYUSH IN PUBLIC HEALTH INFRASTRUCTURE AND UTILIZATION

AYUSH systems have a large footprint in India's health delivery. As noted, 755,780 AYUSH practitioners are registered nationwide [1] (with Ayurveda doctors comprising over half). The public sector supports thousands of AYUSH facilities: Ministry data show 3,844 AYUSH hospitals (with ~50,000 beds) and 36,848 dispensaries as of 2023[1]. Most are government-run (3,403 hospitals and 27,118 dispensaries under government control), with the rest in the private/not-for-profit sector [1]. These run parallel to allopathic facilities but increasingly complement them.

A major integration strategy has been co-location. By 2023, AYUSH units were posted at 6,891 PHCs and 3,149 CHCs [2] (out of roughly 24,000 PHCs and 6,000 CHCs nationally), which translates to roughly 30% of PHCs and 50% of CHCs having an AYUSH doctor. Similarly, hundreds of district hospitals now have AYUSH wings. Under this model, a patient visiting a rural clinic may see an Ayurvedic physician (for say, an arthritis plan) or an allopathic doctor, or both. This dual availability empowers patient choice and supports holistic care. Surveys and program reports indicate substantial use of these services. For example, the AYUSH Ministry reported that in one recent year 84.2 million people availed AYUSH health services through government programs [6]. These include doctor consultations, wellness workshops, and dispensing of herbal medicines. Notably, AYUSH modalities (yoga, herbal remedies, naturopathy kits) are explicitly included in wellness initiatives under *Ayushman Bharat* (e.g. at Health & Wellness Centres), and the government even promoted an Ayurvedic formulation (AYUSH-64) as a supportive treatment during the COVID-19 pandemic [10].

Pilot Integration Initiatives

Some tertiary hospitals are experimenting with integrated departments. For instance, Safdarjung Hospital (Delhi) set up an *Integrative Medicine* department in partnership with the *All India Institute of Ayurveda*, enabling orthopedic or cancer patients to receive complementary Ayurvedic therapies alongside standard care. Similarly, AIIMS institutions are establishing centers (like *integrative oncology*) jointly run with Ayurveda institutes. Early reports from these pilots show positive patient feedback and indications of symptom improvement (e.g. reduced pain medication use), though formal study results are pending. The government has also created higher-level bodies (e.g. a NITI Aayog committee) to strategize integrative health policy, and research collaborations (e.g. Ayush-ICMR centers at AIIMS) to validate AYUSH interventions. These efforts signal growing institutional support for integration.

Despite these gains, full integration remains limited. Most co-located AYUSH units still run as semi-independent clinics: they maintain separate paper registers and receive referrals from patients or doctors on an ad-hoc basis. There is little routine "cross-consultation" where an allopathic physician and an AYUSH physician jointly manage cases. Data fragmentation is a concern: state and national health information systems often do not capture AYUSH patient data, so the scale and outcomes of AYUSH care are underreported. In short, AYUSH is present in the system but often siloed.

2. DIGITAL HEALTH PROGRESS IN AYUSH CONTEXT

India has rapidly built digital health tools, and AYUSH is now gradually being brought onto these platforms. A flagship effort is the Ayush Grid, a suite of IT solutions developed by the Ministry of AYUSH since 2018. Its main component, the AYUSH Hospital Management Information System (AHMIS), is an electronic record system tailored to traditional medicine practice (with fields for Ayurvedic diagnosis, therapies, etc.). Initially deployed in about 100 central government institutions (e.g. *National Institutes for Ayurveda, Unani, Siddha*), its rollout is expanding. AHMIS is now being adopted by more state-run AYUSH hospitals, aiming to replace paper logs. Early adopters report improved record-keeping (such as tracking *Panchakarma* treatments and dispensing of herbal drugs). Over time, the plan is to link AHMIS data to the national

network: already, AYUSH hospitals on Ayush Grid can register patients' ABHA IDs so that their AYUSH encounters form part of a unified longitudinal health record.

Ayush Grid also includes consumer and provider apps. The AYUSH Sanjivani smartphone app, launched during COVID, crowdsourced data on herbal remedies and wellness practices used by citizens and disseminated official AYUSH advisories (e.g. immunity-boosting yoga). Another app, Yoga Locator, helps users find nearby accredited yoga centers. For professionals, Ayush Grid is developing online training portals to upskill AYUSH workers. Importantly, from the outset Ayush Grid was designed to interoperate with the NDHM/ABDM. Technical teams have aligned on standards: AYUSH facilities and doctors are being registered in the nation's Health Facility and Professional registries, and efforts are underway to make AYUSH EHR modules exchange data via the ABDM health information network (using FHIR-based APIs). For example, a patient who receives Ayurvedic treatment at an AYUSH dispensary could have that record uploaded to the national cloud-based record, accessible to any authorized provider they visit later [3,4].

Telemedicine and mHealth: Digital health's biggest boost has been teleconsultation. India's free eSanjeevani service (patient-to-doctor and doctor-to-doctor modes) has become a national backbone. While early usage was mostly by allopathic doctors, states have begun including AYUSH specialists on the platform. For instance, Tamil Nadu integrated homeopathy doctors into its eSanjeevani hubs, resulting in over 1,200 homeopathic e-consults in a few months (mostly for COVID prevention and chronic conditions) and 94% user satisfaction in surveys. The Ministry of AYUSH also independently piloted telemedicine nodes: in late 2019 it launched a Siddha telemedicine center in Tamil Nadu, and by mid-2020 added Ayurveda and Homeopathy nodes via C-DAC. These pilots delivered over 20,000 AYUSH teleconsultations in their early phase [5]. To standardize practice, the Telemedicine Guidelines for AYUSH were issued in April 2020[4], paralleling the allopathic guidelines⁶. These require AYUSH providers to obtain consent, maintain confidentiality, and follow approved prescription rules when consulting remotely. This regulatory support has encouraged more AYUSH clinics and startups to offer online consultations, and the public health network is also planning to link AYUSH doctors into eSanjeevani hubs at higher centers.

AYUSH Health & Wellness Centres (AHWCs): A major platform for integration is the Ayushman Bharat Health & Wellness Centre program. Out of a target of 12,500 AHWCs (as part of 150,000 total HWCs), 2,181 have been sanctioned and 1,518 became functional by late 2023[5]. These upgraded AYUSH dispensaries at the sub-centre/PHC level now offer yoga sessions, herbal drug dispensing, and digital services. Notably, AHWCs are equipped with tablets and internet to use the national HWC portal and telemedicine link. In practice, an AYUSH-trained Community Health Officer at an AHWC can input patient data into the eSanjeevani-AB-HWC system and refer complex cases to district hospitals via video. Early reports show these centres are well-received in rural communities, attracting new patients who appreciate the convenience of integrated primary care. Many AHWCs use telemedicine: for example, a village AYUSH HWC in Assam reported using eSanjeevani to connect villagers with doctors every week, supplementing local Ayurvedic medicine counseling. Over one year, there was a 40% increase in patient visits compared to its former status as a lone dispensary, and digital data reporting meant performance metrics from that remote centre were visible to district managers in real time.

Data Standards and AI: Behind the scenes, standardization efforts are linking AYUSH into the data ecosystem. The Ayush Grid team has developed the National AYUSH Morbidity and Standardized Terminologies Electronic (NAMASTE) portal to aggregate AYUSH clinic data with harmonized codes. Notably, India contributed to WHO's ICD-11 Traditional Medicine chapter, ensuring that Ayurveda, Siddha and Unani diagnostic categories are codified in the global classification [7]. This means that an Ayurvedic diagnosis (e.g. *Ama pachana*) can be recorded using an internationally recognized code, facilitating interoperability. On the cutting edge, AYUSH researchers are also exploring AI and analytics: prototypes exist for AI-based identification of herbs, mobile apps that recognize yoga postures, and data mining of AYUSH treatment outcomes. In partnership with WHO and ITU, Indian experts are even developing guidelines for AI applications in traditional medicine. While these are nascent, they signal a move toward evidence-generation using digital technology.

3. FINANCIAL AND ADMINISTRATIVE DIMENSIONS OF DIGITAL AYUSH INTEGRATION

The integration of digital health innovations with the AYUSH systems in India's public health sector represents a complex transformation. This change extends far beyond technological implementation, fundamentally altering the financial and administrative landscape for traditional medicine. The following analysis examines the critical aspects of professional liability, revenue cycle management, and emerging cost benefits, demonstrating how digital integration acts as a strategic enabler for the professionalization and financial viability of the AYUSH sector.

3.1 Professional Liability Risk and Mitigation in Integrative Healthcare

The practice of integrative medicine, which combines traditional and allopathic approaches, introduces a unique and complex set of professional liability risks. Traditional medical professional liability insurance, which is designed for conventional allopathic practice, often does not adequately cover the diverse modalities and unique risks associated with integrative healthcare [11]. This gap in coverage presents a significant challenge for practitioners who blend therapies, exposing them to potential legal and financial repercussions.

In a pivotal response to this challenge, the insurance market in India has begun to adapt. Major insurers now offer specialized professional indemnity policies that explicitly list AYUSH degrees, including Bachelor of Ayurvedic Medicine and Surgery (BAMS) and Bachelor of Homoeopathic Medicine and Surgery (BHMS), as eligible for coverage [12]. These policies offer financial protection against allegations of medical malpractice, professional negligence, or breach of confidentiality, offering coverage of up to ₹ ₹10 million. [12]. The existence of such a product from a financially risk-averse industry is a powerful indicator of the growing institutional trust and financial recognition of AYUSH as a legitimate and insurable medical profession.

Digital integration is not merely a record-keeping exercise; it is a critical strategy for mitigating these liability risks by establishing a clear, legally defensible framework for practice. A core function of robust digital systems is to ensure meticulous and standardized documentation [13]. Electronic health records (EHRs) can meticulously record consent discussions, track treatment details, manage dosage information, and log follow-up plans, creating an unalterable audit trail that is invaluable in the event of a malpractice claim [13]. The Ayush Hospital Management Information System (AHMIS), a component of the Ayush Grid platform, is a primary example of such a system, as it is tailored to traditional medicine practices to ensure all patient encounters and prescriptions are precisely documented [14]. Beyond documentation, digital platforms also offer protection against breaches of confidentiality and loss of documents, as highlighted in the professional indemnity policies [12]. This is underpinned by the security protocols of national digital health infrastructure like the Ayushman Bharat Digital Mission (ABDM), which are governed by emerging legal frameworks like India's Digital Personal Data Protection Act [14]. By implementing secure storage, encryption, and restricted access policies, these systems ensure data integrity, which is a core requirement for legally robust patient records [13]. For telemedicine platforms, which face a "liability conundrum," a clear digital record of consultations is essential for delineating responsibility and reducing platform liability in case of a mishap [15].

The explicit inclusion of AYUSH degrees in private sector professional indemnity policies signifies a pivotal shift in the sector's standing. Government policy recognition of AYUSH has established it as a legitimate professional body. This legitimacy has in turn convinced private insurers—a risk-averse industry—to underwrite the profession's specific risks. The willingness of a major insurer to offer coverage is not just a commercial service; it is a powerful statement of institutional trust that legitimizes the profession in the eyes of the public and the broader financial sector. Furthermore, the role of digital systems extends beyond clinical efficiency. They function as a form of legal infrastructure. The legal risks for integrative medicine are significant, and digital systems provide a solution by converting what could be ambiguous, paper-based documentation into legally robust, timestamped evidence. This transformation makes digital integration a strategic professional risk-management directive that protects practitioners, improves patient safety, and strengthens the entire professional ecosystem.

3.2 Revenue Cycle Management (RCM) and Financial Streamlining

The financial model for public sector AYUSH services has historically been constrained by limited budgets and dependence on government programs like the National AYUSH Mission (NAM) [16]. However, this model is undergoing a significant evolution with the inclusion of AYUSH in major government and private health insurance schemes.

The Insurance Regulatory and Development Authority of India (IRDAI) has mandated that all insurance providers offer coverage for AYUSH treatments, a move that has provided millions of Indians with financial security for alternative treatments [17]. Schemes like the Central Government Health Scheme (CGHS) and Ayushman Bharat PM-JAY now provide reimbursement packages for inpatient AYUSH care, expanding the potential revenue streams for hospitals [18]. A crucial prerequisite for participating in these modern revenue models is formal accreditation. The National Accreditation Board for Hospitals and Healthcare Providers (NABH) has established a specific accreditation program for AYUSH hospitals, which helps them "demonstrate legitimacy" and become "eligible for government empanelments and insurance schemes" [20]. This accreditation is not merely a quality assurance measure; it is a direct financial enabler. For instance, the CGHS explicitly provides a strong financial incentive for accreditation by offering 15% lower reimbursement rates to non-NABH accredited AYUSH hospitals [21]. This creates a clear causal relationship: government mandates create a market for AYUSH services, and accreditation provides the quality assurance that is rewarded with higher reimbursement rates, thereby making AYUSH hospitals more financially viable.

Digital systems are the central nervous system of this new revenue cycle. The shift to cashless and reimbursement models for schemes like PM-JAY necessitates standardized, digitized processes for billing, coding, and claims submission [18]. For a claim to be successfully processed, AYUSH treatments must be meticulously documented and coded [17]. A groundbreaking development in this regard is the inclusion of an AYUSH-specific chapter in WHO's International Classification of Diseases (ICD-11), a project to which India contributed through its Ayush Grid platform [14]. This provides an internationally recognized coding framework for AYUSH diagnoses, which is indispensable for modern claims processing and data exchange. Interoperability between different systems is crucial. The Ayush Grid's AHMIS is being designed to interoperate with the national ABDM network, enabling a seamless flow of patient data from the point of care to the billing department [14]. Without a digital system that can capture, code, and transmit the required data, an AYUSH unit cannot efficiently participate in these schemes, which explains the slow uptake in digitization noted in research [14].

NABH accreditation is not just a quality-assurance measure; it is a financial enabler and a competitive differentiator [20]. In a modern fee-for-service or reimbursement model, quality and standardization must be auditable, and NABH accreditation provides this critical assurance. The CGHS policy concretely demonstrates that the government rewards this standardization with higher reimbursement rates, creating a powerful causal loop: policy mandates from regulators like IRDAI drive demand, which in turn incentivizes quality assurance through NABH accreditation, which is then rewarded with higher reimbursement rates, thereby ensuring the financial viability of AYUSH hospitals. This shows that digitization, which supports standardization and data capture, is the key to unlocking the economic potential of AYUSH [22]. The details of PM-JAY and CGHS confirm that reimbursement for AYUSH is tied to formal, documented, and often inpatient care [17]. The administrative burden of documenting and processing a high volume of claims is immense, making a paper-based system inefficient and error-prone [14]. Therefore, a modern, digital EHR system that can capture and process this data is not a luxury but a fundamental prerequisite for participating in the formal revenue cycle ecosystem [14].

TABLE 1: FINANCIAL AND ADMINISTRATIVE ENABLERS FOR DIGITAL AYUSH INTEGRATION IN INDIA

Enabler/Scheme	Role in RCM	Key Requirements/Benefits	Corresponding Digital Component
NABH Accreditation	Legitimacy and Quality Assurance	Eligibility for empanelment and insurance schemes; 15% higher reimbursement rates for accredited hospitals [20].	EHR systems, Ayush Grid/AHMIS
IRDAI Mandate	Mandating Coverage	Requires all insurance providers to offer AYUSH coverage [17].	Digital billing and coding platforms
Ayushman Bharat PM-JAY	Cashless and Paperless Access	Cashless cover for up to ₹5,00,000 per family for secondary and tertiary care [19].	ABDM, EHRs
CGHS Empanelment	Reimbursement for Empanelled Hospitals	Provides a package rate for specific treatments; requires detailed documentation and hospital records [21].	EHR systems, Ayush Grid/AHMIS

3.3 Emerging Cost Benefits of Integrated Digital AYUSH

The economic impact of digital AYUSH integration extends beyond streamlined revenue management to encompass significant cost benefits for both patients and the broader healthcare system. One of the most direct and quantifiable benefits is the reduction of patient costs. Telemedicine, in particular, has emerged as a key tool for improving healthcare accessibility and affordability. A study on telemedicine services at a tribal health center in Rajasthan revealed that teleconsultations "significantly reduce patient transportation costs," a crucial factor for underserved populations in remote and hilly regions [23]. This directly addresses the problem of healthcare access in India's vast and rural landscape, where distance and travel expenses can be a major barrier to care [23].

Furthermore, the deeper economic value of integrative medicine lies in its potential to manage chronic and lifestyle-related diseases, which are a major contributor to rising healthcare costs and out-of-pocket spending [24]. A report from ResearchGate suggests that focusing on prevention and lifestyle interventions—a core strength of AYUSH—can reduce the need for hospitalizations and multiple medications, leading to "significant cost savings" for both citizens and the government [25]. By integrating AYUSH therapies like yoga and naturopathy into the digital health system, it becomes possible to track their long-term effects on chronic conditions, providing a data-driven justification for their use in national health programs [25].

A critical and often underappreciated benefit of digital integration is its ability to make the contributions of AYUSH "visible" to policymakers. The original paper notes that data integration could help planners by making AYUSH contributions visible in the Health Management Information System (HMIS) [14]. This visibility is not just a bureaucratic improvement; it is a powerful political-economic tool. In a resource-constrained public health system, funding follows demonstrated need and impact [27]. Historically, AYUSH services operated in a data vacuum, and their patient load "didn't count" in the mainstream HMIS [14]. The Ministry of AYUSH's budget increased by 20% in 2023-24, with a 50% increase for the National AYUSH Mission (NAM), a change that the Press Information Bureau directly linked to the government's focus on "integrating Ayush system in National Health ecosystem" and the stated need for "evidence-based generation of the database for Ayurveda" [27]. As the Ayush Grid and ABDM platforms make patient consultation data visible, policymakers can see the sheer volume of services being delivered. This data becomes a political and economic tool, justifying massive budget increases and securing the financial future of the sector [27]. The budget increase is the direct outcome of the policy to digitize and make AYUSH contributions visible [27]. The economic impact goes beyond reducing costs. The creation of a unified dataset allows for a new kind of economic analysis that can be used to compare outcomes of integrative versus allopathic care, justify new research funding, and even attract medical tourism [28]. The cost benefit of digital integration is therefore not just a reduction of expenses but a creation of new economic and research value [22].

4. INTERNATIONAL MODELS OF TRADITIONAL MEDICINE INTEGRATION

As India embarks on its journey to integrate traditional and modern medicine, an examination of international models provides crucial comparative context. The examples from the Asia-Pacific region reveal a spectrum of integration

philosophies, from cautious, top-down regulation to a more synergistic co-existence [19]. These case studies highlight different strategies and their underlying policy rationales, offering valuable lessons for India's unique pluralistic approach.

4.1 Case Study: Australia's Regulatory Framework for Acupuncture

Australia provides an example of a highly regulated, yet cautious, approach to integrating traditional medicine, with a strong emphasis on formal regulation and a limited scope of practice. The Australian government, through its Medicare Benefits Schedule (MBS), provides a framework for funding traditional medicine, but with strict limitations [30]. Medicare covers acupuncture, but only for "chronic low back pain" and with a capped number of sessions (up to 20 per 12-month period), and it does not pay licensed acupuncturists directly [32]. Instead, the treatment must be administered by a "doctor or another health care provider" who has a master's or doctoral degree in acupuncture and a license to practice [32]. This model places the traditional therapy within a conventional medical framework, prioritizing allopathic oversight [32].

The system is further characterized by rigorous, formal regulation of traditional medicine practitioners. The Australian Health Practitioner Regulation Agency (AHPRA) formally regulates a limited number of traditional medicine professions, with Chinese Medicine practitioners being the most prominent [34]. The Chinese Medicine Board of Australia, which operates under the AHPRA umbrella, is responsible for setting standards, approving courses of study, registering practitioners and students, and handling complaints [35]. This rigorous regulatory environment, while restrictive, provides a framework for quality and safety [37]. Australia's approach is a prime example of a 'top-down,' highly controlled integration. The system only covers a specific, well-researched condition for which acupuncture has demonstrated efficacy, reflecting a risk-averse policy that prioritizes scientific evidence over cultural recognition [32]. This contrasts sharply with India's broader pluralistic approach and is a valuable comparative model. A key lesson is that formal regulation via a government body like AHPRA is a necessary precondition for financial recognition and reimbursement through Medicare [36]. A government agency first sets standards for education, training, and practice, and only once a profession is formally legitimized through this process does the government's financial arm consider funding it [35]. This is a clear causal path that India can emulate by linking its new National Commission Acts for AYUSH to the formal registration processes of ABDM and reimbursement through schemes like CGHS and PM-JAY.

4.2 Comparative Examples from the Asia-Pacific Region

The experiences of other countries in the Asia-Pacific region highlight different strategies for traditional medicine integration, from deliberate re-integration to functional synergy, all of which offer unique lessons for India.

Thailand's model is a compelling case study of a nation that first rejected and then deliberately re-integrated its traditional medicine (TTM). In the early 20th century, TTM was dismissed as "quackery" and outlawed in favor of Western medicine [38]. However, by the mid-1990s, the government began to actively support its re-integration, driven by the Seventh National Economic and Social Plan of 1992–1996, which aimed to "systematize and standardize" the body of TTM knowledge [38]. This led to the creation of the National Institute of Thai Traditional Medicine [38]. As a result of this policy, TTM is now partially subsidized under the country's universal health scheme, and licensed TTM practitioners are available in thousands of hospitals [38]. This model demonstrates that re-integration can be a conscious, top-down policy decision that successfully reclaims a nation's traditional healthcare assets for modern public health benefit.

Sri Lanka has taken a strategic approach to leveraging its indigenous traditional medicine systems, which include Ayurveda, Siddha, Unani, and Desiya Chikitsa, as a means to "reduce the overburden of the health expenditure" and promote medical tourism [39]. The country's National Traditional Medicine Policy for 2024-2034 outlines a clear strategic roadmap to strengthen this sector through better infrastructure, research, and a clear regulatory framework [39]. The policy's focus on health promotion, self-care, and disease prevention, which are hallmarks of its traditional systems, is intended to reduce overall healthcare costs [39]. This shows a commitment to using traditional medicine as a strategic asset for universal health coverage.

The **Democratic People's Republic of Korea (DPR Korea)** offers a unique and highly integrated model. Koryo (traditional Korean) medicine and Western medicine are used as complementary and adjunct therapies at every level of the health system [41]. The system does not treat the two as competing parallels but as synergistic partners [42]. For example, Koryo medicines are used to alleviate the side effects of conventional drugs for conditions like tuberculosis and hypertension, thereby improving patient adherence and outcomes [42]. This approach reframes the value proposition of traditional medicine, positioning it not as a standalone cure but as a patient-centered support that improves the tolerability and efficacy of conventional treatments [42]. This is a highly relevant model for India, particularly in chronic disease management where the side effects of long-term medication are a significant issue [24].

Comparative analysis reveals that integration philosophies vary widely. Australia's model is one of *controlled incorporation*, integrating only evidence-based, low-risk practices [32]. Thailand's is one of *deliberate re-integration*, reclaiming cultural and public health value after a period of neglect [38]. Sri Lanka's is one of *strategic leveraging*, using a traditional system to reduce health expenditure and create economic value [39]. DPR Korea's model is one of *functional co-existence and synergy*, using traditional medicine to support allopathic care [42]. India's approach, with its pluralistic policy and emphasis on co-location, most closely resembles a hybrid of the Thai and Sri Lankan models, but with the added complexity of a massive digital infrastructure.

TABLE 2: COMPARATIVE ANALYSIS OF INTERNATIONAL TRADITIONAL MEDICINE INTEGRATION MODELS

Country	Integration Strategy	Regulatory Body	Financial Model	Key Lesson for India
Australia	Controlled Incorporation	AHPRA/Chinese Medicine Board	Limited Medicare benefits for specific services [32]	Regulation precedes reimbursement; focus on evidence-based, low-risk practices.
Thailand	Deliberate Re-integration	Ministry of Public Health	Subsidization under universal health scheme [38]	Government policy can reverse historical neglect and successfully re-integrate traditional systems.
Sri Lanka	Strategic Leveraging	National Traditional Medicine Policy	Government and private insurance coverage [39]	Traditional systems can be a strategic asset for reducing health expenditure and promoting economic value.
DPR Korea	Functional Co-existence	State Health System	Fully integrated at	Synergy with allopathic care

			all levels of care [42]	can be achieved by using traditional medicine to mitigate side effects and improve patient outcomes.

5. CHALLENGES OF DIGITAL-AYUSH INTEGRATION

Our analysis identified several interrelated challenges:

Technical and Interoperability Issues: Despite Ayush Grid's progress, most AYUSH clinics still lack comprehensive digital systems. A large majority still use paper or isolated software. Where EHRs exist, they often follow traditional terminology not recognized by allopathic systems. For instance, Ayurvedic descriptions of disease do not map easily to ICD-10/ICD-11 terms. This requires continuous work: the NAMASTE portal and coding efforts are helpful, but semantic mapping is complex. Moreover, connecting AYUSH records to the national ABDM network involves real-time data exchange which is hampered by infrastructure gaps. Many rural AYUSH units struggle with spotty electricity and internet. Even when connectivity exists, latency and data reliability can cause syncing delays. Unlike larger allopathic hospitals with IT staff, a small Ayurveda dispensary may have no dedicated tech support. Until these technical gaps are closed, patient data will remain fragmented.

Human Resources and Training: There is a digital literacy divide. AYUSH practitioners, especially older ones, are generally less accustomed to computers and smartphones in their clinical workflow. AHMIS training initiatives (e.g. by C-DAC) have reached a few hundred staff, but this must scale to thousands. We found reports that one-time training often needs follow-up: many providers feel unprepared to type notes or manage digital prescriptions. Conversely, younger AYUSH doctors are keen but need institutional support (devices, software). From the other side, allopathic staff sometimes lack awareness of AYUSH roles or query the validity of AYUSH data, leading to underuse of integrated tools. This cultural gap can slow integration. Overcoming it will require not only computer training, but also joint learning sessions: for example, mentoring allopathic and AYUSH doctors together on using the same EHR interface or on collaborative case management protocols.

Organizational and Funding Barriers: Public hospital bureaucracies complicate new system roll-outs. Our review of cases found that integration projects faltered without a champion to coordinate across departments. For instance, if an AYUSH unit is part of the AYUSH Ministry network but sits inside a state-run hospital (health department), who orders the computer upgrades or network access? These jurisdictional divides often led to misalignment. Budget cycles are another issue: many AYUSH units operate on NAM grants which may not prioritize IT. Unlike mainstream hospitals, they may not have a line item for annual software maintenance or telemedicine equipment. One stakeholder remarked that "AYUSH always seems last on the list" for digital investments. Without dedicated funding and clear mandates, hospital managers tend to focus digital efforts on high-traffic allopathic services, leaving AYUSH units to lag.

Standards and Data Governance: Privacy and data security apply equally to AYUSH, but specific guidance is still evolving. AYUSH teleconsultations generate the same sensitive health data as any other consultation, yet some practitioners remain unsure how to obtain digital consent or where to store e-prescriptions. Under ABDM policy, patients must consent before their data enters the central system, but implementation is uneven (e.g. in a crowded PHC setting, digital consent forms may be skipped). An additional nuance is traditional knowledge: digitizing AYUSH practices (like local herbal recipes) raises issues of intellectual property and ethical use. Policymakers have not fully articulated how AYUSH data should be shared for research versus protected. Furthermore, there is no uniform standard yet for AYUSH digital coding. While the WHO ICD-11 Traditional Medicine chapter exists, its adoption in software is nascent. Without consistent data standards, hospitals cannot easily aggregate AYUSH outcomes or compare across sites.

Evidence and Perception Gaps: A subtle barrier is the lingering question of measurable benefit. Some managers and physicians question the value-add of integrating AYUSH into digital systems: if AYUSH treatments lack large-scale efficacy trials by Western criteria, why invest in their data? This can dampen enthusiasm. Ironically, integration could generate the needed evidence (by tracking outcomes), but there is a chicken-and-egg problem: stakeholders want proof before they build systems. To break this, even small pilot evaluations must capture patient and cost outcomes for integrated care models. Without demonstrating improved metrics (e.g. reduced repeat visits for chronic patients using combined therapies), AYUSH digital integration may be seen as an expense rather than an investment.

Heterogeneity of AYUSH Practices: AYUSH is not monolithic. The five recognized systems (plus Yoga) each have unique diagnostic frameworks. A single EHR must accommodate an Ayurvedic pulse chart, a Unani mizaj, Siddha Tasina marks, and homeopathic potencies. This diversity complicates design. One-size-fits-all digital templates may oversimplify or ignore key data fields. For example, a standard billing module might not easily encode complex Panchakarma therapy regimens. This requires software flexibility and consultation with each discipline's experts.

TABLE 3: KEY CHALLENGES IN INTEGRATING DIGITAL HEALTH WITH AYUSH, AND SUGGESTED MITIGATION STRATEGIES.

Challenge	Description	Potential Mitigation
Data interoperability	AYUSH records use nonstandard terms (e.g. Sanskrit diagnosis, herbal formulations), making exchange with allopathic EHRs difficult.	Develop standardized AYUSH terminologies (as in NAMASTE/ICD-11) and map them to global codes. Adopt common data models (e.g. FHIR) and APIs so AYUSH software can link with hospital EHRs.
Technical infrastructure gap	Many AYUSH facilities lack adequate computers, connectivity, or unified software. They may use standalone or paper systems.	Provide basic IT infrastructure (PCs, tablets, internet) to AYUSH units via NAM funding. Implement cloud-based, mobile-capable applications with offline data capture. Establish district-level AYUSH IT support personnel.
Digital literacy and training	AYUSH staff often have limited experience with EHRs/telehealth. Initial training may be insufficient, causing reluctance.	Conduct regular hands-on workshops for AYUSH professionals on using hospital IT systems and telemedicine platforms. Introduce IT education in AYUSH curricula. Create "AYUSH Digital Champions" (enthusiastic younger staff) to mentor peers.
Professional silos/resistance	Skepticism exists on both sides: some modern doctors undervalue AYUSH data; some AYUSH practitioners resist digital oversight.	Organize interdisciplinary case conferences and joint protocols. Highlight success stories of collaborative care. Encourage hospital leaders to endorse an inclusive culture. Engage professional bodies to issue joint statements promoting mutual respect and integration.

Administrative coordination	AYUSH and allopathic departments often have separate governance; new projects fall between jurisdictions.	Form joint committees/task forces (at hospital, district, state levels) with AYUSH and Health ministry representatives. Appoint integrative health coordinators to bridge departments. Align reporting requirements so AYUSH data flows into mainstream HMIS.
Funding and resource constraints	Limited budgets in AYUSH can delay digital upgrades (e.g. buying hardware, maintaining systems).	Allocate dedicated budget lines under NAM/ABDM for AYUSH digitization. Tie funding to integration targets (e.g. grants for states that implement AYUSH EHRs). Seek public-private partnerships or CSR funding for technology in traditional medicine units.
Privacy & data security	Ensuring AYUSH patient data is securely managed under consent rules; safeguarding proprietary traditional knowledge from misuse.	Implement the ABDM Health Data Management Policy for all AYUSH records (obtaining patient consent, using secure APIs). Train AYUSH staff on data privacy practices. Consider special regulations to protect indigenous knowledge embedded in digital records.
Unproven benefit perception	Decision-makers may question the ROI of integrating AYUSH without clear evidence of improved outcomes.	Build monitoring/evaluation into pilot programs. Collect patient feedback and clinical outcomes data for integrative services. Publicize findings (e.g. improved quality of life or reduced drug use) to demonstrate value. Use evidence to refine and scale successful models.
Heterogeneity of AYUSH modalities	Multiple systems (Ayurveda, Yoga, Unani, etc.) each with distinct diagnostics and treatments, complicating a single digital solution.	Develop flexible digital modules tailored to each system's needs. Involve each AYUSH discipline's experts when designing data fields and workflows. Harmonize core elements (like patient history, prescriptions) across systems where possible.

6. CASE INSIGHTS

Concrete examples illustrate these themes. At Safdarjung Hospital (Delhi), the Ayurveda wing tried a shared EMR: referrals from orthopedics went into a common digital folder. Over one year, ~500 patients received Ayurvedic therapies alongside standard care. Staff noted anecdotal improvements (e.g. lower pain medication use), but also friction: the hospital EMR wasn't designed for Ayurveda, forcing doctors to free-text notes. This highlighted the need for customized EHR interfaces and IT support[44]. In Tamil Nadu, homeopathy doctors at a state telemedicine hub on eSanjeevani saw ~1,200 patients over 3 months, mostly for COVID advice and stress management. Patient surveys showed ~94% satisfaction. However, it was reported that some staff were unsure how to triage to the homeopaths, suggesting protocols are needed for who to refer into integrative telehealth slots [45].

Data initiatives also show promise: Rajasthan contributed 50,000 AYUSH outpatient records to the NAMASTE portal, revealing that respiratory and joint disorders are very common among AYUSH patients. State officials used this insight to start an integrative lung clinic combining Ayurveda and modern asthma care in one district. This case also taught that data quality had to be improved by using standardized electronic forms. In rural Assam, an AYUSH HWC equipped with a tablet saw 40% more visits after adding teleconsultation and yoga classes. The officer learned to schedule tele-appointments when the 4G signal was strongest, ensuring reliable use of eSanjeevani despite connectivity issues. These cases underscore that careful management – from technical setup to scheduling and training – can make integration tangible at the ground level.

DISCUSSION

Our investigation shows that India possesses the foundational building blocks for AYUSH–digital integration, but scaling this in practice is challenging. The enabling environment is strong: national policy (NHP 2017, 2020 Cabinet decisions) explicitly calls for a “pluralistic approach” linking AYUSH with primary care⁸. Technology-wise, platforms like Ayush Grid and ABDM exist to support interoperability, and hundreds of millions of citizens and thousands of AYUSH providers have already joined the digital system. These conditions are, globally speaking, uncommon: few countries have invested so heavily in both traditional medicine and health IT simultaneously. The case of China – where nearly 90% of major hospitals have TCM departments [9] – shows that large-scale integration is attainable with strong government direction. India’s evolving digital ID system and telemedicine may even position it ahead: for example, the inclusion of Ayurveda in ICD-11 [7] was driven in part by our Ayush Grid collaboration, hinting India’s leadership in this space.

However, we found that “on-paper” integration has yet to become “on-the-ground” transformation. As of 2023, while the Ayush Grid and ABDM networks are operational, many AYUSH units remain only partly digitized. Only 1,518 AHWs out of 12,500 planned are active [5] – progress, but slow. The 37/137 integrated hospitals statistic [6] also shows that even designated centers faced delays. The COVID-era explosion of telemedicine occurred mainly in the allopathic sector, and AYUSH uptake was modest by comparison. Our analysis attributes this to the multi-faceted barriers outlined above: interoperability is technically difficult, people need training, and without visible quick wins, managers have limited incentive to push deeper integration immediately.

In spite of limitations, our findings indicate real benefits to be gained. Patients using integrative digital care often report higher satisfaction, and there are logical cost and health gains – for example, if tele-AYUSH can manage mild conditions remotely, it frees allopathic specialists for more acute cases. The very act of integrating data makes AYUSH contributions visible: one state health minister remarked that seeing AYUSH consultation numbers in the HMIS motivated increased support, whereas before these patients “didn’t count” in the system. Moreover, as our pilots suggest, combining therapies (e.g. yoga plus antihypertensives, or Ayurvedic diet counseling plus diabetes meds) may improve outcomes in chronic diseases. Digitization will generate evidence to prove or refine these synergies.

STRENGTHS AND LIMITATIONS

Our study’s strength lies in its breadth and currency. We compiled the latest official statistics and policy news (up to mid-2025) alongside academic sources, providing a panoramic view of a rapidly evolving field. Triangulating Ministry press releases with independent media (e.g. *Business Today* reports [6]) gave robustness to key figures. We also drew on international benchmarks to contextualize. However, the analysis has limits: it is largely descriptive and based on published data. We did not conduct new surveys or interviews, so some practical nuances (like the day-to-day workflow changes) rely on secondary accounts. Certain numbers (e.g. actual AYUSH teleconsult volumes) were not fully available, so we cite the best estimates we found. The framework proposed is conceptual; its practical effectiveness will require testing in real settings. Nonetheless, by documenting current status and obstacles comprehensively, we provide a foundation for further operational research.

MANAGEMENT FRAMEWORK AND RECOMMENDATIONS

Based on our findings, we outline a framework centered on four interlocking domains. Hospital administrators and policymakers should ensure progress in each to achieve true integration:

1. TECHNOLOGY INFRASTRUCTURE

Equip all AYUSH units with digital tools and connect them to the national network. This means deploying or upgrading hospital information systems (HIS) that support AYUSH workflows. For instance, the AHMIS or e-Hospital systems used in mainstream facilities should be extended into AYUSH wings, with fields for traditional therapies. Rural clinics need tablets or PCs with reliable internet. Administrators can leverage funds: the National AYUSH Mission already has provisions for upgrading AYUSH dispensaries and telemedicine nodes. Importantly, the chosen technology must be interoperable: it should follow ABDM/NDHM standards (open APIs, FHIR data formats) so that patient data flows into the centralized health record. Regular technical audits should ensure AYUSH data is not stranded in siloed software.

2. STANDARDS AND DATA INTEGRATION

Develop and adopt consistent coding and data standards for AYUSH across systems. This includes finalizing and implementing the terminology sets (e.g. the NAMASTE dictionary) and linking them to ICD-11/12 codes[7]. All EHR vendors and hospital IT teams should incorporate these terms. Data-sharing protocols must be established: for example, if a patient has a history of an Ayurvedic procedure, that info should be fetchable by any physician treating the patient next. Privacy mechanisms (as per ABDM policy) must be applied uniformly, with digital consent taken for any AYUSH data entering the cloud. Policymakers should consider adding AYUSH-specific modules to the national EHR guidelines.

3. CAPACITY BUILDING AND CULTURE CHANGE

Invest in people. This means training AYUSH doctors, nurses, and staff not only on the use of computers but on the value of integrative care pathways. Workshops can cover how to document an AYUSH case in the EHR, how to use decision-support apps (e.g. automated drug interaction checkers that include herbal formulations), and best practices for telemedicine etiquette. Allopathic clinicians should receive orientation on interpreting AYUSH terms and respecting parallel treatments. Leadership should designate "digital AYUSH champions" (motivated staff with extra tech skills) in each department to mentor others. Institutions can create joint clinical rounds where an allopathic and an AYUSH doctor consult on complex cases together, demonstrating mutual respect and teaching each other's approaches. Over time, such cross-training can reduce skepticism and make collaborative care the norm.

4. GOVERNANCE AND POLICY ALIGNMENT

Ensure that rules, leadership, and incentives align. At the national/state level, there should be explicit mandates for integration. For example, the Ayushman Bharat guidelines could require that all public hospitals with AYUSH units link those units into the hospital's digital systems. Joint committees (as under NITI Aayog's integrative health initiative) should oversee inter-ministerial coordination, clarifying who funds what (e.g. AIS hires vs digital network expansion). In hospitals, form an Integrative Health Committee (with AYUSH and IT leads) responsible for rolling out projects. On the regulatory side, clarification is needed: telemedicine rules and data protection laws should explicitly cover AYUSH teleconsults and records. Policymakers might also institute performance metrics e.g. include AYUSH service utilization and digital usage rates in hospital scorecards.

POLICY LEVEL ACTIONS

In parallel, national programs should be tweaked to institutionalize integration. For instance, the National AYUSH Mission could add targets like "80% of co-located PHCs will use EHR by 2026." Insurance schemes or reimbursement structures (in the future) could encourage electronic record-keeping for all services. Global collaboration is another lever: the WHO's new Global Centre for Traditional Medicine (in India) can help set international standards and support research collaborations to promote evidence-based integration. Finally, continued advocacy is crucial: success stories (e.g. reduced patient travel or better chronic care with AYUSH-modern combos) should be published to build momentum.

Our analysis suggests this integrated approach will yield multiple benefits: improved access (especially in rural and tribal areas where AYUSH is popular), more comprehensive patient records, and richer health data for planners. It aligns with global UHC goals by offering more care options and emphasizing prevention (a traditional AYUSH strength). In summary, the convergence of digital health and AYUSH can transform India's public hospitals into truly holistic health hubs, but realizing this requires a concerted, well-managed strategy as outlined.

FUTURE RESEARCH

To refine this framework, implementation research should be conducted. Studies can test specific interventions (e.g. a new EHR module or joint training program) in selected hospitals and measure outcomes such as patient satisfaction, clinical indicators, and cost. Comparative analyses across states can identify which policies or funding models work best. With India generating an enormous dataset as integration proceeds, data science research should also examine how AYUSH treatments affect long-term outcomes when combined with standard care. These efforts will not only improve India's health system but can also serve as a model for other countries blending traditional medicine with modern digital health.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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KNOWLEDGE, ATTITUDES, AND PRACTICES OF REPRODUCTIVE HEALTHCARE SCHEMES AND EVALUATION OF A MENSTRUAL HYGIENE AWARENESS MODULE AMONG TRIBAL WOMEN AND ADOLESCENT GIRLS IN JHARKHAND, INDIA: A MIXED-METHODS PILOT STUDY

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ABSTRACT

PURPOSE:

This study aimed to evaluate the Knowledge, Attitude, and Practices (KAP) related to the healthcare schemes among reproductive-age tribal women, along with the perspective of various stakeholders, and to pilot an awareness module on menstrual health among tribal adolescent girls.

METHOD:

In the first phase needs assessment for KAP with a sample of 100 randomly selected participants was done. This was collected through a questionnaire, followed by an in-depth interview among ten participants. A descriptive analysis in terms of frequency and percentage, followed by the chi-square test was done. For in depth interviews, analysis was performed manually, and themes were generated. In the second phase, a preliminary awareness module related to the menstrual hygiene was developed. A health awareness session of the developed module was delivered to 30 participants, and their feedback were collected.

RESULTS:

Approximately half of the reproductive-aged tribal women (52%) and adolescent girls (50%) were aware of reproductive healthcare schemes; however, awareness of specific services was largely partial and primarily limited to cash-incentive schemes. Scheme utilization was reported by 52% of reproductive-aged women, while no adolescent girls reported utilization. Qualitative findings highlighted cash benefits, cultural practices, lack of supervision, inadequate infrastructure, and limited awareness as key barriers. The menstrual hygiene awareness module was well received, with 46.7% rating it as good and recommending school-based integration and culturally relevant visuals.

CONCLUSION:

This study shows that awareness and use of reproductive healthcare schemes among tribal women and adolescent girls in Jharkhand are low, mainly influenced by cash incentives, reflecting gaps in health communication and service delivery.

The findings highlight the need for culturally appropriate, community-based policy approaches beyond financial incentives. Strengthening awareness activities, training, supervision, and healthcare infrastructure can improve scheme reach and equity. The menstrual health module was well accepted, supporting its integration into school and community programs for wider and sustainable impact.

KEYWORDS

indigenous people, adolescent, female, reproductive health, health awareness

BACKGROUND

The United Nations, Sustainable Development Goals (SDGs) underscore the importance of addressing health, education, and social inequities among indigenous population, as their inclusion is critical to achieve equitable and sustainable development by 2030.[1] In any community, females in the reproductive-age group (15-49 years) constitutes the priority group, because 15-49 year females are given special importance in planning, implementation, evaluation of health and social interventions, because of their critical role as individual, in family, and towards population health outcomes. These age group constitutes approximately 71.14% of the total population in developing countries, with 22.2% of the total population in India.[2] These age groups include some of the most important turning point in women's life. This period also represents a critical window, during which health knowledge, attitudes, and practices established in adolescence. An early adulthood directly influences reproductive outcomes, maternal health, and intergenerational well-being. . By the time they turn 15-18 years, two-third of the female get married, which leads to unsafe pregnancies. Approximately 27 million live births and 30 million pregnancies occur annually in India. Millions of women experience pregnancy-related illness each year, and over 57,000 maternal fatalities occur in India each year.[2] The Indian Maternal Mortality Rate (MMR) is greater in rural regions than in urban regions. Therefore, women play a crucial role in shaping the nation's future.[2] Focusing on one of the Indian states: Jharkhand, which is located in the east-central region of India.[3] This state is also known for its rich biodiversity, consisting of various tribal population. These tribal population refer to indigenous communities with distinct cultural, social, and historical identities, often residing in geographically isolated areas. In India, they are officially recognized as Scheduled Tribes (ST) and commonly face social and health-related disadvantages. There are approximately 32 tribal groups in the state, among which the Santhal Tribes constitutes the majority.[3] The estimated total population of ST is 8,645,042, of which 7,868,150 live in rural areas and 7,76,892 live in the urban region.[3] East Singhbhum, is a district in Jharkhand and a home to various tribal communities, such as the Santhal, Ho, Munda, Kharia, Savar and Bhumij tribes. These communities face healthcare challenges due to socioeconomic disparities, limited healthcare access, traditional beliefs, and practices among tribal communities.[4] The Indian government has implemented various health schemes across the country, including in the state of Jharkhand to tackle these situations. Therefore, the aim of implementing health schemes is to safeguard well-being and establish a prosperous society for women of reproductive age group.[4] There are several health coverage schemes running in India to improve the health of a women and adolescent girls. These healthcare schemes are "Janani Suraksha Yojana" (JSY), "Janani Sishu Swasthya Karyakram" (JSSK), "Pradhan Mantri Matri Vandana Yojana" (PMMVY), "Rashtriya Kishori Swasthya Karyakram" (RKSK), "Poshan Abhiyan" (PA), "Anemia Mukh Bharat" (AMB), and the National Family Welfare Scheme "ASHA Schemes & Enhanced Compensatory Scheme".

Despite the availability of these schemes, evidence suggests that their utilization remains suboptimal among tribal women, largely due to gaps in the awareness, sociocultural barriers, inadequate health communication, and systemic challenges at the service delivery level.[5] East Singhbhum district, which has a substantial tribal population, presents a critical context for examining these disparities. Understanding the extent of scheme utilization and the barriers faced by the tribal women in this district is essential for identifying implementation gaps and informing context-specific interventions.[4] Therefore, this study focus on assessing the utilization of healthcare schemes among tribal women of reproductive age in East Singhbhum, Jharkhand, and on developing and validating a culturally appropriate menstrual health awareness booklet to enhance knowledge, awareness, and informed health-seeking behavior.

This pilot study was a part of doctoral research, conducted in two phases.[4] In the first phase, the objectives of the study were to assess the knowledge, attitudes, and practices of relevant healthcare schemes among adolescent girls and tribal women in the reproductive-age group. Another objective was to understand the challenges faced in the provision of tribal women's healthcare schemes from different stakeholders' perspectives. The second phase was the implementation phase, with the objective of developing and validating an awareness booklet on menstrual health for tribal adolescent girls and to evaluate the perception of participants toward it. Despite of the documented gaps in the utilization of reproductive healthcare schemes among tribal population, evidence from Jharkhand integrating KAP assessment, stakeholder perspectives, and pilot testing of a culturally tailored menstrual health intervention is limited. Therefore, this pilot mixed-methods study addresses the gap by combining these elements in the tribal setting.

METHODS:

A cross-sectional study was conducted in East Singhbhum district of Jharkhand. An Institutional Ethics Committee (IEC) approval was taken from Manipal Tata Medical College, Institutional Ethics Committee with the IEC number MTMC/IEC/2023/53. . Data collection was initiated after the participation information sheet was explained to the study participants. Signatures were obtained from the study participants on the informed consent form, and in the case of minors, written assent was also obtained from the concerned parents/guardians. Eight healthcare schemes were included to assess the knowledge, attitudes, and practices of these schemes among the study participants as listed in Table 1.[6]

TABLE 1: EIGHT HEALTHCARE SCHEMES INCLUDED IN THE STUDY

Adolescent Girls schemes	Schemes for reproductive-age group women
1.Rashtriya Kishori Swasthya Karyakram	4.Janani Suraksha Yojana
2.POSHAN Abhiyan	5.Janani Sishu Suraksha Karyakaram
3.Anaemia Mukht Bharat	6.Pradhan Mantri Matri Vandana Yojana
	7.Pradhan Mantri Surakshit Matritva Abhiyan
	8.Family Planning Schemes under NHM including: a. ASHA Scheme b. Enhanced Compensatory Scheme
	8. Anemia Mukht Bharat

In Phase 1 (Need assessment), Under objective 1, to assess the KAP towards reproductive health schemes of India, the study focused on adolescent girls (10-19 years) and tribal women (15-49 years) from the Santhal, Ho, Munda, Bhumiz, Kharia, and Sabar tribes. Details of the different tribes living in the East Singhbhum region are mentioned in Table 2: Name and percentage of the different tribes residing in the East Singhbhum District excluding migrant populations and those with mental illness.

TABLE 2: NAME AND PERCENTAGE OF THE DIFFERENT TRIBES RESIDING IN THE EAST SINGHBHUM DISTRICT

Sl. No.	Name of the different tribes residing in the East Singhbhum District	Percentage
1.	Santhal	15.01%
2.	Bhumij	5.44%
3.	Ho	2.48%
4.	Munda	2.36%

5.	Ghasi	1.08%
6.	Bhuiya	0.70%
7.	Dom	0.65%
8.	Mahli	0.59%
9.	Oraon	0.54%
10.	Kharla	0.48%
11.	Savar	0.35%
12.	Lohra	0.24%
13.	Gond	0.18%

Two villages were randomly selected from the Golmuri cum Jugsalai block in East Singhbhum, Jharkhand, with 50 participants chosen from each village: 25 reproductive-aged women and 25 adolescent girls.

Knowledge was assessed under three domains: awareness of healthcare schemes, awareness of services provided under the schemes, and source of information. These domains captured participants' recognition of schemes, understanding of scheme benefits, and the channels through which information was obtained. Attitude was assessed in three domains: perceived benefits of healthcare schemes, overall experience with scheme-related services, and perceptions regarding the role of community participation in improving community health. Whereas practices were assessed in three domains: utilization of healthcare schemes, receipt of financial assistance, and perceived adequacy of existing schemes in meeting tribal community health needs.

In objective two, to understand the challenges faced in the provision of tribal women's healthcare schemes from different stakeholders' perspectives. Purposive sampling technique was used for qualitative analysis, and in-depth interviews were conducted with 10 participants. These participants were frontline health workers and other volunteers such as Accredited Social Health Activist (ASHA) workers, Auxiliary Nurse Midwifery (ANMs), Anganwadi Workers (AWWs), Gram Mukhiya/ Gram Pradhan (village head), Health Officers, and Tribal women of reproductive age group.

In Phase 2, a preliminary menstrual hygiene module under the Rashtriya Kishor Swasthya Karyakram was developed and was delivered to 30 participants through an interactive session, followed by a Q&A segment. This module talked about the menstrual hygiene awareness booklet was designed as an educational intervention to improve menstrual health knowledge and hygiene practices. It covered menstruation basics, hygienic practices, sanitary product use and disposal, and myth-busting messages in simple, illustrated language. A training/awareness session presentation of this booklet of around three to four hours was provided to 30 study participants. Feedback was collected. The details of the module are provided in the extended data file as the menstrual hygiene scheme preliminary module.[7]

STATISTICAL METHODS:

SAMPLE SIZE CALCULATION

In phase 1, this pilot study was part of a doctoral research project with a total sample size of 745.[4] For objective 1, considering 10% of the study sample (n=74) and a dropout rate of 20%, the final calculated sample size was 92, which was rounded to 100. This figure was rounded up to 100 to enhance statistical precision, ensure adequate representation of subgroups, and account for potential incomplete or missing responses during data collection, thereby strengthening the methodological rigour of the study. A self-administered questionnaire validated by external experts and translated into Hindi language was used.[8] The tool has two sections: Section A covers demographic details, and Section B consists of a baseline survey on tribal women's knowledge, attitudes, and practices related to the eight healthcare schemes. The content validity index (CVI) score of the questionnaire was 0.92, with a reliability score of 0.734 using Cronbach's alpha. This is a statistical measure used to assess the internal consistency and reliability of items within a scale, indicating how closely related the items are in measuring the same construct. Descriptive statistics (frequency, percentage, and median)

and a chi-square test were used to examine the association between two categorical variables by comparing observed frequencies with expected frequencies. . Raw data set is mentioned in the data availability section.[9]

Under objective 2, qualitative part, analysis was done manually with the help of Microsoft Excel software. A total of ten in-depth interviews with ASHA, ANM, gram mukhiya, tribal women, and adolescent girls with the help of an interview guide was done.[8] The SWOC framework was used to organize qualitative findings because it provides a structured and systematic approach to capturing internal strengths and weaknesses as well as external opportunities and challenges related to the implementation and utilization of healthcare schemes, thereby enhancing analytical clarity and programmatic relevance.

In Phase 2, a preliminary awareness module on menstrual health[7] was developed on the basis of gaps identified in the literature and the results and suggestion came from the study participants from objective 1 and 2 under phase 1. This booklet was also validated by the public health experts with a CVI index of 0.79 and delivered to 30 adolescent girls and reproductive-aged tribal women from one of the blocks in East Singhbhum district in the state of Jharkhand, India. The training sessions included interactive lectures, local-language audiovisual clips, question and answer sessions, and feedback collection.

RESULTS:

PHASE 1 (NEED ASSESSMENT)

In both the groups i.e. tribal women and adolescent girls the majority number of participants were from the Santhal tribe. Approximately 48% of the study participants were aged between 15 to 29 years, and 60% of the study participants were aged 10-15 years. The characteristics of the participants are listed in Table 3.[10]

TABLE 3: SOCIO-DEMOGRAPHIC DATA REPRESENTING CHARACTERISTICS OF THE STUDY PARTICIPANTS

Reproductive-age tribal women (n=50)		Adolescent girls (n=50)	
Variables	Percentage	Variables	Percentage
Marital Status		Marital Status	
Married	94%	Unmarried	100%
Widowed	6%		
Religion		Religion	
Sarna Dharam	100%	Sarna Dharam	100%
Tribal Affiliation		Tribal Affiliation	
Santhal	70%	Santhal	100%
Munda	18%		
HO	12%		
Age		Age	
20-29years	48%	10-15 years	60%
30-39 years	20%	15-19 years	40%
40-49 years	32%	NA	NA

Knowledge: Among reproductive-aged women (n = 50), 26 participants (52%) were aware of reproductive healthcare schemes, while 24 (48%) were not aware. However, none of the women reported complete awareness of the services available under these schemes; 26 (52%) had only partial awareness, and 24 (48%) reported no awareness of scheme services. Among adolescent girls (n = 50), 25 (50%) were aware of healthcare schemes and 25 (50%) were not aware. Similar to reproductive-aged women, none of the adolescent girls demonstrated complete awareness of services under the schemes; 25 (50%) reported partial awareness, while the remaining 25 (50%) had no awareness. Regarding sources of

information, among reproductive-aged women who were aware (n = 26), 17 (65%) reported ASHA workers as their primary source of information, while 9 (35%) received information through AWWs. In contrast, among aware adolescent girls (n = 25), only 2 (8%) obtained information through ASHA workers, AWWs, or family and friends, whereas the majority, 23 (92%), relied solely on AWWs as their source of information.

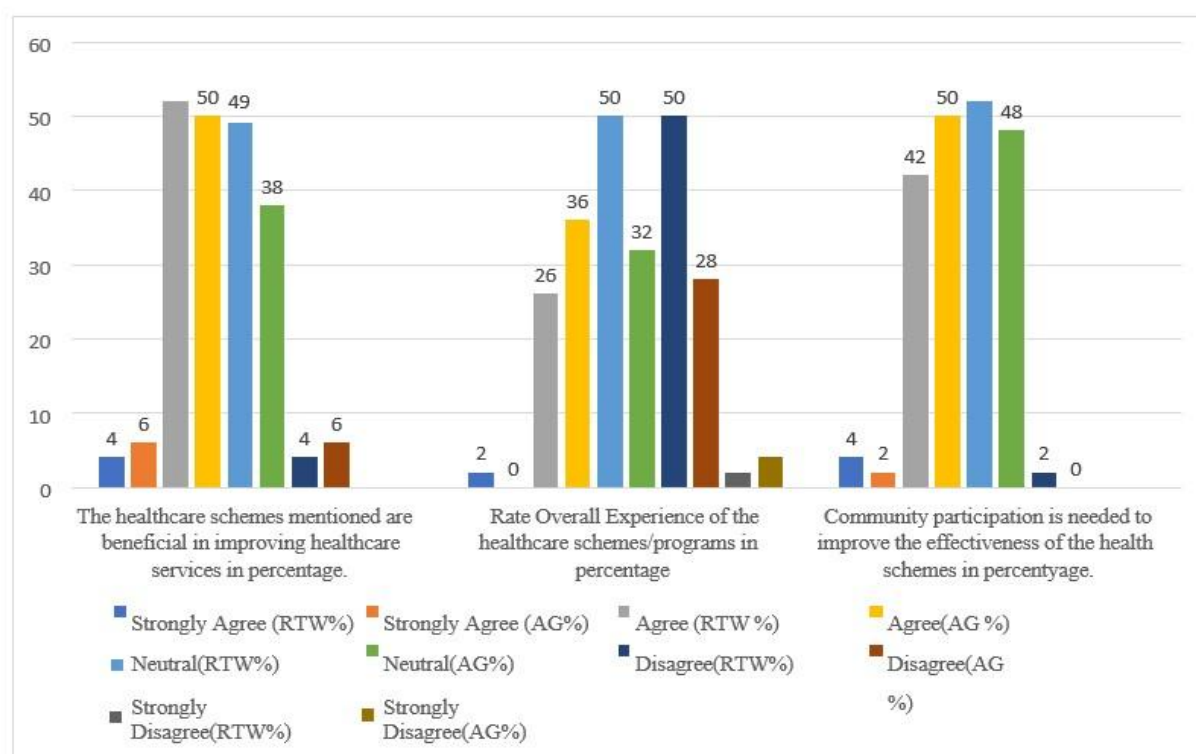
A chi-square test revealed that tribal affiliation among reproductive-aged women was significantly associated with awareness of healthcare schemes ($P=0.024$). However, age and occupation among women and age among adolescent girls were not significantly associated with awareness. Similarly, the education level of adolescent girls did not significantly impact their awareness of healthcare schemes. The results of the association test are presented in Table 4.[11]

TABLE 4: ASSOCIATION OF SOCIO-DEMOGRAPHIC FACTORS WITH KNOWLEDGE OF HEALTHCARE SCHEMES AMONG REPRODUCTIVE AGE GROUP WOMEN.

Knowledge	Categories	Levels (N=50)		Chi Square value	Df	P value
		Yes/Partial	No			
Awareness of healthcare schemes/Programs	Tribal Women in the reproductive age group					
	Age					
	20-29	8	16	4.84	2	0.089
	30-39	5	5			
	40-49	11	5			
	Tribal Affiliation					
	Santhal	21	14	7.44	2	0.024
	Munda & Ho	5	10			
	Occupation					
	Homemaker	20	19	0.0366	1	0.848
	Self employed /Government /Private Job	6	5			
	Education					
	Illiterate	8	8	2.58	4	0.630
Literate	18	16				
Adolescent Girls						
Awareness of healthcare schemes/Programs	Education					
	Primary education	16	20	9.04	4	0.060
	Secondary education	9	5			
	Age					
	10-14	17	13	1.33	1	0.248
15-19	8	12				

Attitude: The analysis of attitudes revealed that 50% (n=25) of the participants in both groups were neutral regarding the perceived benefits of healthcare schemes in improving services. However, both groups agreed that community participation is essential for improving the effectiveness of healthcare schemes, with 42% (n=21) of reproductive-aged women and 50% (n=25) of adolescent girls supporting this view. Figure 1 [12] shows detailed attitudes toward reproductive healthcare schemes.

FIGURE 1. ATTITUDE OF REPRODUCTIVE-AGE GROUP TRIBAL WOMEN (RTW) AND ADOLESCENT GIRLS (AG) TOWARDS REPRODUCTIVE HEALTH CARE SCHEMES



Practices: Among reproductive-aged tribal women (RTW), 52%(n=26) reported having availed the benefits of reproductive healthcare schemes and received financial cash assistance, while 48%(n=24) reported not availing such benefits. In contrast, none of the adolescent girls (AG) reported availing financial benefits under the schemes (0%), with all respondents indicating non-utilization. Regarding perceptions of adequacy, 40%(n=20) of RTW felt that existing schemes were sufficient to meet the healthcare needs of the tribal community, whereas 60%(n=30) believed they were inadequate. Among adolescent girls, only 30%(n=15) perceived the schemes as adequate, while a larger proportion, 70%(n=35), reported that existing schemes were insufficient. These findings demonstrate that although over half of reproductive-aged women have accessed scheme benefits, utilization and perceived adequacy remain markedly lower among adolescent girls, underscoring significant gaps in scheme reach and effectiveness for this younger population. Participants from both groups emphasized the need for more awareness and training sessions on healthcare schemes. They were predominantly aware of schemes offering direct monetary incentives (cash benefits): such as Janani Suraksha Yojana (JSY), Pradhan Mantri Matru Vandana Yojana (PMMVY); which were recommended by the majority.

In Objective 2: The qualitative analysis of ten in-depth interviews revealed key themes related to strength, weakness, opportunities, and challenges (SWOC). The verbatim responses in relation to the in-depth interviews on challenges faced in the provision of tribal women's healthcare schemes from the participants are detailed in Table 5,[13] and the themes developed from the interviews are shown in Figure 2.[14]

FIGURE 2: REPORTING OF THE THEMES FROM THE PROBING QUESTIONS BASED ON THE STRENGTH, WEAKNESS, OPPORTUNITIES, AND CHALLENGES (SWOC).

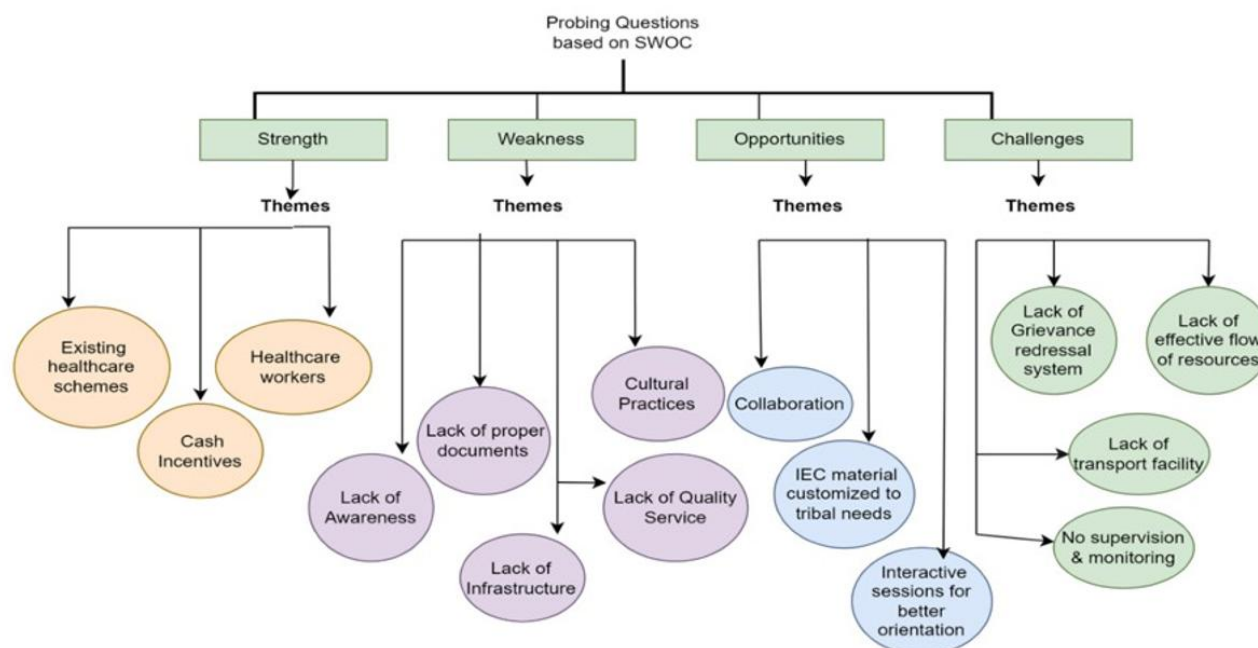


TABLE 5 VERBATIMS BY THE STUDY PARTICIPANTS

S.No.	Participants coded Name & Age	Verbatims by participants
1.	ASHA, 35	"More awareness is needed through pictorial form or audio-visual clips"
2.	Gram Mukhiya, 34	"Still there is a need for awareness, women in this village uses local clothes for maintaining their personal hygiene, and they wash it with plain water"
3.	Adolescent Girl, 18	"We never went to Anganwadi centers, also here is no proper building for Anganwadi centers"
4.	Tribal Women, 28	"I got the money after my delivery, ASHA Didi helped me in getting the money. But I suggest if we can get information on the documentation process, how to open bank account, making aadhar/ pan card"
5.	Tribal Women, 25	"I am not aware of health schemes, only I know that money is given after delivery in hospital"

PHASE 2 (IMPLEMENTATION)

A preliminary module on menstrual health, developed under the RKSK program, was delivered to 30 participants through an interactive session, followed by a Q&A segment. Around n=25 (83.3%) participants reported that the module's design and layout: including font style, spacing, and color scheme were appropriate and user-friendly. Additionally, n= 26(86.6%) participants indicated that the key messages were effectively communicated through the pictorial presentations included in the module. In terms of overall evaluation, 14 participants (46.7%) rated the quality of the training as good, while a majority, 23 participants (76.7%), agreed that the content was relevant and well aligned with the topic. Responses on the Likert scale demonstrated high levels of satisfaction across various components of the module, including content clarity, duration, pace, pictorial presentation, and facilitator effectiveness, with a median score of 4 on a 5-point scale, indicating agreement to strong agreement.

Qualitative feedback further highlighted areas for enhancement to improve cultural relevance and acceptability. Twenty-eight participants recommended incorporating tribal prints and designs to make the module more visually

attractive and contextually representative. Participants also emphasized the need for linguistic adaptation by including the Santhali language using the Devanagari/Hindi script to improve comprehension. Additional suggestions included introducing the module in school settings to strengthen early awareness among adolescents, replacing urban-centric visuals with village-based imagery, and making the finalized module freely accessible to ensure wider dissemination. Overall, these findings suggest that while the module was well accepted, culturally tailored refinements and broader dissemination strategies are crucial to maximize its effectiveness in tribal communities.

DISCUSSION:

AWARENESS AND UTILIZATION OF HEALTHCARE SCHEMES AMONG TRIBAL WOMEN AND ADOLESCENT GIRLS:

Several studies have examined the challenges faced by marginalized tribal communities. These tribal communities are often illiterate and hold traditional beliefs. This study investigated the use of healthcare schemes among reproductive-age tribal women in Jharkhand, India. The findings revealed that awareness of these schemes was limited, with ASHA and AWWs being the key information sources. Despite, most of the women did not utilize the available healthcare benefits. In comparison with our study, a randomized controlled trial examined the socioeconomic inequalities in the receipt of JSY benefits in Jharkhand. The analysis was based on the prospectively collected data on 3,682 births between 2009-2010 from a demographic surveillance system across five districts of Jharkhand and Odisha, India.[15] They reported that the percentage of women who obtained benefits varied greatly by district wise, particularly in the state of Jharkhand when compare to Odisha state, where only 5% of women in Godda District and 40% of women in Ranchi District of Jharkhand state respectively benefitted from the healthcare schemes.[15] Through this pilot study, it was reported that the majority of adolescent girls was unaware of the health schemes and did not receive benefits. The majority of participants recommended awareness session on schemes related to nutrition and anemia, due to a lack of awareness on these topics. Similar to our study, another study from Madhya Pradesh which is an Indian state located in the central region of India reported that tribal girls have remarkably little awareness of the changes that occur during adolescence, compared with the girls from nontribal backgrounds. They also had less knowledge of Human Immunodeficiency Virus (HIV), Sexually Transmitted Infections (STIs), and contraceptive techniques. [16]

ACCESSIBILITY BARRIERS AND RURAL-TRIBAL DISPARITIES:

It was reported that on the basis of publicly available data from the National Family Health Survey (NFHS)-4, the socioeconomic inequities manifested in caste, class differentials, inequities in availability, utilization, and affordability of maternal healthcare services. Also, the probability of not receiving full antenatal care (ANC) was the highest among scheduled caste/scheduled tribe families in India.[17] Scheduled Castes (SC) and Scheduled Tribes (ST) are officially designated groups in India that have historically faced social, economic, and educational disadvantages. SC communities typically include groups that were traditionally marginalized in the caste hierarchy, while ST communities consist of indigenous tribal populations with distinct cultures, languages, and socio-economic practices. Families belonging to these groups often experience limited access to resources, healthcare, and social services, making them a key focus for health and development programs.

Another study[18]conducted in the year 2019, in the city named Ayodhya in one of the Indian state Uttar Pradesh. This study was related to the accessibility of reproductive health schemes for pregnant and lactating women, reported that women in the rural areas of Uttar Pradesh experienced access to and hurdles in using healthcare schemes.[18] Consistent with these findings, our study also observed that tribal women faced substantial challenges in accessing and utilizing available healthcare schemes, primarily due to limited awareness and systemic barriers.

PREFERENCE FOR CASH INCENTIVE SCHEMES:

Our study, revealed that the awareness of healthcare schemes among tribal women was more inclined towards the schemes offering cash benefits. "Participants' preference for recommending cash-incentive schemes such as JSY and PMMVY is understandable, as these programs provide immediate financial support that can reduce economic barriers to maternal and child healthcare. However, this focus also highlights a gap in awareness about non-cash health interventions, such as immunization or nutritional programs, which are equally important for long-term health outcomes.

Knowledge, Attitudes, and Practices of Reproductive Healthcare Schemes and Evaluation of a Menstrual Hygiene Awareness Module among Tribal Women and Adolescent Girls in Jharkhand, India: A mixed-methods pilot study

This underscores the need for targeted education to improve comprehensive utilization of available health service.[19] Another study conducted in rural areas of Odisha in the year 2018, on a cash transfer scheme for maternal child healthcare practices, reported that a substantial portion of the recipients used cash incentives to pay for healthy meals, prescription drugs, diagnostic tests, and supplementary foods for their children under the financial incentives to mothers who deliver a girl child (MAMTA) Scheme.[20] This highlights that cash-based schemes can positively influence maternal and child healthcare practices when beneficiaries are aware of them.

AWARENESS GAPS AND THE NEED FOR TARGETED HEALTH EDUCATION:

In our study, most adolescent girls and tribal women reported non-utilization of available schemes due to a lack of awareness, emphasizing that without adequate knowledge and training, even potentially beneficial programs like MAMTA may not achieve their intended impact. This underscores the need for targeted awareness campaigns and education to improve uptake of non-cash and cash-based health schemes. Another study[21] conducted in the year 2019, emphasized the need for organized efforts and grassroots-level campaigns on sexual and reproductive health and rights for young people in rural Jharkhand. Although our study focused on schemes related to anemia, such as the Anemia Mukta Bharat (AMB) program, the underlying issue is similar: both studies highlight the critical role of awareness and targeted outreach in improving health outcomes among adolescents and young women. Just as organized campaigns are necessary to improve knowledge and utilization of sexual and reproductive health services, effective awareness and education are also essential to ensure uptake of nutrition-related programs like AMB, particularly in tribal and rural communities." As a result, we conclude that more awareness sessions are needed for anemia prevention. This conclusion has also been reported from another study performed in Odisha where only 20% of the study participants knew about anemia, and the majority of beneficiaries preferred government health care to receive treatment for anemia.[22] Hence, people's perceptions of health-seeking behaviors can change through social mobilization and an increase in community awareness. Effective anemia control goes beyond distributing Iron Folic Acid (IFA) and albendazole tablets; it also requires raising awareness about their proper use, promoting iron-rich diets, and improving sanitation to prevent infections. Integrating education and behavioral interventions with supplementation is essential to ensure adherence and maximize program impact, particularly among adolescents and tribal women. Targeted, culturally appropriate awareness campaigns are therefore critical to enhance the effectiveness of anemia control initiatives. [22]

STAKEHOLDER'S PERSPECTIVE ON SCHEME IMPLEMENTATION:

Another objective of our study was to understand the utilization of healthcare schemes among the tribal reproductive age group population from a stakeholder's perspective, such as the ASHA, AWWs, village representatives, tribal women, and adolescent girls. There is a need for more healthcare awareness, infrastructure, proper documentation, quality services, strengthening of grievance-redressal systems, effective flow of resources, and more monitoring/supervision. A similar study,[23] on accessibility and barriers to maternal health programs in the tribal region of Odisha and concluded that the government's maternal health program barely considers tribal culture and traditions when providing care. Owing to taboos in the community, indigenous women encounter difficulties accessing healthcare services because maternal health programs are not widely accepted or easily accessible. [23] Another study[24] stated that, in Odisha, maternity and newborn care services were not well utilized in the community, and the directions provided by programs (IMNCI) and their actual implementation differed greatly.[24] A similar study[25] also examined the extent to which healthcare schemes were covered. The study reported that the coverage gap score was the highest in northeastern Indian states (55.7%) and the lowest in Kerala (10.48%). [25]

CULTURAL SENSITIVITY AND CULTURAL BARRIERS:

In phase two, the results correlated well with those of other studies conducted in one of the South Indian states i.e. Tamil Nadu,[26] this study concluded that menstruation is shaped by sociocultural norms that reinforce gender role and stigmatizing practices. These norms influence menstrual hygiene management at home and at school. This research emphasizes the importance of understanding girls' personal experiences and recommends tailoring WASH health interventions in the local context. Similarly, another study highlighted the unpleasant experience of using medical jargon while communicating between health care workers and patients.[27] The current study emphasized the need for a culturally sensitive healthcare approach in tribal areas, In our study, we observed that tribal women and adolescent girls

often faced barriers in accessing healthcare due to cultural practices, language differences, and limited awareness of health schemes. These findings emphasize the need for a culturally sensitive healthcare approach in tribal areas to ensure programs are accessible, acceptable, and effective for these populations.

LIMITATIONS OF THE STUDY:

This study had a small sample size, focused on a single scheme in the preliminary booklet, and included only the Santhal tribe, which may limit the generalizability of the findings to other tribes or broader populations. Although the module was developed in Hindi and English without using the Ol Chiki script, participants did not express concerns likely due to limited familiarity with the script, but this could have influenced comprehension and engagement, potentially affecting the accuracy of feedback collected. Additionally, the study relied on self-reported data, which may be subject to recall bias or social desirability bias, potentially impacting the validity of the results.

GENERALIZABILITY:

This study offers insights that may inform health educators, school teachers, community health workers, and NGO personnel working with tribal populations to improve menstrual health awareness. Findings related to knowledge gaps, barriers to scheme utilization, and preferred communication channels are likely transferable to other tribal communities in similar rural and resource-constrained settings. However, elements such as cultural norms, language preferences, and engagement with specific health schemes are context-specific and may vary across tribes. These distinctions should be considered when adapting the findings to other settings to support effective and culturally responsive interventions.

RECOMMENDATION:

The findings highlight the need for a holistic and culturally sensitive approach to reproductive healthcare delivery among women and adolescent girls in the tribal regions, which should be implemented by state and district health authorities through the integration of local cultural practices, tribal belief systems, and gender-sensitive strategies into existing health schemes. Strengthening the capacity of frontline healthcare workers (ASHA, ANM, and AWW) to deliver context-specific services is essential. In addition, government health departments, in collaboration with local NGOs, community-based organizations, and tribal leaders, should develop robust, pictorial IEC materials in local languages that clearly explain scheme benefits and documentation processes. Repeated and participatory awareness activities, such as street plays, folk media, and structured training sessions can be delivered through schools, anganwadi centers, and Village Health and Nutrition Days to enhance awareness and utilization of reproductive healthcare schemes among tribal women and adolescent girls.

CONCLUSION

This study demonstrates that awareness and utilization of reproductive healthcare schemes among tribal women and adolescent girls in Jharkhand remain limited and are largely driven by cash incentives, highlighting systemic gaps in health communication and service delivery. These findings underscore important public health implications, particularly the need for policy reforms that prioritize culturally responsive, non-monetary behavior-change strategies alongside financial incentives. Strengthening community-based interventions through targeted awareness campaigns, structured training sessions, and improved healthcare infrastructure, can enhance the effectiveness and equitable reach of reproductive-health schemes. Insights from healthcare workers and community leaders further emphasize the need for improved supervision, infrastructure, and quality of care as core components of sustainable health system strengthening. The menstrual health awareness module piloted among tribal adolescent girls was perceived as satisfactory and useful, indicating the potential of school and community-based educational interventions. Participant feedback supports policy-level integration of such modules into school health programs, the use of culturally relevant village-themed visual content, and the free public dissemination of educational materials to promote scalability and long-term impact at the community level.

LIST OF ABBREVIATIONS:

SDG's: Sustainable Development Goals

MMR: Maternal Mortality Rate

JSY: Janani Suraksha Yojana

JSSK: Janani Sishu Swasthya Karyakram

PMMVY: Pradhan Mantri Matri Vandana Yojana

RKSK: Rashtriya Kishori Swasthya Karyakram

PA: Poshan Abhiyan

AMB: Anemia Mukh Bharat

NFHS: National Family Welfare Scheme

IEC: Institutional Ethics Committee

ASHA: Accredited Social Health Activist

AWW: Anganwadi Worker

ANM: Auxiliary Nurse Midwife

ANC: Antenatal Care

MAMTA: Financial Incentives to Mothers who Deliver a Girl Child

HIV: Human Immunodeficiency Virus

STIs: Sexually Transmitted Infections

ETHICS AND CONSENT

This study was approved by the Institutional Ethics Committee (IEC) of Manipal Tata Medical College, Jamshedpur, India. Under IEC number MTMC/IEC/2023/53 dated 16th October, 2023. I was a noninvasive, minimal risk study. Data collection started after the participation information sheet was explained. Written consent approved by the IEC was obtained from the study participants, and in the case of minors, written consent was also obtained from the concerned parents/guardians.

CONSENT FOR PUBLICATION:

Not Applicable

DATA AVAILABILITY: UNDERLYING DATA AND EXTENDED DATA:

Figshare: Dataset 1 contains raw data on the knowledge, attitudes, and practices of reproductive healthcare schemes among tribal women in the reproductive age group. <https://doi.org/10.6084/m9.figshare.27230835.v1> [9]

This study contains the following extended data at figshare:

- Menstrual Hygiene Scheme Preliminary Module. <https://doi.org/10.6084/m9.figshare.27266868.v1> [7]
- Figure 1: Attitudes of reproductive-age group Tribal Women (RTW) and Adolescent Girls (AG) toward reproductive health care schemes. <https://doi.org/10.6084/m9.figshare.27267081.v1> [12]
- Figure 2: Reporting of themes from the probing questions on strengths, weaknesses, opportunities, and challenges (SWOC). <https://doi.org/10.6084/m9.figshare.27267108.v1> [14]
- Table 1: Eight healthcare schemes included in the study. <https://doi.org/10.6084/m9.figshare.27267705.v1> [6]
- Table 3: Sociodemographic data representing the characteristics of the study participants. <https://doi.org/10.6084/m9.figshare.27267792.v1>. [10]
- Table 4: Association of sociodemographic factors with knowledge of healthcare schemes among reproductive-aged women. <https://doi.org/10.6084/m9.figshare.27267957.v1> [11]
- Table 5: Verbatims by study participants. <https://doi.org/10.6084/m9.figshare.27267981.v2>. [13]
- Questionnaire and interview guide. <https://doi.org/10.6084/m9.figshare.27268032.v1>. [8]
- Data are available under the terms of the describe the rights and responsibilities that apply to use of the website at www.figshare.com, and the products and services made available in connection with the Site license (CC by 4.0).

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THE CORRELATION OF INFORMAL INTRA-ORGANIZATIONAL COMMUNICATION WITH ORGANIZATIONAL TRUST AND ORGANIZATIONAL COMMUNICATION SATISFACTION AMONG IRANIAN PSYCHIATRIC NURSES

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ABSTRACT

AIM:

This study aimed to determine the correlation of informal intra-organizational communication with organizational trust and organizational communication satisfaction among Iranian psychiatric nurses.

DESIGN:

This cross-sectional descriptive study was conducted from October to November 2020 to analyze and visualize informal intra-organizational communication among nurses.

METHOD:

The current research was conducted on 154 nurses, head nurses, supervisors, and the matron working at Roozbeh Psychiatric Hospital in Tehran, who were selected using a census method. In order to comply with ethical considerations in sampling for social network analysis (SNA) studies, a list was designed including all 168 nurses working at the hospital.

RESULTS:

The majority of nurses reported having informal communication with their colleagues, and a significant proportion (47%) believed that information obtained from this informal communication was sometimes valuable for them. The results revealed that nurses' informal communication network was significantly correlated with organizational trust ($p \leq 0.02$, $X^2 = 7.81$) and communication satisfaction ($p \leq 0.01$, $X^2 = 21.82$).

CONCLUSION:

Informal communication in the nursing workplace should not be overlooked. Given the physical, psychological, and organizational impacts of informal workplace communication on nurses working at hospitals and healthcare centers, nursing managers and policymakers should develop systematic and precise plans to recognize, prevent, and manage this phenomenon.

KEYWORDS

professional communication, informal communication, organizational trust, satisfaction, nurses

INTRODUCTION

In today's world, due to organizational complexities, the subject of communication is of paramount significance so that it can be argued that the first and most important responsibility of any manager is to identify and develop an organizational communication system. Communication is a critical skill for effective organizational management, as it fosters and maintains the relationships necessary for employees to optimally carry out their daily tasks [1, 2].

Nursing communication is established through interactions among nurses while performing professional nursing activities. It is a crucial component of the healthcare quality improvement system and a key criterion for enhancing nurses' competence so that the Nursing and Midwifery Council (NMC) has mandated the development and ability to establish effective communication as an essential standard to enroll for nursing education. Other essential elements include effective intra-group and inter-group communication, teamwork, coordination, and group support [3].

Within organizations, there exists two types of communication networks: Formal and informal. A formal communication network is a planned structure observable on an organizational hierarchy chart, where officials' authorities and the relationships between them and employees are defined by rules and regulations. Conversely, an informal communication network is a form of undefined communication in formal structures, where information is exchanged between two individuals, groups, or organizations without adhering to conventional laws, formalities, processes, or organizational command or job hierarchies. Characteristics such as spontaneity, interactivity, and the rich nature of informal communication have led such communication to play a significant role in creating both positive and negative work environments within organizations [2]. Conversely, undesirable informal communication among nurses can have severe consequences for nurses, the nursing profession, and healthcare organizations, including poor work performance, absenteeism, and rapid job turnover. In such circumstances, nurses often experience a range of physical and psychological symptoms, including mild to severe stress, headaches, eating disorders, and sleep disturbances. Many of them report significant rates of leaving their jobs or the location where they were abused [4-6]. Studies have indicated that nurses who experience poor intragroup interactions are less likely to ask questions or use other support methods for seeking help, leading to an increased likelihood of adverse events in patient care [7]. Statistics reveal that 60-70% of clinical errors are related to unfavorable interactions and communication [8]. Thus, considering the extensive consequences of this dilemma and the crucial role of communication, particularly informal communication, within organizations, this concept, which is somewhat unfamiliar in the nursing profession, should be further explored from various aspects.

Some studies suggest that organizational trust is a key variable that may significantly impact organizational communication [9, 10]. Organizational trust is defined as "employees' trust in the utility and consistency of the organization's members' behaviors and statements when faced with unstable and risky conditions" [11]. Organizations characterized by high levels of trust are often marked by open communication, accountability, productivity, organizational commitment, culture of accommodation, teamwork, high job satisfaction, and involvement in decision-making. Conversely, in organizations with low levels of trust, there is no discipline in work. Low levels of trust lead employees to distort information flow within the organization, fostering suspicion and mistrust among employees and eroding open and honest communication. This, in turn, culminates in poor-quality decision-making. In such organizations, employees are hesitant to voice their ideas and opinions because of fear that their plans and initiatives may fail [12].

In situations where there is a low level of organizational trust among nurses working at a hospital, the quality of interpersonal communication among nurses may also be affected, leading to dissatisfaction with organizational communication among this group. In 1977, Downs and Hazen first introduced the concept of communication satisfaction [13]. Organizational communication satisfaction is defined as "an individual's satisfaction with the information flow and variables related to communication within an organization" [14]. In organizations where employees are satisfied with their communication, they can foster supportive and creative networks by establishing effective communication patterns and mutual trust, culminating in improved organizational outcomes, including collaboration, integration, and alignment

among different departments toward achieving common goals and effective information sharing [13]. Conversely, employee dissatisfaction with intra-organizational communication results in disrupting employee focus, creating incorrect performance of tasks and delays in task completion, and decreasing job satisfaction and organizational commitment [15]. Since organizational communication satisfaction can underlie integration and yield significant outputs, attention to the factors affecting this construct is of particular importance.

Social network analysis (SNA) has been utilized in clinical settings for over two decades to elucidate communication patterns in various healthcare departments. In a systematic review of SNA studies in the field of nursing, Benton et al. (2014) demonstrated the applicability of SNA in analyzing communication networks and patterns, as well as information sharing, among nurses, suggesting its potential to enhance nursing communication. Key concepts in SNA theory comprise nodes, ties, relational power, and centrality. Social networks consist of nodes (including individuals, groups, and larger institutions) and ties (the interest links between two groups). In this theory, relational power can be defined as a linear probability, a combination of time, intensity of emotion, intimacy (mutual trust), and reciprocal services that characterize communication [3]. SNA among nurses working in psychiatric wards is essential due to the unique characteristics of patients hospitalized in these wards and the existence of multiple interpersonal communication.

The existence of effective and correct communication among nurses has constantly been considered a significant influential factor in the success of healthcare service organizations, hospitals, and the nursing profession. It is also a crucial component of a healthcare quality improvement system and a key criterion for enhancing nurses' competence. On the other hand, research findings demonstrate that informal and unfavorable communication among nurses can have detrimental consequences for nurses, the nursing profession, and healthcare organizations. In this context, it seems that a lack of organizational trust and also organizational communication dissatisfaction play a significant role among nurses. Currently, there are no accurate statistics on the prevalence and status of informal communication patterns among Iranian nurses. The current research was conducted to investigate the correlation of informal intra-organizational communication with organizational trust and organizational communication satisfaction among Iranian nurses working in psychiatric wards.

METHODS

STUDY DESIGN

This present cross-sectional descriptive study was conducted from October to November 2020 to analyze and visualize informal intra-organizational communication among nurses.

STUDY PARTICIPANTS

The sample size was calculated using G*Power version 3.1. In order to determine the sample size, a type I error rate of 0.05, a type II error rate of 0.20 (power of 0.80), and 8 variables were considered. In addition, based on previous research and the researcher's expectation, an effect size of $f^2 = 0.10$ (less than medium) was assumed. The final sample size was calculated to be 159. This study was conducted on 154 nurses, head nurses, supervisors, and the matron working at Roozbeh Psychiatric Hospital in Tehran, who were selected using a census method.

Inclusion criteria included holding at least a bachelor's degree in nursing, having a minimum of 6 months of nursing experience in the current ward, and willingness to participate in the research. After obtaining ethical approval from the Joint Ethics Committee of Tehran School of Nursing and Midwifery and Rehabilitation, as well as the complex managers' consent, nurses who met the inclusion criteria entered the study after providing written informed consent.

STUDY PROCESS

Social network data can be collected using various qualitative, quantitative, or mixed methods, from primary or secondary sources. In this study, to ensure ethical considerations in sampling for SNA research, a list of all 168 nurses working at the hospital (nurses, head nurses, supervisors, and matron) was prepared. Each nurse was assigned a unique code

based on their organizational position (nurses were coded as N, and since 145 nurses were working at this hospital, codes from N1 to N145 were generated). The head nurses were coded as HN, and given that 13 head nurses were working at the hospital, codes HN1 to HN13 were generated. Similarly, supervisors were coded as HS with codes from HS1 to HS9 according to the number of supervisors working at the hospital. The matron was also coded as HM. During the interview, the list was placed in front of the participants to identify the names of their colleagues who are in contact with them within the organization. However, instead of directly entering these names into the SNA Questionnaire, unique codes assigned to the individuals were entered into the questionnaires. The SNA Questionnaire was completed through a ten-minute interview conducted by the researcher with the nurses. Additionally, the Organizational Trust Questionnaire and the Organizational Communication Satisfaction Questionnaire were provided to the nurses by the researcher, and after completion, they were returned to the researcher through a self-reporting method. The network sample analyzed in the current research was the "complete network" of employed nurses. In this method, the information regarding the connections of each actor with all other actors must be examined. This approach, by nature, is more of a census of connections among a population of actors rather than a sample. By collecting connections between two or all pairs of a population, complete network data provides a comprehensive picture of the population's communication.

STUDY INSTRUMENTS

The data collection instruments included four questionnaires: 1) A demographic questionnaire (age, gender, marital status, education level, clinical work experience, working ward, work experience in the current ward), 2) the SNA Questionnaire, 3) the Organizational Trust Questionnaire, and 4) the Organizational Communication Satisfaction Questionnaire.

- The Social Network Analysis (SNA) Questionnaire

This questionnaire was developed by Durant and Milen in 2007 to examine and depict informal communication patterns among employees in organizations. The questionnaire consists of 8 questions that analyze the informal organizational communication network. In question 1, participants are asked to list the names of 10 individuals within the organization who are important to them and with whom they communicate, particularly when facing personal or professional challenges, seeking advice or assistance (a minimum of 4 names is required). In question 2, participants should specify the ward or area of work for each individual they have introduced. In question 3, participants must indicate the level of closeness in the hierarchy to each person they have introduced, selecting from one of the three levels: Higher, lower, or equal. In question 4, participants are asked to choose the most significant help they have received from each individual from a list of seven options. In question 5, participants are asked to write a number between 1 and 10 next to each person's name based on the level of their communication with that person (1 denoting the highest communication and 10 denoting the lowest communication). In question 6, participants must select the frequency of information provided to them from among the four options of "never, sometimes, often, or always," and place their chosen option in front of each individual's name. In question 7, participants are asked to rate the informational value provided to them by each individual for completing tasks using the three options: Sometimes valuable, valuable, or very valuable. In question 8, participants must specify the individuals they consulted for decision-making over the past six months. This questionnaire was originally in English and underwent a forward-backward translation process. In the forward translation phase, the original English version of the questionnaire was translated into Persian by two English language experts, following the International Quality of Life Assessment (IQOLA) protocol, after obtaining permission from the original designer (16). To ensure the content validity of the questionnaire, a forward-backward translation method was employed. Subsequently, the questionnaire was presented to 10 faculty members from the School of Nursing and Midwifery, Tehran University of Medical Sciences, for content validity assessment. The test-retest method was employed to assess the reliability of the questionnaire in the present study. To this aim, 10 randomly selected nurses working at Roozbeh Hospital in Tehran completed the questionnaire. After a two-week interval, the same nurses were again asked to complete the questionnaire. Then, the correlation coefficient between the two sets of data was found to be 0.76.

- The Organizational Trust Questionnaire (Ellonen et al.)

This questionnaire, originally developed by Meyer and Davis (1999) and later adapted by Ellonen et al. (2008) with minor modifications (11), consists of 49 items divided into three dimensions: Lateral trust (15 items), hierarchical trust (15 items),

and organizational trust (19 items). This questionnaire is rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The minimum possible score is 49, and the maximum is 245. A higher score indicates a higher level of organizational trust. The validity of this questionnaire has been confirmed in previous studies, and its reliability was reported to be 0.96 using Cronbach's alpha (10). In this study, the questionnaire was presented to 10 faculty members from the School of Nursing and Midwifery, Tehran University of Medical Sciences to determine content validity.

In order to assess the reliability of the questionnaire in this study, the test-retest method, as employed in the SNA Questionnaire, was utilized. The correlation coefficient between the two sets of data was found to be 0.81.

- The Organizational Communication Satisfaction Questionnaire

This questionnaire consists of 40 items rated on a 7-point Likert scale ranging from 1 (completely dissatisfied) to 7 (completely satisfied). The minimum possible score for this questionnaire is 40, and the maximum is 280, with higher scores indicating greater organizational communication satisfaction. Scores between 40 and 93 indicate low satisfaction, scores between 93 and 186 denote moderate satisfaction, and scores above 186 show high satisfaction. The reliability and validity of this questionnaire have been established in previous studies, with a Cronbach's alpha of 0.76 reported [4].

STUDY ANALYSIS

Data collected from the SNA Questionnaire were entered into Excel, and subsequently, the resulting edge list was imported into UCINET 6 as a matrix for further analysis. To determine the overall structure of communication patterns, allowing for a comprehensive view of existing relationships, a graph consisting of nodes and connections between nodes, including (degree, betweenness, and closeness), was utilized. Additionally, data from the Organizational Trust Questionnaire and the Organizational Communication Satisfaction Questionnaires were analyzed using SPSS version 21, employing both descriptive and analytical statistics. In this study, descriptive statistical methods, including frequency distribution, mean, and standard deviation, were employed in relation to the research objective. The chi-square test was utilized to examine the correlation of informal intra-organizational communication with organizational trust and organizational communication satisfaction. In this study, an innovative approach was employed to report the results for the variables of organizational trust and communication satisfaction so that the midpoint of the questionnaire was chosen, with scores above the midpoint indicating high levels and scores below the midpoint indicating low levels of organizational trust and organizational communication satisfaction.

RESULTS

The participating nurses' mean age was 34.37 ± 7.75 years, with 60% being female and 40% male. The participants' mean years of experience was 11.24 ± 7.28 years in the nursing profession and 5.45 ± 4.32 years in the current ward. The majority of the nurses (73%) worked rotating shifts and had permanent employment. Other demographic information of the participants is presented in Table 1.

TABLE 1. INDIVIDUAL CHARACTERISTICS OF NURSES PARTICIPATING IN THE RESEARCH

Variables		N (%)
Gender	Male	61 (39.6)
	Female	93 (60.4)
	Total	154 (100)
Marital Status	Single	39 (25.)
	Married	115 (74.7)
	Total	154 (100)
How to enter the profession	with awareness	100 (64.9)
	with interest	32 (20.8)
	other	22 (14.3)
	Total	154 (100)

Employment status	Permanent	73 (47.7)
	Contractual	26 (16.9)
	Temporary	25 (16.2)
	Cooperative	12 (11.7)
	Projective	18 (7.8)
	Total	154 (100)
Interest in the workplace	Yes	146 (94.8)
	No	8(5.2)
	Total	154 (100)
Compulsion to work in the current sector	Yes	21 (13.6)
	No	133 (86.4)
	Total	154 (100)
work shift	In the morning	24 (15.6)
	In the evening	8(5.2)
	In the night	9 (5.8)
	In circulation	113 (73.4)
	Total	154 (100)
Management post	Metron	1 (0.6)
	Supervisor	9 (5.8)
	Head Nurse	13 (8.4)
	Nurse	113 (73.4)
	Total	154 (100)

Most of the nurses in this study reported having informal communication with their peer colleagues, with 47% indicating that the information gained from this informal communication was sometimes valuable to them. The network consisted of 168 nodes and 507 ties, with a mean network degree of 3.02. The component ratio was 0.9. The degree centralization was 0.048, in-centralization was 0.024, out-centralization was 0.036, and density was 0.018. The characteristics of the nurses' informal network are presented in Table 2.

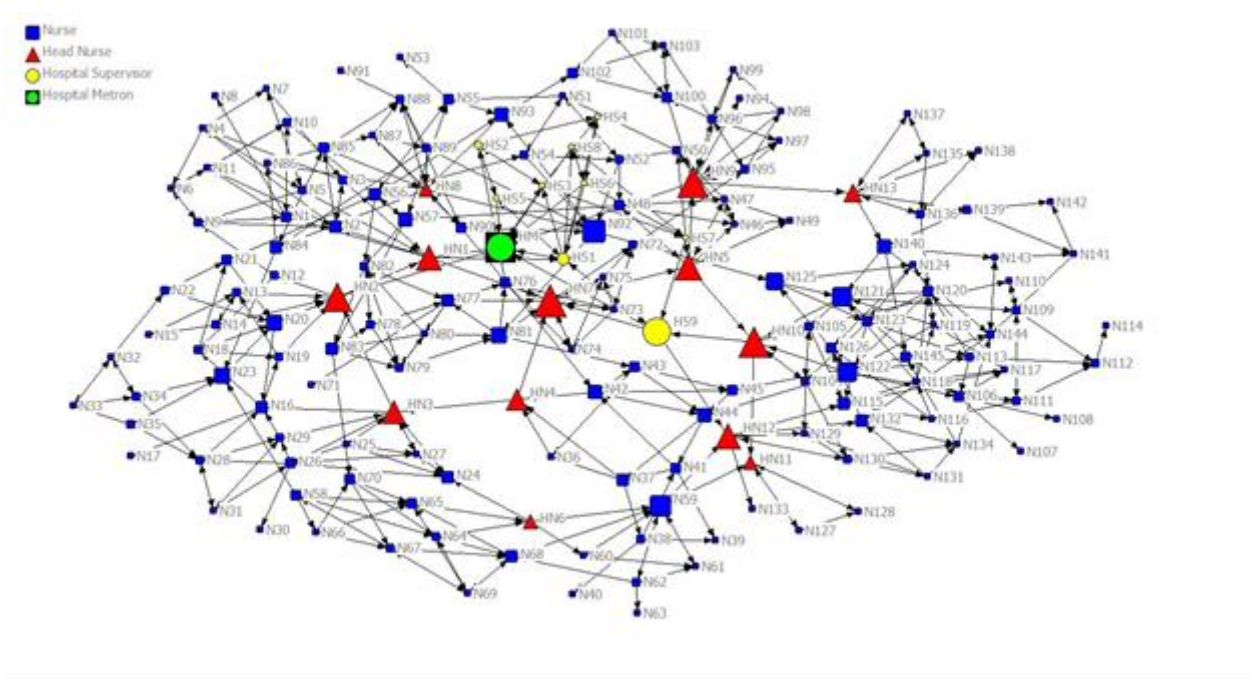
TABLE 2. FREQUENCY DISTRIBUTION AND PERCENTAGE OF CHARACTERISTICS RELATED TO THE NURSES' INFORMAL COMMUNICATION NETWORK IN THE RESEARCH

Please list the primary benefits you are currently receiving from each individual you have introduced.	N (%)
1. Information that helps me solve problems or seize opportunities.	74 (14.6)
2. Access to decision-makers, which allows me to move my plans forward.	36 (7.1)
3. Organizational support that helps me advance my plans.	73 (14.4)
4. Problem-solving interactions that significantly improve my thinking about my work-related problems or opportunities.	86 (17.0)
5. Career counseling or appropriate feedback that helps me be more effective in my work.	134 (26.4)
6. Attracting personal support and strengthening the ability to solve problems and help return to work.	55 (10.8)
7. A sense that the work I do in the workplace is making a positive impact and is important.	49 (9.7)
Total	507 (100)
For each person you have introduced, what is their job position relative to yours?	N (%)
1. Upper	60 (11.8)
2. Equal	396 (78.1)
3. Lower	51 (10.1)
Total	507 (100)

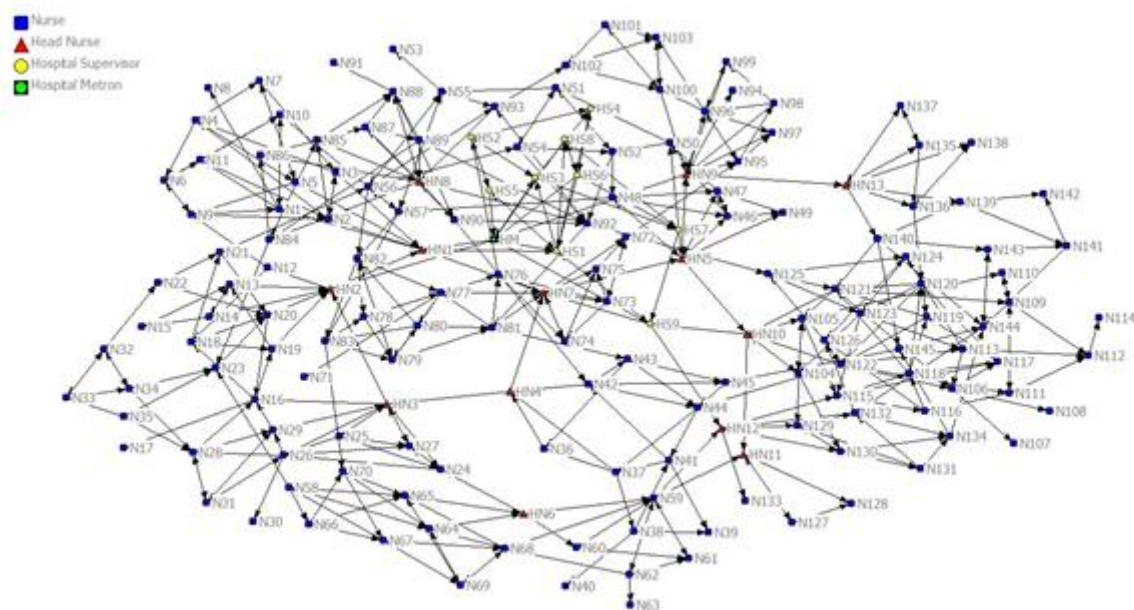
Please indicate the frequency of information provided to you by each individual you have introduced to complete your tasks.	N (%)
1. Never	30 (5.9)
2. Sometimes	242 (47.7)
3. Often	197 (38.9)
4. Always	38 (7.5)
Total	507 (100)
Please indicate the value of the information provided by each individual you have introduced.	N (%)
1. Sometimes valuable	99 (19.5)
2. Valuable	281 (55.5)
3. Very valuable	127 (25.0)
Total	507 (100)

In Graph 1, the characteristics of each network member are represented by color and shape. The blue color and square represent nurses, the red color and triangle represent head nurses, the yellow color and circle represent supervisors, and the green color within a black square represents the hospital's matron. Graph 1 demonstrates that node sizes vary based on the betweenness metric, with larger nodes indicating greater betweenness. Based on Graph 1 and the Ucinet software output, the five individuals with the highest betweenness scores are HN7=7090.1), HN1=6420.21), HN5=6394.38), HS9=4882.75), and HN10=4717.55), respectively. Additionally, Graph 2 demonstrates that the node size varies according to their closeness, with larger nodes indicating greater closeness.

GRAPH 1. SORTING THE NURSES' COMMUNICATION NETWORK BASED ON BETWEENNESS

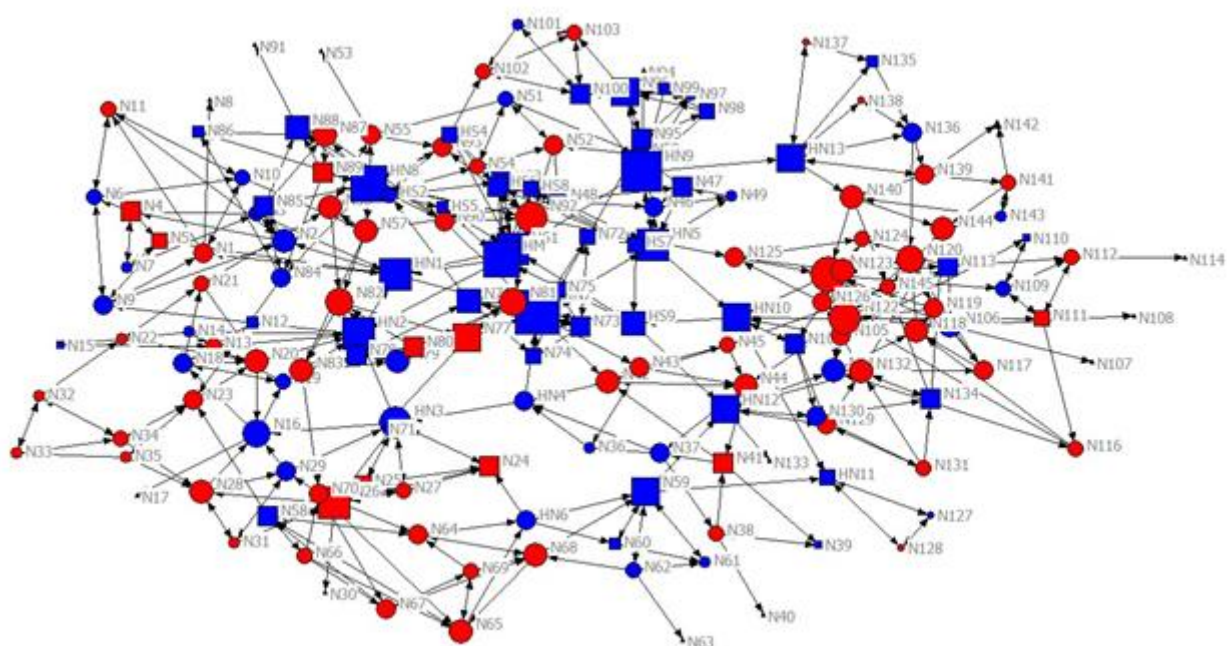


GRAPH 2. SORTING THE NURSES' COMMUNICATION NETWORK BASED ON CLOSENESS

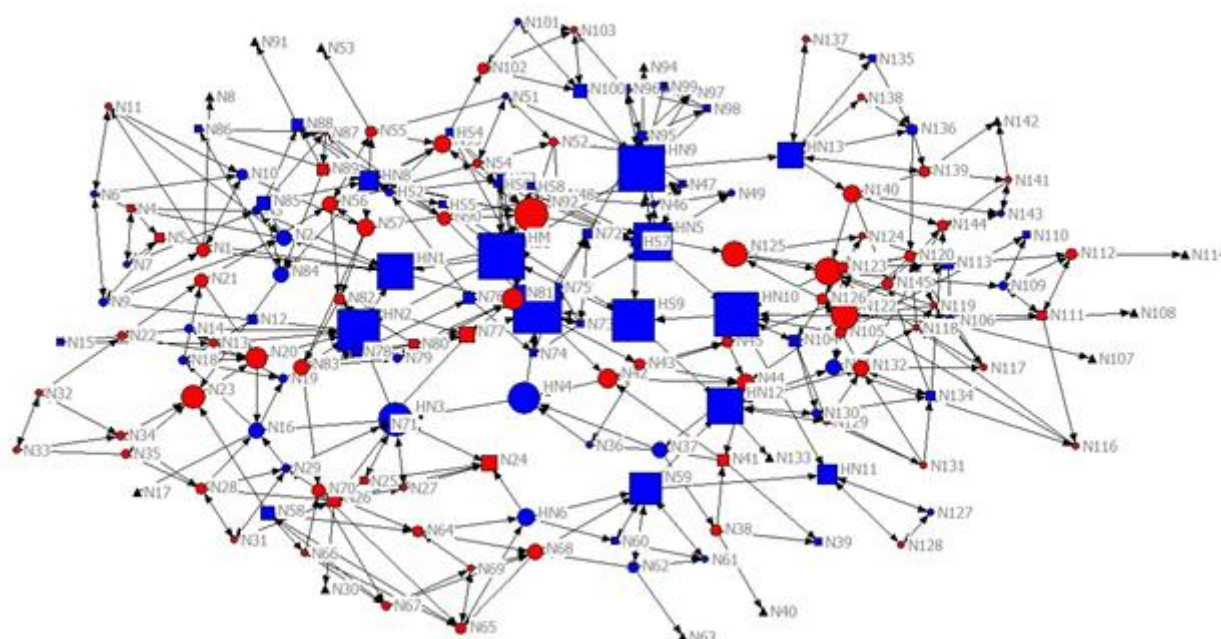


Graph 3 illustrates the nurses' communication network based on organizational trust, communication satisfaction, and the degree of communication. In this graph, organizational trust is categorized into two groups: Low trust (red) and high trust (blue). Communication satisfaction is also divided into two groups: Low satisfaction (circle) and high satisfaction (square). Moreover, the size of each shape represents an individual's degree of communication (the number of incoming and outgoing communication), with larger shapes indicating higher communication. According to Graph 3 and Ucinet output, the five individuals with the highest level of organizational trust were HM=198, N2=193, N59=190, HN8=190, and HS3=189), and those with the highest communication satisfaction were HN7=252, HS1=241, HS3=240, N95=240, and N59=238. Graph 4 also depicts the nurses' communication network based on organizational trust, communication satisfaction, and betweenness. The size of each shape was used to represent the betweenness centrality (the position in the shortest communication paths between other nodes), with larger shapes indicating a more central position in others' communication.

GRAPH 3. NURSES' COMMUNICATION NETWORK BASED ON ORGANIZATIONAL TRUST, ORGANIZATIONAL COMMUNICATION SATISFACTION, AND DEGREE OF COMMUNICATION



GRAPH 4. NURSES' COMMUNICATION NETWORK BASED ON ORGANIZATIONAL TRUST, ORGANIZATIONAL COMMUNICATION SATISFACTION, AND BETWEENNESS



The results of this study finally revealed that nurses' informal communication network was significantly correlated with their organizational trust ($p \leq 0.02$, $X^2 = 7.81$) and communication satisfaction ($p \leq 0.01$, $X^2 = 21.82$).

DISCUSSION

SNA is a valuable tool for mapping and assessing the relational networks within organizations. This simple technique can yield rich insights. This program is used to manage communication, aiming to improve the relational bonds within a group or a communication network of employees in an organization. Therefore, this study intended to determine the correlation of informal intra-organizational communication with organizational trust and organizational communication satisfaction among psychiatric nurses.

The communication network of nurses working at the psychiatric hospital consists of 168 nurse nodes and 507 edges/ties between nurses. Given the nurses' low network density (density = 0.018) and that only 0.018 of the whole potential network communication has been realized, the network exhibits an integrated level. The study results demonstrate that nurses from different wards communicate less with each other and are more inclined to communicate with nurses from their own wards. A study conducted in Iran revealed that the nursing network of Razi Hospital in Rasht, Iran, comprised 64 nodes/nurses, 168 undirected and weighted edges/links, and was classified into 9 clusters, with 6 of these clusters belonging to the investigated wards. Due to the low network density (0.083), the network exhibited low cohesion, meaning that only 8.3% of the total potential and latent communication within the network were activated. In other words, nurses within a cluster or ward demonstrate interconnectedness and strong communication. However, the network of nurses is characterized by weak communication between different wards [15], which aligns with the findings of this study. One of the weaknesses of informal communication networks is the low number of reciprocal communications. Given that, unlike formal communication, there is no obligation in informal communication, it was expected that a higher percentage of informal communication would be reciprocal; that is, there would be a mutual desire to establish these connections. However, this very low percentage may indicate that informal communication among nurses has not yet found its proper place, and this could culminate in network disruption, reducing the positive impacts of this communication on decisions and functions [17]. In line with this study, Shafiei et al. (2018) and Kangarani et al. (2013) stated in their research that informal communication networks existed and could influence formal communication networks. They also highlighted that a strength of informal communication is that it is not limited to employees within a single ward but extends across employees at various wards [15, 17]. These findings are inconsistent with the results of Shoham et al.'s study (2016) [18]. It

can be argued that informal communication networks, in addition to their positive effects, can also have negative and inhibitory effects. Additionally, nursing managers can leverage information from these networks to enhance both productivity and workforce efficiency. For instance, the assignment of individuals to different wards could be based on their ability and willingness to establish friendly and informal communication with other employees. Moreover, it is possible to leverage the abilities of individuals with strong social connections to engage those who lack such connections [17]. On the other hand, studies have shown that over half of employees turn to their friends when facing work-related challenges [17]. It must be said, Low levels of reciprocal communication are a key weakness of informal communication networks among nurses. As informal communication is thought to foster reciprocal interaction due to its voluntary nature, it promotes trust and shared accountability [19]. Studies show that reciprocal interaction among nurses remains low, and the lack of these interactions can reduce the positive effects of informal exchanges on organizational outcomes and the effectiveness of collaborative decision-making, and hinder the development of cohesive networks [18, 20]. To address this issue, nurse managers can enhance nurses' professional growth by using targeted strategies such as peer coaching programs, which are effective in strengthening individual bonds and increasing reciprocal interaction [21, 22]. Also, holding informal meetings between different departments, focusing on promoting shared decision-making, and using social activists to engage less active staff can improve network cohesion and enhance the benefits of informal communication. Therefore, the existence of a robust communication network, particularly among nurses, and the presence of effective and accurate communication among them have always been significant factors influencing the success of healthcare service organizations.

In this study, nursing staff demonstrated a greater inclination to establish communication with colleagues similar to them, such as years of experience, age, gender, and job position, in a social network. In other words, individuals tend to seek out similar individuals within wards for communication. In a study aimed at examining the position of women in organizational networks, Mohammadi Kangarani et al. (2013) used SNA to map and analyze the informal communication network among male and female employees. The results of their research demonstrated that women, on par with and sometimes even more than men, engage in informal intra-organizational communication. However, the nature of their involvement differs, which can be attributed to the varying degrees of centrality between women and men. Additionally, the nature and environment of work, the level of its harshness, and the arrangement of women and men in the workplace influence the communication between women and men [23]. A study investigating the barriers and motivations for women to join networks, as well as the significance of formal and informal networks on the career advancement and promotion of female nurses, revealed that work experience and education level significantly influenced women's networking behaviors. Furthermore, a significant correlation was found between work experience, education level, and networking on women's career advancement and promotion [24, 25]. Consistent with this study, Webster et al. demonstrate in their research that in formal communication networks, managers and head nurses hold more central and pivotal roles. However, in informal communication networks, connections among individuals are formed based on their personal, racial, and linguistic characteristics [26]. Another study revealed that the nursing profession utilized informal communication networks more extensively than other occupational groups [25]. Moreover, these findings align with the results of previous research conducted by Bae et al. (2017) [27], Shafiei et al. (2018) [15], and Shoham et al. (2016) [18]. According to Grandey, this type of communication is often more intimate and profound than formal communication, and the exchange and transmission of information through this channel is more accurate and faster. This is because the nursing profession, due to its direct contact with patients and their conditions, requires rapid and accurate exchange of information with other colleagues and professionals to achieve its goals [28].

The results of this study revealed a statistically significant correlation between nurses' informal communication networks and their organizational trust. This means that nurses with higher levels of organizational trust were more likely to select colleagues with higher communication scores compared to those with lower levels of organizational trust. A lack of research on this topic was evident. However, an analysis of results from some studies with conceptually similar variables to the current findings has been reported. For instance, a study examining the correlation between organizational trust and nursing practice characteristics revealed a direct correlation between organizational belonging and trust and nursing practice characteristics, as well as between nursing practice characteristics and all dimensions of organizational belonging and trust [29]. It can be said that a sense of social belonging refers to a sense of unity with a social class or

similarity among members of an organization. It is a process through which individuals perceive themselves as similar to another person or group of people and acts as a powerful motivator for individuals to take joint action and activity [30-32]. Researchers believe that the foundation of all trust lies in an individual's assertion of their social identity, formed through interactions with others [33]. Furthermore, employee trust in the organization serves as a mediator between the effects of internal communication on employee attitudinal and behavioral outcomes, such as openness to change [34], job engagement [35], and employee communication behavior [36]. A review of the literature suggests that symmetrical, mutual communication between the organization and employees, which emphasizes mutual interaction, employee voice, responsiveness, and empowerment [36], can foster an organizational culture laden with joy, pride, and gratitude, ultimately leading to increased employee trust in the organization [37]. Moreover, according to studies by Ghera and Raesei, communication skills culminate in increased organizational trust. In other words, the higher the employees' proficiency in verbal skills, listening skills, and feedback skills, the greater the organizational trust [38]. Results from another study revealed that employees' trust in the organization has a positive significant impact on their sense of belonging and identification with the organization [39]. Therefore, it can be stated that the higher the individuals' social belonging, the greater their communication and desire to establish connections. These variables are influenced by organizational trust. This finding supports the argument of Kramer et al. (2001), who contended that the employees' sense of identification with the organization is strongly correlated with their beliefs about trust or distrust, giving rise to emotional consequences [40]. Moreover, engaging in and benefiting from trust-building behaviors lead to positive emotions, such as a sense of belonging and organizational identification [40, 41].

In this study, a significant statistical correlation was found between nurses' informal communication networks and organizational communication satisfaction. Nurses who reported higher organizational communication satisfaction were more likely to choose colleagues with higher interaction scores compared to those with lower satisfaction. Consistent with this study, Vermeir et al.'s study demonstrated that nurses' intra-organizational communication could influence their organizational communication satisfaction, job satisfaction, burnout, and intention to job turnover. Nurses who had stronger intra-organizational communication reported higher levels of organizational communication satisfaction and job satisfaction, as well as lower levels of burnout and intention to job turnover [13]. Organizational communication satisfaction is a multi-dimensional construct that reflects several important variables. Most importantly, it elucidates the key points of individuals' interactions with supervisors, subordinates, work groups, work itself, and organizational policies [42, 43]. Employee-manager communication satisfaction is contingent upon the quality and consistency of the way of mutual communication and understanding this process by individuals significantly impacts organizational success [44]. This variable plays a pivotal role in enhancing organizational commitment and employee and organizational effectiveness. Previous studies have reported that poor organizational communication culminates in undesirable outcomes, such as low organizational commitment, higher absenteeism, increased employee turnover, and reduced productivity [4, 45]. It is recommended that hospital managers and administrators strive to optimize informal communication among employees in order to subsequently improve organizational communication satisfaction and for the organization to benefit from positive outcomes.

LIMITATIONS

One of the limitations of this study was the use of the Self-Report method to collect part of the data. Although it seems that using the "observation" method, more detailed information can be obtained in this field. Also, the study was conducted in a single hospital, which may limit the broader applicability of the results to other psychiatric settings or healthcare institutions.

CONCLUSION

According to the results of this study, psychiatric nurses communicate less with nurses from other wards and are more inclined to form communication primarily with colleagues within their own wards. These nurses have a greater inclination to establish communication with colleagues similar to them, such as years of experience, age, gender, and job position, in a social network. Moreover, nurses who reported higher levels of organizational trust and communication satisfaction

are more likely to choose colleagues with higher communication scores for interaction compared to those with low levels of organizational trust and communication satisfaction.

IMPLICATIONS FOR NURSING

Given the physical, psychological, and organizational impacts of the informal workplace communication phenomenon on nurses working at hospitals, managers, and nursing policymakers should develop systematic and precise plans to recognize, prevent, and manage this phenomenon. Organizational factors that contribute to the formation of communication networks in the workplace of nurses should also be identified. Given the significant correlation of informal workplace communication with organizational trust, and communication satisfaction, hospitals should prioritize the identification and mapping of these communication networks within nursing work environments. By recognizing these communication patterns, organizations can better understand their impact on nurses, patients, and healthcare delivery systems. Hence, it is recommended that further research be conducted on the effects of informal intra-organizational communication networks in hospitals.

SUGGESTIONS FOR FUTURE RESEARCH

To gain a deeper understanding, future researchers should explore nurses' perceptions of informal communication using qualitative research methods, such as interviews for data collection. Conducting studies in different psychiatric institutions across various cultural and social contexts would also enhance the generalizability of the findings. Emphasizing longitudinal study designs may help reveal changes over time in the dynamics of trust and communication. Additionally, future research should investigate mechanisms that can increase reciprocity and facilitate more effective communication among psychiatric nurses.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The current study was approved by the Ethics Committee of Tehran University of Medical Sciences and was registered under the registration number: IR.TUMS.FNM.REC.1399.067. Before the commencement of the project, all required permissions were obtained. Moreover, the participants were assured of the confidentiality of the information and the possibility of withdrawing from the study at any stage.

CONSENT FOR PUBLICATION

Free and informed consent was obtained from all participants in the study.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

COMPETING INTERESTS

The authors declare none.

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AUTHORS' CONTRIBUTIONS

F, H. H, A. A., H and SH, M. were involved in designing the idea and preparing the proposal. Data collection was performed by F, H. And H, A. and data analysis was performed by A., H and SH, M. All researchers have participated in data interpretation, preparation and article preparation.

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USE OF AI IN LANGUAGE PROCESSING

To ensure linguistic clarity and consistency, some sections of this manuscript were translated from the original Persian into English with the assistance of an artificial intelligence-based language model. All translated content was carefully reviewed and revised by the authors to maintain accuracy, context fidelity, and academic tone.

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MEDICAL TOURISM: CULTURAL BELIEFS, EXPECTATIONS OF PATIENTS AND QUALITY OF EXPERIENCE IN A DESTINATION HOSPITAL

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ABSTRACT

BACKGROUND:

Medical tourism (MT) involves international travel to receive medical care and India has become a leading MT destination on account of affordability (60-80 percent cheaper than the developed nations), accreditation by Joint Commission International and National Accreditation Board for Hospitals, highly skilled doctors, advanced healthcare facilities and short waiting times. Research has consistently shown that poor cultural awareness results in MT patient misunderstandings, poor quality of clinical experience, and non-adherence to post operative medical advice. Grounded in the Communication Accommodation Theory, this empirical study examines the role of cultural beliefs and expectations of international patients' regarding their intercultural experience in a host country hospital in India immediately after their initial in-person meeting with the team of attending doctors.

METHODS:

This self-reported, questionnaire based, cross-sectional study was conducted at a NABH (National Accreditation Board for Hospitals & Healthcare Providers) and JCI (Joint Commission International) accredited, and Government of India designated healthcare institution for MT in New Delhi. A convenient sampling technique was utilized to select a sample originally comprising 1,600 medical tourism patients. Data were analysed using multiple linear regression tests and Smart PLS for mediation-moderation and Confirmatory Factor Analysis.

RESULTS:

The results show that international patients develop certain beliefs about cultural sensitivity practiced in a destination hospital from various information sources. These beliefs create culture and communication expectations about responsive MT services, which, in turn, influences the perceived quality of their experience regarding communication accommodation in the clinical encounter.

CONCLUSION:

Expectation management and confidence building of MT patients are the two critical activities that designated MT hospitals could adopt. Apart from designing and developing training programmes in intercultural communication (ICC), hospitals can develop belief in India's capability as a reliable medical tourist hub by investing in MT websites. Information regarding Indian culture and tourism potential along with inclusion of simulations based on augmented reality (AR) and Virtual reality (VR) could be uploaded to show how Indian doctors convergently accommodate with patients belonging to different nationalities.

KEYWORDS

medical tourism, culture, communication, patient belief and expectations, patient experience

INTRODUCTION

Medical tourism (MT) has emerged as a booming industry, with millions of MT patients traveling internationally each year for various medical treatments. India has become a leading MT destination on account of affordability (60-80 percent cheaper than the developed nations), accreditation by Joint Commission International and National Accreditation Board for Hospitals, highly skilled doctors, advanced healthcare facilities and short waiting times. [1]. The country received 6,44,387 medical tourists in 2024 (<https://www.pib.gov.in/PressReleasePage.aspx?PRID=2153611>). Key themes in the systematic literature review on medical tourism [2] include the importance of quality care, cost savings, as also the role of cultural competence in MT patient satisfaction [3]. Research also points to India's diverse cultural landscape as both a strength, and a challenge, in providing culturally sensitive care [4]. The provision of e-medical visas and presence of medical tourism boards, along with the Heal in India initiative of the government of India have added fillip to the growth of MT in India. Competition from Thailand, Singapore, the USA, and Mexico is increasing lately; Singapore is now actively promoting its culture and accommodation practices to attract MT patients [5]. This indicates taking a holistic view of the MT practices in India to boost medical tourism and market its strengths

Research has consistently shown that poor cultural awareness on the part of the host country hospitals result in MT patient misunderstandings, poor quality of clinical experience, and non-adherence to post operative medical advice [6,7] underscoring the need for a planned cultural communication strategy [8]. Recent studies have shown that in comparison to the doctor-patient interaction belonging to the same country, the MT patient-doctor interaction belonging to different countries have shown higher instances of disillusionment, poor quality of clinical experience, and even opt-outs [8]. Intercultural communication (ICC) in medical tourism, has been described as a 'potential source of low-quality communication' [9], with poor healthcare outcomes. Leave aside culture, even communication competency has been found to be sorely lacking in doctors leaving the MT patients dissatisfied and disgruntled with the MT services [7, 11, 12, 13].

Differences exist between the cultures of western and non-western regions especially relating to cultural beliefs, communication styles, and expectations. For instance, the western cultures are explicit, individualistic, and direct in their communication styles. In contrast, the non-western cultures are much more implicit, relationship oriented and indirect in their communication [9,10]. In western countries, a direct and blunt approach is appreciated along with adherence to prescribed set of rules; in non-western countries directness is perceived as rude, decision making is deemed to be collective, and rules may be overturned for convenience. Another difference pertains to greeting styles and physical contact between genders belonging to eastern and western cultures; even between conservative Muslim countries and non-conservative Muslim African countries [14].

MT patients differ in their cultural belief systems regarding the type of healthcare services they would like to receive from the host country hospital [15] and this has the potential to influence outcomes [16,17, 18]. For example, some cultures prioritize holistic and traditional approaches to healing, while others may place more trust in modern, evidence-based medicine. Gender-based clinical examination practices also vary widely across cultures [15].

Globally, medical tourism is a well-researched area, with studies exploring various dimensions such as MT patient motivations, economic impact, MT facilities, and healthcare quality [19]. Much of the healthcare research in medical tourism is related to service delivery, choice of host country, or effect of language differences, and very few on MT patients' experience in the host country hospital [20]. There is a gap in the understanding of how medical tourists communicatively engage with physicians belonging to a different culture [21]. Moreover, there is less understanding of how MT patients' ICC beliefs on healthcare in a host country hospital influences patients' expectations and experiences.

The two prominent indices measuring MT patient satisfaction: The Medical Tourism Index [22], and the Medical Tourism Experience Scale [23], lack items related to culture and communication. While the former does measure 'cultural and religion match', emphasis is on similarity rather than on differences. Similarly, the Medical Tourism Experience Scale measures the experience in the destination culture, labelling it as 'arts and other manifestations of human intellectual achievements available in the destination', and not on the perceived quality of intercultural communication (ICC) experience in the destination hospital.

Defined as the "subjective mental state felt by the participants" [24], the clinical experience of tourists influences behavioural, affective and cognitive feelings towards a destination. Experience affects satisfaction, loyalty and the sense of well-being as also consumption-related emotions [24]. While there does exist a 'memorable tourism experience scale' based on destination attributes, it excludes the measurement of tourists ICC experiences [27]

Apart from clinical experience, managing medical tourist expectations in service delivery is critical for patient experience, satisfaction and loyalty [25]. Expectation management or EM in healthcare context is a communicative process whereby each party is clearly told in advance what to expect, when, by whom, where and how. Healthcare expectations have been found to be related to subjective factors such as the communication and the cultural competence of the doctors, apart from the objective factors such as cost, treatment duration, prescribed medicines and medical tests [25]. In truth, patients are themselves unaware of their expectations, consumed as they are with the treatment and other concerns. They may have a mental picture about their expectations, but it is rarely sought to be verbalised in most medical settings. The listing of these expectations, researchers agree, is a highly documented activity. Unmet expectations lead to disillusionment and hostility leading to inadequate follow up, dissatisfaction with healthcare services, poor word of mouth, and even choosing to opt out from the host country system altogether. One study reported that close to 80 % of the litigation on hospitals was due to unmet expectations and poor communication [26].

In this context, our study investigated the MT patients' perceptions regarding the quality of intercultural communication by the host country team of doctors on the subject of their treatment. It examined whether their initial clinical experience in the medical interview, including the physical examination, matched their ICC beliefs and expectations in the host country hospital, the Artemis Hospital, situated in Noida, New Delhi. Artemis is a Joint Commission International accredited hospital. Focused on the research paradigm of positivism, the study administered questionnaires originally to 1600 international patients. The study contributes to both theory and practice in communication, culture and MT.

THEORETICAL FRAMEWORK

Misunderstandings occur when the patients and doctors do not share a common language. This affects clinical interactions regarding symptoms, treatment plans and both pre-operative and post-operative patient care. In this regard the Communication Accommodation Theory [28] was used as a theoretical anchor for this study. Communication accommodation theory (CAT) illustrates how healthcare systems, such as hospitals, prioritized diverse identity groups by considering various micro- and macro-level attributes. These attributes included roles (such as patient and clinician) and professions (such as physician and nursing specializations, including surgical nurse and cardiologist). By emphasizing the intergroup dynamics of health communication, CAT facilitates understanding of patient interactions, interdisciplinary dialogue, and patient education techniques, all of which may enhance medication satisfaction and the delivery of medical treatment. CAT includes sociolinguistic procedures, such as the concepts related to approximating, representativeness, relational control, dialogue management and emotionality, as well as their applications in research on how doctors communicate with patients. The study validated CAT as a useful theory in understanding both the linguistic and sociopsychological aspects of patient-provider medical interactions.

The Communication Accommodation Theory recognised two types of communication styles prevalent across cultures: the convergent communication style and the divergent communication style. Originally concentrated on verbal communication, it now includes aspects related to non-verbal communication as well. In 2014, a study employed the use of the Nonverbal Analysis of Accommodations System, (NAAS), to categorize the nonverbal behaviours of both medical personnel and patients involved in 45 cancer (high severity disease) consultations [29]. Subsequently, each case was

classified into one of seven categories based on the observed patterns of accommodation during the discourse. The findings indicated that, among all NAAS behaviour categories, joint convergence was the most often utilized descriptor for physician–patient interactions, closely followed by asymmetrical–patient convergence. Common instances of cooperative convergence were observed in paraverbal behaviours, including conversation duration, interruptions, and pauses. Eye contact, laughter, and gestures were the nonverbal behaviours most frequently categorized as asymmetrical–physician convergence. Thus, from the point of healthcare communication in an intercultural context, physicians who preferred to adapt to the MT patient communication and prioritised the patients' needs first, used convergent communication style (including both receptive and expressive communication skills, verbal as well as non-verbal). Conversely, physicians who preferred to assert their professional authority and prioritized their own needs used divergent communication style (such as poor listening style, lack of probing questions, poor body language signals, and detachment in general).

We proposed the following hypotheses:

- H1: MT patients' subjective beliefs regarding a destination hospital influences the quality of their clinical experience (in terms of communication accommodation by the doctors)
- H2: MT patients form expectations regarding the destination hospital based on their beliefs regarding a destination hospital
- H3: Expectations of MT patients mediate the relationship between MT patients' ICC beliefs and the quality of ICC experiences in the clinical encounter; unmet expectations can reduce the perception of the quality of experiences

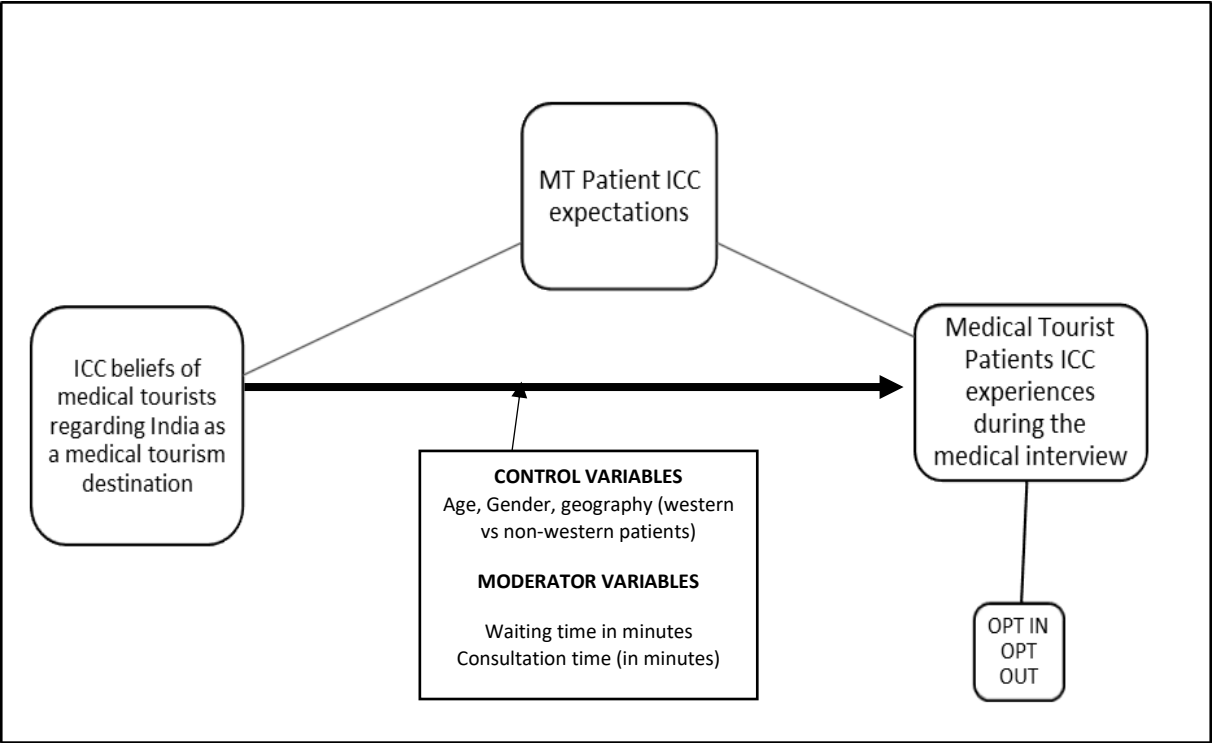
Geography, World Bank ranking of the country of origin, severity of the ailment, and gender of the patient were used as control factors; waiting time and consultation time in minutes were used as moderators in the proposed model. Accreditation status was not considered since this the hospital was accredited by the Joint Commission International (JCI) the certifying body for health care organisations. Participants had also signed forms conforming to the ethico-legal aspects relating to the research design. A Research had revealed that the higher the severity of ailment, the lower the patients' self-reported perception of satisfaction with the hospital. We sought to test this with the sample of MT patients [30] whose severity of the disease (low, medium or high) was cross-checked by the doctor. The World Bank ranking was considered to demarcate low-income countries from the middle- and high-income countries to get a sense of the MT patients' country of origin's gross national income (GNI) per capita. It was expected that patients from prosperous countries would have higher expectations from the Indian MT hospital, than the countries ranked lower in the World bank classification scheme. Extant research studies had pointed out a positive relationship between geographical proximity and cultural affinity [31] and therefore it was expected that non-western patients would report a higher quality of experience in the clinical interaction than the western patients. It was also expected that patients dissatisfied with higher waiting time and lower consultation time would report a lower quality of experience based on our own experience.

The following hypothesis was proposed:

- H4: The proposed model is differentiated by gender, geography, satisfaction with waiting and consultation time, severity of the ailment, and the World Bank classification of economy.

The proposed research model is shown in Figure 1.

FIGURE 1-THE PROPOSED RESEARCH MODEL



DATA COLLECTION AND MEASURES

RESEARCH APPROACH

A convenient sampling technique was utilized to select participants for the self-reported, questionnaire based, cross-sectional study. Harman's single factor test was used to compute the Common method variance (CMV); the total variance extracted by one factor was 25.34% (A2).

STUDY CONTEXT AND PARTICIPANT DEMOGRAPHICS

The data collection was conducted at a NABH accredited, GOI approved healthcare institution in New Delhi. Due permission of patients was taken to record their preferences in the questionnaire. Patients of doctors belonging to the following specialisations: Ophthalmology; psychiatry; neurology; cardiology and paediatrics-were considered for this study.

Prior written permission was taken from the hospital authorities to survey the MT patients (vide document number ART/BM/4376).

The participants were originally 1,600 MT patients from 16 different countries, visiting the destination hospital from May 2023-December 2023; 1,474 completed questionnaires were finally used for the study (Table 1). The participants were interviewed by the translators trained for the purpose by the authors. In few cases relatives of the patient helped in answering the questions which were in English language.

TABLE 1. DEMOGRAPHIC PROFILE OF THE MT PATIENTS

Demographic category	Group 1	Group 2	Group 3	Group 4
Gender of the MT patient	Male	Female		
	832	642		
Geography* of the MT patient	Western	Non-western		
	89	1385		
World bank classification of Economy of the country of belonging of the MT patient	Low	Middle	Upper	
	1,003	347	124	
Severity of ailment of the MT patient	Less complicated	Moderately complicated	Highly complicated	
	473	589	412	
Satisfaction of the MT patient with consultation time	Low	Moderate	High	
	347	147	980	
Average Waiting time in minutes	Less than 5	6-10	11-15	Above 15 minutes
	403	510	427	134
Final decision to opt for treatment in the hospital after first few clinical encounters	Not opted	Opted in		
	83	1,391		

*Indicative list:

Western countries: France, Germany, USA, Great Britain, Russia, Uzbekistan

Non-western countries: Nigeria, Mauritius, Nepal, Iran, Bangladesh, UAE, S. Arabia, Turkey, Iran, Japan

DATA COLLECTION INSTRUMENTS

A pilot testing was done with 300 patents and five doctors using a comprehensive questionnaire in the hospital with the assistance of language translators. Finally, 41 items were retained in the final questionnaire relating to patient beliefs, expectations and their clinical experiences. Data was collected soon after their initial clinical interaction with the host country doctor in the form of exit interviews.

DATA ANALYSIS TECHNIQUES

Data analysis was performed using a combination of statistical techniques for Confirmatory Factor Analysis and MGA-PLS

RESULTS AND ANALYSIS

STUDY ONE

The data was normally distributed. Factor Analysis using the Principal Components Analysis (PCA) method was used for data reduction. The construct, 'MT patient ICC beliefs regarding the Indian MT hospital' revealed three factors: *country and culture beliefs*, *quality of communication accommodation*, and *treatment related beliefs* (Table 2)

TABLE 2. FACTOR ANALYSIS FOR THE CONSTRUCT: ICC RELATED BELIEFS OF MT PATIENTS REGARDING THE INDIAN MT HOSPITAL (N=12 INDICATORS)

Sn	Rotated Component Matrix ^a			
	ICC related beliefs of MT patients regarding the Indian MT hospital	Component/ Factor		
		Country and culture beliefs	Communication accommodation by the hospital	Treatment related beliefs
1	I am aware of health risks in new country	.779		
2	I believe that Indian hospitals are sensitive to patient concerns	.742		
3	I believe that cultural disparities are accounted for in the hospital	.666		
4	I am conscious about doctor's gender	.644		
5	I believe I am knowledgeable about the characteristics of treating hospital	.614		
6	I believe that the medical record language is amenable to my culture		.815	
7	I am knowledgeable about traditional healing systems/cultures		.680	
8	India is a reliable MT hub		.644	
9	I believe that the doctors in the treating hospital have received cross-cultural training		.563	
10	I believe that the Indian doctors are knowledgeable about cultural differences			.834
11	I believe that the doctors are flexible to appreciate my specific treatment concerns			.582
12	I believe treatment cost can be discussed			.580
	Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			
	Rotation converged in 8 iterations. Total variance explained=58.700			

The Factor Analysis using the PCA on MT patient clinical experience revealed four factors viz., communication accommodation, listening behaviour, language or code-switching behaviour, and expressive communication behaviour. It sought to operationalise the convergent and divergent communication shown by the doctors and which factors contributed the most to the patient perception of doctors' ICC accommodation behaviours (Table 3)

TABLE 3. FACTOR ANALYSIS FOR THE CONSTRUCT: ICC RELATED EXPERIENCES OF MT PATIENTS IN CLINICAL INTERACTIONS THE INDIAN MT HOSPITAL (N=17 INDICATORS)

	Rotated Component Matrix ^a					
1	The hospital /attending team of physicians/Items	Communication accommodation	Listening behaviours	Code switching	Expressive communication behaviour	
		1	2	3	4	
2	appointed a language translator	.815				
3	was adept in handling queries	.680				
4	educated me about medical issue	.653				
5	advised change in health behaviours	.647				
6	showed concern	.589				
7	made eye contact	.585				
8	performed a culturally sensitive PE	.584				
9	dealt confidently with questions		.773			
10	identified unexpressed cultural ICC beliefs		.762			
11	made cultural gaffes		.721			
12	prescribed/negotiated a culturally sensitive treatment plan					
13	listened to me					
14	engaged in small talk			.867		
15	explained problem in my language			.814		
16	apologised for these cultural gaffes			.828		
17	demonstrated knowledge about cultural expressions of pain			.558		
	Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.					
	a. Rotation converged in 6 iterations. Total variance explained: 61.041					

The Factor Analysis using the PCA for the construct MT patient expectations (mediator) resulted in four factors, viz., expressive communication skills, cultural sensitivity in medical processes, and receptive communication style (Table 4).

TABLE 4. FACTOR ANALYSIS FOR THE CONSTRUCT: ICC RELATED EXPECTATIONS OF MT PATIENTS FROM THE INDIAN MT HOSPITAL (N=27 INDICATORS)

Sn.	ICC expectations from the hospital /attending team of physicians	Expressive communication skills	Cultural sensitivity in medical process	Receptive communication style
1	talk clearly with patients	.764		
2	advise changes as per culture	.764		
3	adeptness in handling queries	.760		
4	apologies for cultural gaffes	.674		
5	deal with my questions	.671		
6	appear informal and relaxed	.655		
7	be direct and speak plainly	.653		
8	translators	.652		
9	culturally sensitive treatment plan to be drawn		.768	
10	perform culturally sensitive PE		.742	
11	listening and responsive			.754
12	eye contact			.719
	Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 6 iterations. Total variance explained: 58.078			

THE GLM MULTIVARIATE

The General Linear Model served as a multi regression statistical tool to determine statistical association between the dependent mediator, moderator and independent variables. Table 5-1 displays the four significance tests for each model.

TABLE 5-1. RESULTS OF GLM ANALYSIS

Multivariate Tests ^a									
Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^c
Intercept	Pillai's Trace	.000	.000 ^b	4.000	1467.000	1.000	.000	.000	.050
	Wilks' Lambda	1.000	.000 ^b	4.000	1467.000	1.000	.000	.000	.050
	Hotelling's Trace	.000	.000 ^b	4.000	1467.000	1.000	.000	.000	.050
	Roy's Largest Root	.000	.000 ^b	4.000	1467.000	1.000	.000	.000	.050
FAC1_2 Beliefs regarding country and culture	Pillai's Trace	.742	1053.560 ^b	4.000	1467.000	<.001	.742	4214.240	1.000
	Wilks' Lambda	.258	1053.560 ^b	4.000	1467.000	<.001	.742	4214.240	1.000
	Hotelling's Trace	2.873	1053.560 ^b	4.000	1467.000	<.001	.742	4214.240	1.000
	Roy's Largest Root	2.873	1053.560 ^b	4.000	1467.000	<.001	.742	4214.240	1.000
FAC2_2	Pillai's Trace	.824	1711.423 ^b	4.000	1467.000	<.001	.824	6845.693	1.000

Beliefs regarding cultural accommodation	Wilks' Lambda	.176	1711.423 ^b	4.000	1467.000	<.001	.824	6845.693	1.000
	Hotelling's Trace	4.666	1711.423 ^b	4.000	1467.000	<.001	.824	6845.693	1.000
	8Roy's Largest Root	4.666	1711.423 ^b	4.000	1467.000	<.001	.824	6845.693	1.000
FAC3_2 Cognitive ICC beliefs related to treatment in the hospital	Pillai's Trace	.678	771.220 ^b	4.000	1467.000	<.001	.678	3084.882	1.000
	Wilks' Lambda	.322	771.220 ^b	4.000	1467.000	<.001	.678	3084.882	1.000
	Hotelling's Trace	2.103	771.220 ^b	4.000	1467.000	<.001	.678	3084.882	1.000
	Roy's Largest Root	2.103	771.220 ^b	4.000	1467.000	<.001	.678	3084.882	1.000
a. Design: Intercept + FAC1_2 + FAC2_2 + FAC3_2									
b. Exact statistic									
c. Computed using alpha = .05									

The multinomial regression showed that the Wilks' λ value was closer to 0 for the three MT belief factors indicating the strength of the relationship between patient belief and experience. Of the three, *communication accommodation behaviours* of the hospital team ranked significantly higher for influencing MT patient ICC clinical experiences. Pillai's trace and Hotelling's trace were positively valued with increasing values indicating effects that contributed more to the model; MT patient' ICC beliefs regarding communication accommodation had higher values showing that it contributed more to the model than other two factors ($p > 0.05$).

The larger partial eta squared values show the extent of variance explained by that variable/factor in the model (Table 5-2).

TABLE 5-2. RESULTS OF GLM ANALYSIS (TESTS OF BETWEEN-SUBJECTS EFFECTS)

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^e
Corrected Model	Experience factor 1 Communication accommodation	812.097 ^a	3	270.699	602.096	<.001	.551	1806.288	1.000
	Experience factor 2 Receptive communication behaviours	579.398 ^b	3	193.133	317.708	<.001	.393	953.125	1.000
	Experience factor 3 Code switching by the doctors/staff	145.919 ^c	3	48.640	53.878	<.001	.099	161.634	1.000
	Experience factor 4 Expressive communication behaviours	130.554 ^d	3	43.518	47.653	<.001	.089	142.958	1.000
Intercept	Experience factor 1 Communication accommodation	.000	1	.000	.000	1.000	.000	.000	.050
	Experience factor 2	.000	1	.000	.000	1.000	.000	.000	.050

	Receptive communication behaviours								
	Experience factor 3 Code switching by the doctors/staff	.000	1	.000	.000	1.000	.000	.000	.050
	Experience factor 4 Expressive communication behaviours	.000	1	.000	.000	1.000	.000	.000	.050
FAC1_2 Beliefs regarding country and culture	Experience factor 1 Communication accommodation	169.437	1	169.437	376.867	<.001	.204	376.867	1.000
	Experience factor 2 Receptive communication behaviours	237.056	1	237.056	389.963	<.001	.210	389.963	1.000
	Experience factor 3 Code switching by the doctors/staff	5.224	1	5.224	5.786	.016	.004	5.786	.671
	Experience factor 4 Expressive communication behaviours	47.927	1	47.927	52.481	<.001	.034	52.481	1.000
FAC2_2 Beliefs regarding cultural accommodation	Experience factor 1 Communication accommodation	605.156	1	605.156	1346.005	<.001	.478	1346.005	1.000
	Experience factor 2 Receptive communication behaviours	43.832	1	43.832	72.105	<.001	.047	72.105	1.000
	Experience factor 3 Code switching by the doctors/staff	140.689	1	140.689	155.841	<.001	.096	155.841	1.000
	Experience factor 4 Expressive communication behaviours	12.873	1	12.873	14.096	<.001	.009	14.096	.963
FAC3_2 Cognitive ICC beliefs related to treatment in the hospital	Experience factor 1 Communication accommodation	37.503	1	37.503	83.416	<.001	.054	83.416	1.000
	Experience factor 2 Receptive communication behaviours	298.510	1	298.510	491.057	<.001	.250	491.057	1.000
	Experience factor 3 Code switching by the doctors/staff	.006	1	.006	.007	.932	.000	.007	.051
	Experience factor 4	69.753	1	69.753	76.380	<.001	.049	76.380	1.000

	Expressive communication behaviours								
Error	Experience factor 1	660.903	1470	.450					
	Experience factor 2	893.602	1470	.608					
	Experience factor 3	1327.081	1470	.903					
	Experience factor 4	1342.446	1470	.913					
Total	Experience factor 1	1473.000	1474						
	Experience factor 2	1473.000	1474						
	Experience factor 3	1473.000	1474						
	Experience factor 4	1473.000	1474						
Corrected Total	Experience factor 1	1473.000	1473						
	Experience factor 2	1473.000	1473						
	Experience factor 3	1473.000	1473						
	Experience factor 4	1473.000	1473						
e. Computed using alpha = .05									

Beliefs regarding country and culture explained much of the variance in Communication accommodation and Receptive communication behaviours. Experience factor 1 and 2 (Cultural accommodation and Receptive communication behaviours) displayed high R-square values (Adjusted R Squared = .550; Adjusted R Squared = .392) whereas Experience factor 3 and 4 (Code switching by the doctors/staff and Expressive communication behaviours) displayed low R square values (Adjusted R Squared = .097; Adjusted R Squared = .087), indicating that these did not contribute to the model.

PARAMETER ESTIMATES

The effect of each predictor is summarised in the parameter estimates table. MT patients' beliefs relating to the Country and culture was found to significantly influence the dependent variable Communication accommodation. Results show that except treatment cost, all factors contributed significantly to the model (Table 5-3)

TABLE 5-3. RESULTS OF GLM ANALYSIS -PARAMETER ESTIMATES

Dependent Variable	Parameter	B	Std. Error	t	Sig.
Experience factor 1 Communication accommodation	Intercept	-4.359E-17	.017	.000	1.000
	Belief in Indian MT FAC1_2 country and culture	.339	.017	19.413	<.001
	Belief in Indian MT FAC2_2 Cultural accommodation	.641	.017	36.688	<.001
	Belief in Indian MT FAC3_2 Treatment cost	.160	.017	9.133	<.001
Experience factor 2 Receptive communication behaviours	Intercept	3.787E-17	.020	.000	1.000
	Belief in Indian MT FAC1_2 country and culture	.401	.020	19.747	<.001
	Belief in Indian MT FAC2_2 Cultural accommodation	.173	.020	8.491	<.001
	Belief in Indian MT FAC3_2 Treatment cost	.450	.020	22.160	<.001
Experience factor 3 Code switching	Intercept	-4.309E-17	.025	.000	1.000

	Belief in Indian MT FAC1_2 country and culture	-.060	.025	-2.405	.016
	Belief in Indian MT FAC2_2 Cultural accommodation	.309	.025	12.484	<.001
	Belief in Indian MT FAC3_2 Treatment cost	.002	.025	.085	.932
Experience factor 4 Receptive communication behaviours	Intercept	-1.093E-16	.025	.000	1.000
	Belief in Indian MT FAC1_2 country and culture	.180	.025	7.244	<.001
	Belief in Indian MT FAC2_2 Cultural accommodation	.093	.025	3.755	<.001
	Belief in Indian MT FAC3_2 Treatment cost	.218	.025	8.740	<.001

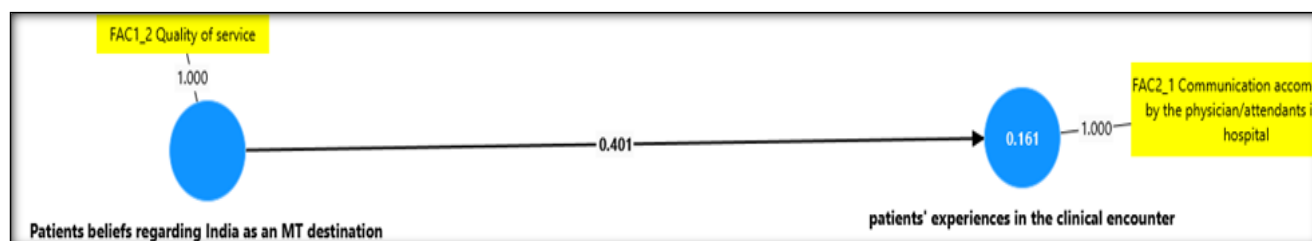
Study 1, based on Factor Analysis and the GLM, concluded that the MT patients' beliefs about the culture of the country and the hospital services influenced their quality of clinical experience. MT patients' expectations were largely derived from these set of ICC beliefs and these expectations mediated the relationship between patients' ICC beliefs and patients' ICC experiences. Study 2 was conducted to further test for the validity and reliability of the GLM output.

STUDY 2

The outputs of the Factor Analysis factors were then transferred to the Smart PLS to run the CFA and the mediator analysis. The SPSS file containing the values were uploaded on smart PLS to test endogenous constructs that contributed most to the model. Derived from the Factor Analysis (PCA), these were identified as formative constructs in Smart PLS.

For factor indicators, only values above .700 were accepted. Consequently, only one factor in each construct significantly contributed to the model (Figure 2). The independent variable was FAC1_2, in the construct, *Belief in the country and culture of Indian MT hospital* (comprising five items: I am aware of health risks in new country; I believe that Indian hospitals are sensitive to patient concerns; I believe that cultural disparities are accounted for in the hospital; I am conscious about gender; and I believe I am knowledgeable about the characteristics of the treating hospital). The dependent variable was FAC 2_1, belonging to the construct *Quality of patient experience in the clinical encounter* (Communication accommodation by the attending team) comprising seven items: The hospital /attending team of physicians appointed a language translator; was adept in handling queries; educated me about medical issue; advised change in health behaviours; showed concern; made eye contact; and performed a culturally sensitive physical examination (PE)

FIGURE 2-RESULTS OF THE MEASUREMENT MODEL



Source: Smart PLS

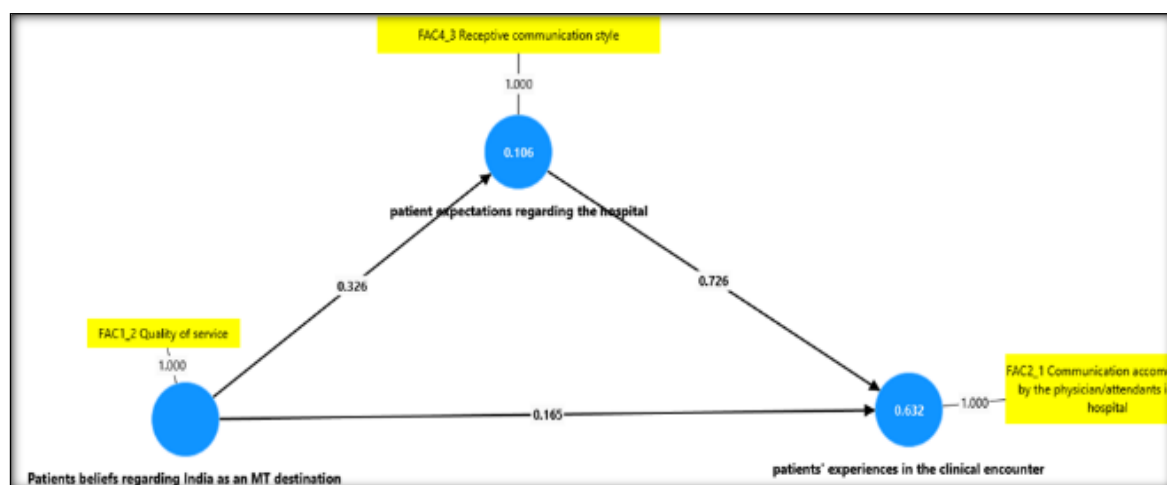
Table 6 shows the values of the quality tests, before and after adding the mediator variable (expectations regarding the receptiveness of the team, comprising two items: listening and responsive eye contact):

TABLE 6. VALUES OF QUALITY CRITERION BEFORE AND AFTER ADDING THE MEDIATOR VARIABLE

1	Path Coefficients: Before adding the Mediator			Path coefficients: After adding the mediator
	Constructs	Dependent Construct (ICC experience of MT patients regarding Communication accommodation)	Independent construct (ICC belief of MT patient regarding the Indian hospital as MT hub)	Mediator (Expectations regarding the receptive communication behaviour of the team)
	ICC experience of MT patients regarding Communication accommodation (dependent variable)	1		
	ICC belief of MT patient regarding the Indian hospital as MT hub (independent construct)		0.401	0.165
2	R-square: Before the mediator			R-square: After the mediator
	Experience of MT patients-behavioural ICC	0.160		0.631
3	f-square: Before the mediator			f-square: After the mediator
	Mt patients' ICC beliefs Indian hospitals as MT hub -> experience of MT patients-communication accommodation	0.192		0.066
	(Note: Recommended f2 cut offs are 0.02, 0.15, and 0.35 for small, medium, and large effect sizes respectively.			

Partial mediation was indicated by patients' expectations (value of path coefficient decreased from 0.401 to 0.165). The model also shows robustness after adding the mediator (the R square increased to 0.631). Figure 3 displays the final model:

FIGURE 3- FINAL RESEARCH MODEL



Source: Smart PLS

Structural Model. Bootstrapping for N=10,000 sample showed increase in the R square values (Table 7). The Q² values obtained by the blindfolding procedure in PLS-SEM was positive, indicating that the model enjoyed predictive relevance.

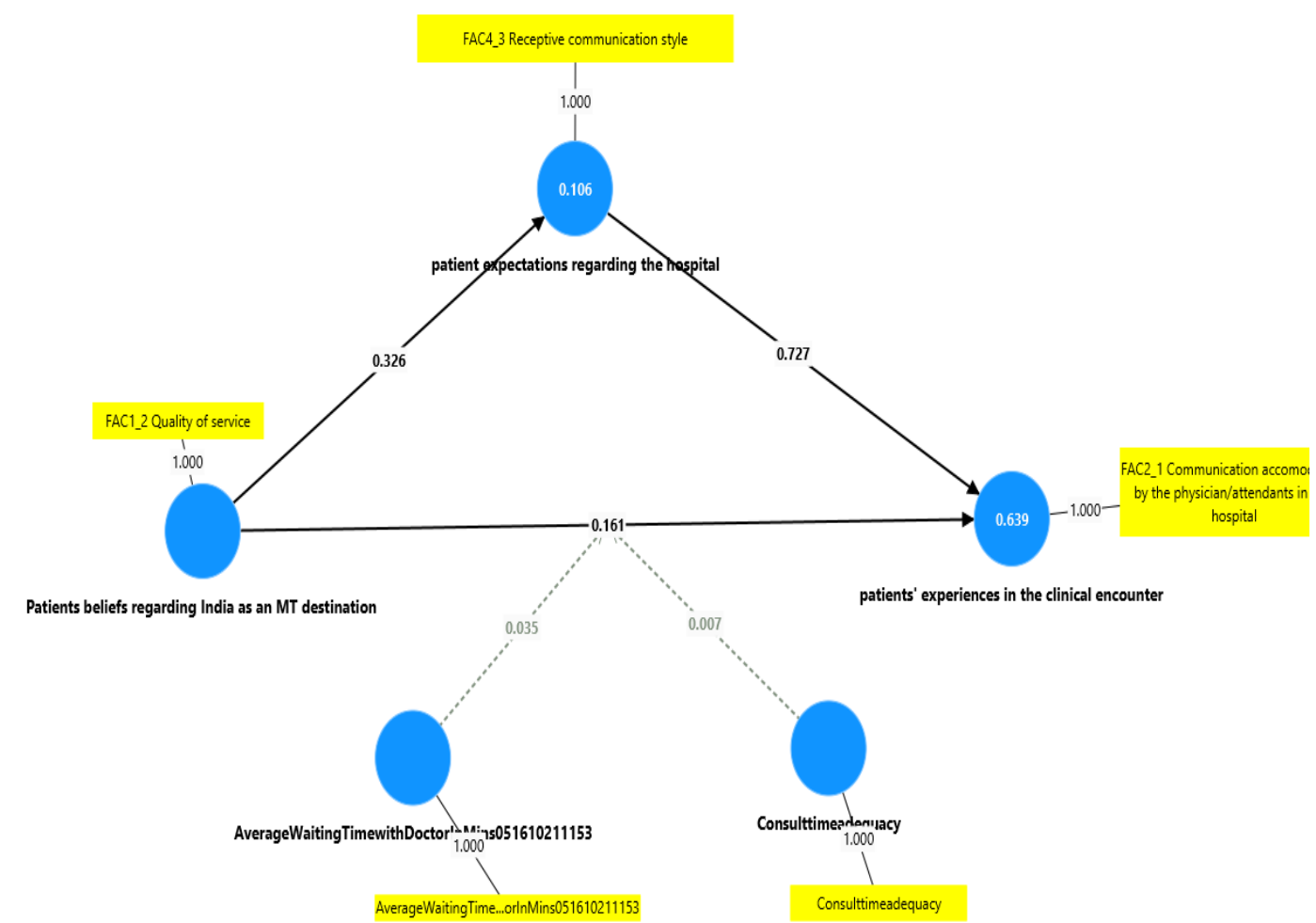
TABLE 7. COMBINED RESULTS OF THE MEASUREMENT AND STRUCTURAL MODEL

1	Path Coefficients: Before adding the Mediator			Path coefficients: After adding the mediator	Bootstrapping	Blindfolding
	Constructs	Dependent Construct (ICC experience of MT patients regarding Communication accommodation by the hospital team)	Independent construct (ICC belief of MT patient regarding the Indian hospital as a reliable MT hub)	Mediator (Expectations regarding the receptive communication behaviour of the team)		
	ICC experience of MT patients regarding Communication accommodation (dependent variable)	1				
	ICC belief of MT patient regarding the Indian hospital as MT hub (independent construct)		0.401	0.165		
2	R-square: Before the mediator			R-square: After the mediator	R-square: After Bootstrapping	
	ICC Experience of MT patients in communication accommodation	0.160		0.631	0.631; T-stat: 43.992; p=0.000<.05	
3	f-square: Before the mediator			f-square: After the mediator	f-square: After Bootstrapping	
	Mt patients' ICC beliefs Indian hospitals as MT hub -> experience of MT patients- communication accommodation	0.192 (Note: Recommended f2 cut offs are 0.02, 0.15, and 0.35 for small, medium, and large effect sizes respectively.		0.066	1.277; T-stat=14.220; p=0.000<.05	
4	HTMT-Monotrait				2.5% 0.759 97.5% 0.798	
5	Communication accommodation perceived by the MT patients			Q²		0.159

			(Note: Moderate Predictive relevance)

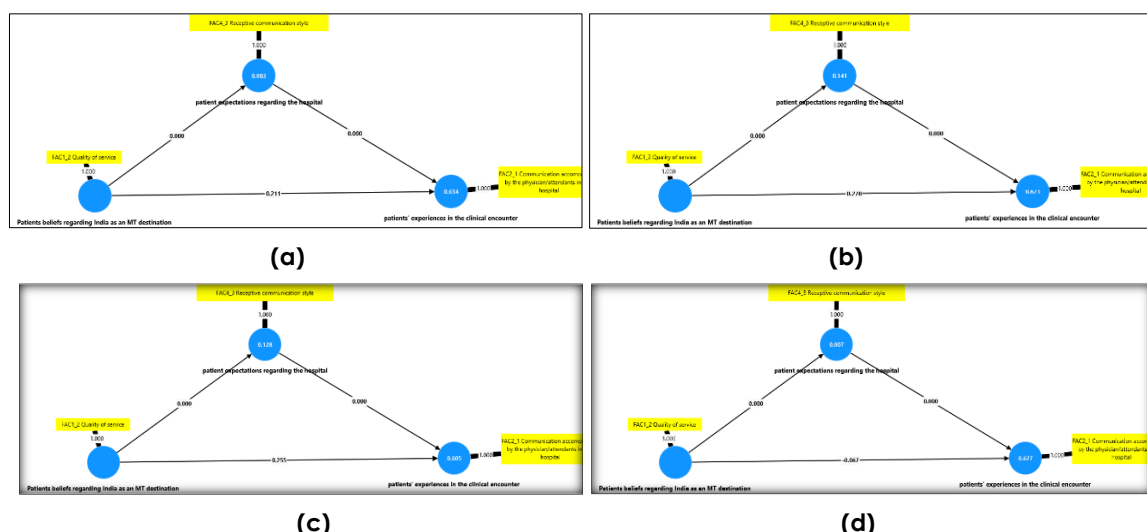
The Multigroup analysis (MGA) revealed that overall, the model was not differentiated for any of the moderator variables (waiting time, and consult time), and nor for any control groups such as gender, geography, economic status, and severity of the disease. However, the difference was significant between two groups of wait time (Group_1 403 MT patients; less than 5 minutes - Group_2 510 MT patients; between 6-10 minutes = -0.056; (Group_1 vs Group_2) p value=0.000 <.01)

FIGURE 4-MODERATOR ANALYSIS OUTPUT



The Multi-group analysis (Figure 5) shows that patients in Group 3 showing high satisfaction with consultation time improved the model, than patients with low satisfaction with consultation time; patients in Group 2 belonging to western countries improved the model than patients belonging to non-western countries; patients in Group 4 with high severity of disease improved the model than patients with less complicated medical problems; and that Group 3 (patients least satisfied with waiting time) contributed most negatively to the model.

FIGURE 5-MGA OUTPUTS FOR (A) CONSULT TIME (B) GEOGRAPHY (C) SEVERITY OF DISEASE (D) WAIT TIME



DISCUSSION

Significant differences were found to exist between the western and the non-western countries with regard to patient communicative experiences in the clinic. This corroborates the findings of earlier studies [9,10, 14]. The beliefs systems regarding the host country hospitals influenced outcomes such as a self-reported poor clinical experience in this study [15,16,17,18]. Our study supports the assertion that medical tourist expectations need to be documented and managed [see 25]. The study validated CAT as a useful theory in understanding both the linguistic and sociopsychological aspects of patient-provider medical interactions. The accommodation practices by the doctors were mainly found to be divergent in our study and it affected the quality of clinical experiences [28] of the MT patients. Both verbal and non-verbal communication accommodation practices by doctors were found to be insufficient in our study. Our study supports the findings of the NAAS survey [29] wherein also asymmetrical accommodation was found in doctor-patient interactions for severe ailments

The results showed that developing confidence among the MT patients is important for building trust in the host country hospital in the medical tourism sector. A high level of confidence in the communication and cultural accommodation practices followed by the destination hospital influenced the quality of the MT patients' initial clinical encounters (Hypothesis 1). Patients perceived a positive experience when the attending team of doctors convergently accommodated by way of arranging language translators, handling patient queries patiently, listening to them, showing positive body language behaviours, educating patients about their medical issues, demonstrating verbal concern, using proper eye contact, advising change in health behaviours in accordance with their culture and religion, and more importantly, performing a culturally sensitive physical examination (PE) respecting gender preferences (Hypothesis 2). However, divergent accommodation, characterised by fewer questions raised by the doctors, poorly responding to the patient queries, and low expressive skills of the attending team negatively influenced their experience in the clinical encounter.

Expectations are internally manifested by the patients and depend on a number of factors such as word of mouth promotion by other patients. Results show that patients develop expectations about the MT services based on their beliefs, which, in turn, influenced the quality of their experiences. The mediation analysis revealed that patient expectations regarding the receptive communication abilities of the host country team of doctors mediated the relationship between MT patient beliefs and MT patient experiences (Hypothesis 3) ultimately enhancing overall satisfaction and health outcomes. In other words, higher expectations enhanced the in-clinic experience of the patients; conversely lower expectations reduced the quality of clinical interactions. The hospital can nurture positive expectations by talking about

the brand of the hospital in a positive manner, promoting their hospital brand, recounting of success stories, and highlighting the cultural richness of the place. This is important because medical tourism is more than just tourism; it is also travel and hospitality arrangements made by the hospital where culture is inexplicably drawn in. (Hypotheses 1 and 2).

Our study showed that the non-western patients had higher expectations from Indian doctors regarding cultural and communication accommodation than western patients. This could be due to assumptions regarding communication and cultural similarities and the geographical proximity of their respective countries to India. Patients belonging to countries with high cultural affinity with the host country in terms of collectivism, patriarchal culture and collaborative decision making expected more 'family like' behaviour from the Indian doctors rather than a professional demeanour.

Patient dissatisfaction with waiting time and severity of the disease have the potential to positively or negatively influence the quality of experience. The patients with least waiting time recorded better experience than patients with the highest wait time in this study. The moderation analysis using satisfaction with the wait time and consult time did not reveal any significant results (Hypothesis 4). Consultation time, while overall a poor differentiator, negatively influenced the experience for patients who had less than five minutes of consult time with the attending team of host country doctors.

The model was controlled for gender, geographies, severity of the illness, and economic status of the countries, but no significant differentiation was found across categories. This hints at influence of other determinants of overall quality of experience in the host country hospitals. The MGA results, however cannot be ignored, because patients with more severe ailments expected more communication and cultural sensitivity from the attending team of doctors at the hospital than patients with low or moderate severity of ailments

CONCLUSION

Expectation Management (EM) is emerging as a critical field in doctor-patient interactions especially in the case of Medical Tourism. It is not enough to obtain accreditation; hospitals should ensure that the administrative processes in terms of patient expectations regarding hospital facilities, tourism opportunities, stay of relatives, socio-religious cultural accommodation, and related services are met accordingly. Our study shows that the hospital can benefit from conducting cross-cultural training programs to enhance service quality and patient experience in the clinical interaction. Doctors need information on gender sensitivities, touch, eye contact, and more, especially when dealing with non-western patients

Raising expectations has a domino effect on raising perception of quality of service. This may be done by investing in promotion of the hospital services to build confidence in the MT patients regarding the hospital selected by them. The study recommends investing in building MT websites, providing evidence of cognitive, affective, and behavioural expertise of Indian hospitals in treating MT patients. For instance, simulations based on augmented reality (AR) and Virtual Reality (VR) technologies may be used to display nuances of doctor-patient communication in an intercultural communication context. Similarly, concerns regarding gender preferences especially for physical examination and drawing up of culturally aligned prescription plans may be addressed through these websites by means of referrals, videos, pictures, and other promotional materials.

LIMITATIONS AND FUTURE WORK

The study is not without its limitations. First, it was conducted in one hospital which significantly limited the generalisability of the findings. Secondly it relied on self-reported data from patients with the help of language translators. Many minor points might have been 'lost in translation' even as the data was captured as soon as the patient had exited from the clinical venue. Thirdly, the data was cross sectional rather than longitudinal. Results might vary according to context and time. Scholars working on this area can overcome these limitations by adding data from more accredited hospitals in one country or across different countries. They may also choose to conduct a longitudinal study on patients from select countries over multiple consultations with a focus beyond culture and communication.

LIST OF ABBREVIATIONS USED

MT: Medical Tourism

NABH: National Accreditation Board for Hospitals & Healthcare Providers

JCI: Joint Commission International

EM: Expectation Management

CAT: Communication Accommodation Theory

ICC: Inter-Cultural Communication

PE: Physical Examination

MGA: Multi Group Analysis

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APPENDIX

A1: COPY OF THE PATIENT QUESTIONNAIRE

Dear patients

This is to solicit your opinions on communication, cultural beliefs, expectations, and experiences in this hospital. Request your kind cooperation. We assure you that all information will be kept confidential, and that the data is used for the research purposes only. The study has duly been approved by the Hospital Administration. Thank you

- Name-
- Nationality-
- First Language-
- Age: (25-35) (36-45) (46-55) (56-65) (66-75)
- Gender: (1) Male (2) Female
- I have consulted this hospital before (1) Yes (2) No
- I have been recommended to visit this hospital (1) Through social media (2) Friends/Relatives (3) Resident doctor of my country (4) Popular media (5) Others such as
- The medical interview time with the doctor was 0-5 minutes; 6-10 minutes 11-15 minutes 16-30 minutes; above 30 minutes
- The waiting time on an average with the doctor was 0-5 minutes; 6-10 minutes 11-15 minutes 16-30 minutes; above 30 minutes
- The average waiting time was (a) too less (b) moderate (c) adequate
- The medical interview time was (a) too less (b) moderate (c) adequate
- I was satisfied with the medical interview (a) No (b) Yes
- I requested for more consultation time / consultation with other experts in this hospital before taking a decision to opt for this hospital (a) No (b) Yes
- I opted for medical treatment in this hospital (a) No (b) Yes
- My treatment went on for (a) 1-3 months (b) 4-8 months (c) 8 months and above

Q2 Rate the importance of the following in your choice of treatment on a scale of 1-10

1 2 3 4 5 6 7 8 9 10

Not at all

Extremely important

- The doctor's racial and ethnic identity
- The gender of the doctor based on our culture's practice and acceptability
- The characteristics of the treating hospital (location, region, competency, expertise)
- The doctor's experience with patients/health care professionals from culturally diverse backgrounds
- The cultural differences/ disparities in deciding treatment in a foreign country (for yourself)
- The health risks experienced by patients belonging to diverse racial and ethnic groups in medical treatment
- The sensitivity of the physicians on issues related to children, adults (especially women from different countries, religions and cultures)
- The flexibility of the doctor to my concerns
- The doctor's knowledge about the different healing traditions (e.g., Ayurvedic Medicine, Traditional Chinese Medicine, and Allopathic treatments) and especially those practiced in my culture
- The treatment cost and expense of stay of patient and relatives
- The medical record language spoken in the hospital

Q3 Rate your self-beliefs on a scale of 1-10 about the following statements:

	1	2	3	4	5	6	7	8	9	10
Totally Disagree										Totally Agree
• I have considerable knowledge about the different healing traditions (e.g., Ayurvedic Medicine, Traditional Chinese Medicine, Allopathic Medicine) • I am highly aware about my own cultural identity, stereotypes and prejudices • I researched heavily about India's culture, its beliefs and ways of doing things in healthcare before coming to India • The healthcare professionals must compulsorily receive training in cultural diversity and/or multicultural health care • India is a good hub of reliable medical tourism										

Q4 Rate the expectations from a doctor in medical tourism during consultation on a scale of 1-10

	1	2	3	4	5	6	7	8	9	10
Totally Disagree										Totally Agree
• Small talk about family, food, culture, and country • Explain the problem in my language/language I understand • Listen to me without interruptions • Make eye contact • Show concern • Perform a culturally sensitive physical examination • Prescribe/negotiate a culturally sensitive treatment plan • Educate me about the problem using proper mediums • Appoint a language translator with knowledge of my cultural background • Adept in handling questions • Deal confidently with objections in a culturally sensitive manner • Identify cultural beliefs that are not expressed but might interfere with the treatment regimen • Apologies if cultural gaffes are made • Demonstrates knowledge about interpreting different cultural expressions of pain, distress, and suffering • Advises a patient to change behaviours or practices related to cultural beliefs that impair one's health										

Q5 Rate the body language expectations from a doctor in medical tourism on a scale of 1-10

	1	2	3	4	5	6	7	8	9	10
Not at all										Extremely Skilled
• Physicians should be aware of greeting patients in a culturally sensitive manner • Physicians should make a good eye contact with the patient • Physicians should be direct and forthright • Physicians should convey the bad news directly and quickly • Physicians should be formal in saying good-byes • Physicians should always be punctual for an appointment; being late is unprofessional • Physicians should strictly adhere to meeting time • Physicians should always be well dressed ensuring adherence to safety concerns • Physicians should always be pleasant and be smiling when consulting the patient • Physicians should always be informal and relaxed with the international patients • Physicians should talk clearly and loudly with the international patients										

- Physicians should write prescriptions which are legible
- Physicians should use culturally specific gestures that might have different meanings in different cultures

Q6 Rate the actual experience during consultation in this hospital on a scale of 1-10

1 2 3 4 5 6 7 8 9 10

Totally Disagree

Totally Agree

- Indulged in small talk about family, food, culture, and country
- Explained the problem in my language/language I understand
- Listened to me without interruptions
- Made eye contact
- Showed concern
- Performed a culturally sensitive physical examination
- Prescribed/negotiated a culturally sensitive treatment plan
- Educated me about the problem using proper mediums
- Appointed a language translator with knowledge of my cultural background
- Were adept in handling questions
- Dealt confidently with objections in a culturally sensitive manner
- Identified cultural beliefs that are not expressed but might interfere with the treatment regimen
- Made cultural mistakes
- Apologized when these mistakes were made
- Demonstrated knowledge about interpreting different cultural expressions of pain, distress, and suffering
- Advised changing behaviours or practices related to cultural beliefs that impair one's health

A2: CMV OUTPUT

Total Variance Explained			
Factor	Extraction Sums of Squared Loadings		
	Total	% Of Variance	Cumulative %
1	.760	25.344	25.344
Extraction Method: Maximum Likelihood.			

FACILITATORS AND BARRIERS TO SERVICE UTILIZATION FOR BENEFICIARIES OF 12 SERVICE PACKAGES PROVIDED UNDER COMPREHENSIVE PRIMARY HEALTH CARE (C-PHC) IN INDIA: A QUALITATIVE STUDY

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ABSTRACT

INTRODUCTION:

In February 2018, the Government of India announced that 150,000 Health & Wellness Centres (HWCs) (renamed as Ayushman Aarogya Mandir (AAM) in November 2023) will be created by transforming existing Sub-Centres (SC) and Primary Health Centres (PHCs) for Comprehensive Primary Health Care (C-PHC) delivery under Ayushman Bharat Yojana. The study aims to understand the barriers and facilitators influencing the eligible beneficiaries' perspectives on the utilization of C-PHC services offered at AAM.

MATERIALS & METHODS:

A qualitative study was conducted in Gandhinagar district, and in-depth interviews (IDIs) were conducted with the eligible beneficiaries for C-PHC services at AAM. The data obtained was transcribed to identify codes, and subsequently, themes were merged with those codes.

RESULTS:

The results showed that ASHAs were key to building awareness about AAMs amongst the beneficiaries. Trust in staff and social network influence were facilitators for service uptake. Beneficiaries undergoing TB treatment chose private clinics over AAM due to stigma. Due to lack of infrastructure beneficiaries had privacy concerns in consulting the service provider of opposite gender.

CONCLUSION:

Further strengthening of the initiative can be done by addressing challenges such as infrastructure issues, physical access, and shortage of medicines. Facilitators such as beneficiaries' trust in the system, and patient-centric behavior of the staff can be considered for implementation in line with the regional context.

KEYWORDS

ayushman aarogya mandirs, comprehensive primary healthcare, ayushman bharat yojana, health and wellness centers

INTRODUCTION

Health lies at the core of the 2030 Agenda for Sustainable Development, intersecting with multiple Sustainable Development Goals (SDGs) and being explicitly prioritized under Goal 3, which aims to ensure healthy lives and promote well-being for all at all ages. In recent years, Primary Health Care (PHC) has received renewed global emphasis owing to its pivotal role in advancing universal health coverage and achieving the overarching objective of health and well-being for all [1]. PHC seeks to enhance both the level and equitable distribution of health and well-being by prioritizing people's needs and preferences, addressing them as early as possible along the continuum of care from health promotion and disease prevention to treatment, rehabilitation, and palliative care [2]. The need to strengthen PHC in India was first articulated in the Bhore Committee Report 1946 and the 1st & 2nd National Health Policy (1983 and 2002) [3].

In February 2018, the Government of India announced the establishment of 150,000 Health and Wellness Centres (HWCs) by transforming existing Sub-Centres (SCs) and Primary Health Centres (PHCs) to deliver Comprehensive Primary Health Care (C-PHC) under the Ayushman Bharat programme. In November 2023, these HWCs were subsequently renamed Ayushman Arogya Mandir (AAM) [3,4]. The policy objective behind creating AAM is that they should provide a continuum of care for maternal and child healthcare services including care for non-communicable diseases, palliative and rehabilitative care, oral, eye and Ear, Nose & Throat (ENT) care, mental health, and first-level care for emergencies and trauma, including provision of free essential drugs and diagnostic services referred to as Comprehensive Primary Healthcare (C-PHC) [5].

In line with staffing norms, upgraded SCs were to be staffed by a team comprising at least three service providers, including one Community Health Officer (CHO), two to three Multi-Purpose Workers (MPWs), and an Accredited Social Health Activist (ASHA) workforce deployed at the norm of one ASHA per 1,000 population. Staffing at upgraded PHCs are to be strengthened in accordance with the Indian Public Health Standards (IPHS) [3]. Key inputs like logistics, infrastructure, capacity building, health promotion, and community mobilization, linkages with Mobile Medical Units (MMUs) will be provided at the upgraded AAMs. From the latest details, there are 620 million footfalls at 77,784 AAMs and 107.2 million diabetes screenings for 30+ aged individuals [6].

In the existing literature, several studies have been conducted in the context of SCs and PHCs, focusing on supply-side and demand-side factors to understand factors influencing service utilization [7–9]. However, as AAM is a recent initiative, there is a lack of understanding of the facilitators and barriers that citizens face in accessing the services at AAM. This study aims to understand from the perspectives of eligible beneficiaries, the barriers and facilitators influencing their decision to utilize the C-PHC services offered at AAM. Study findings will contribute to the literature by highlighting the facilitators and barriers faced by the eligible beneficiaries in accessing services at the AAM and will provide actionable insights for policymakers to strengthen AAM utilization.

METHODS

STUDY DESIGN

A descriptive study design was used to conduct a qualitative study for 6 months at AAMs of Gandhinagar district, Gujarat.

This study was conducted after obtaining ethical approval (TRC-IEC No: TRC/2023-24/21-29) from the Institutional Ethics Committee of the Indian Institute of Public Health (IIPHG) university, Gandhinagar with which the first author is affiliated.

Sampling - A purposive sampling method was employed to select beneficiaries for in-depth interviews (IDIs), as the study aimed to capture their experiences, knowledge, and perceptions regarding service utilization. All eligible beneficiaries, whether they availed of or did not avail themselves of the C-PHC services from AAM, were included in the study.

ELIGIBLE BENEFICIARY

Eligible Beneficiaries are individuals or groups who meet defined criteria and are therefore entitled to receive services as set out in AAM guidelines,

including community-based services and facility-based services, as well as benefits of government health schemes, irrespective of whether they have availed/received these services/benefits or not.

INTERVIEW GUIDE

Based on literature review, a semi-structured interview guide with open-ended questions was developed, prepared in English, and translated into the local language. It was pilot tested with 10 eligible beneficiaries in an Ahmedabad district block, and iterative changes were made to fine tune the guide.

DATA COLLECTION

The data collection process started after obtaining approval from district officials. In consultation with district officials, five AAM-PHCs and five AAM-SCs (falling under the identified AAM-PHCs) were selected for data collection. The list of beneficiaries was obtained from respective AAM-PHCs, and AAM-SC teams. ASHAs, owing to their close engagement with the community, assisted solely in verifying beneficiary eligibility and facilitating initial contact; they were not involved in the selection of participants for IDIs. Verbal informed consent was obtained from all respondents, and 30 IDIs (25–30 minutes each) were conducted in the local language with beneficiaries, until data saturation was achieved. All IDIs were audio-recorded for transcription and analysis.

DATA ANALYSIS

All audio recordings were transcribed and translated into the English language. The transcripts were read several times to identify the codes. Subsequently, codes were merged into themes through manual coding from each transcript for Data Analysis.

RESULTS

The majority of the study participants were housewives. Study participants who went to primary and secondary schools were nearly equal followed by illiterate and then people with higher secondary education. None of the participants were a tertiary level graduate or college dropout. Many participants belonged to Other Backward Categories (OBC) followed by SEBC (Socially & Economically Backward Class), General, and SC (Schedule Caste)/ST (Schedule Tribes). Participant socio-demographic details are summarised in Table 1.

TABLE 1 SOCIODEMOGRAPHIC DETAILS

Study Participants Socio-Demographic Details			
Particulars	Details	N =30	%
Gender	Male	11	36.66
	Female	19	63.33
Occupation	Housewives	14	46.66
	Farmers	4	13.33
	Daily wagers	3	10
	Healthcare providers	3	10
	Retired employees	5	16.66

	self-employed	1	3.33
Education	Primary (nursery to 7 th std)	10	33.33
	Secondary (8 th - 10 th)	11	36.66
	Higher Secondary(11 th -12 th)	2	6.66
	Illiterate	7	23.33
Caste	OBC	13	43.33
	SEBC	11	36.66
	SC/ST	2	6.66
	General	4	13.33
Age Group	20-40 years	20	66.66
	40-80 years	10	33.33

FACILITATORS ENCOURAGING THE BENEFICIARIES TO UTILIZE SERVICES AT AAM

Field connect with the beneficiaries by ASHAs:

The results highlighted that ASHAs are key to building awareness about AAMs amongst the beneficiaries; the more an ASHA was active and engaging, the more she was able to inform eligible beneficiaries about the services available at AAM.

"Here, ASHA visits every house regularly, and she advised that all medicines are available at AAM" (Female, 41 years)

"I got information about the medicines that are available at the center clinic from our ASHA". (Female, 35 years)

Patient-centric behavior by the service providers:

IDIs with the eligible beneficiaries highlighted that patient-centric behavior by AAM staff has a positive impact on the beneficiaries' intention to use AAM services. The two main behaviors that were highlighted from the interviews are treating beneficiaries with respect and informing them about the duration for which AAM will not be functioning. These behavioral aspects of AAM staff help make beneficiaries feel valued and remove uncertainty about whether on reaching AAM will they be able to access the services or not.

"I have never seen rude behavior from the staff here...they always treat us with respect" (Female, 64 years)

"Yes...they inform us if it is closed for 1-2 days. They tell us beforehand if there is a holiday" (Female, 36 years)

"We call them and ask...they tell us when there is a holiday or for some reason the clinic will remain closed...they tell us to get the medicines accordingly" (Female, 41 years)

Ease of access to the facility:

Another factor that came out from the IDIs was the ease of physical access to AAM by the beneficiaries. The proximity of AAM makes it convenient for beneficiaries to visit AAM regularly. The newly built infrastructure and re-branding of AAMs created a positive influence on beneficiaries' opinion about AAM, encouraging them to utilize the services at AAM.

"The clinic is located in the center of our village, 1km from our home, and is near Mahadev temple, so whenever we go to the clinic we also visit temple" (Male, 72 years)

"The clinic is new...it was made recently...previously there was a leakage in the old clinic...but now the new clinic is good and the services are also very good." (Male, 65 years)

No Financial barrier to access and trust in the healthcare system:

People trusted the government system that the system would take care of them if something went wrong & motivated them to seek services from AAM. Patients seeking Tuberculosis treatment reported that not only there is an absence of financial barriers, but they are also financially supported by the system in their recovery process.

"I started taking medicines from the Center because everything is costly out there, and here we get free medicines. The treatment was free of cost, and I also received money for Tuberculosis treatment" (Female, 30 years)

"If something goes wrong, if there is any side effect, the doctor will take care of it, or whatever happens, the doctor will come, so there is no problem...then because of medicines if any yes-no (consequence) happens then in government everything is free of cost so I started taking medicines from here" (Female, 30 years)

Social Network Influence:

During the IDIs, as shared by the beneficiaries, the opinion of people (known to them, such as relatives, neighbors, friends) about the available services had a direct influence on their decision to utilize services. It was also shared by the beneficiaries that, after observing the improvement in their health, they advised people in their network to visit AAM to avail themselves of the services.

"My younger brother works in a government clinic, it is a big clinic, and he always tells me to go to a government clinic and not go to a private clinic" (Female, 40 years)

"...I saw other people known to me taking medicines and that influenced me to take medicines from the center." (Female, 55 years)

"I take medicines from the center, and the medicines suit me, so I tell other family members and neighbors to take them from the center as well." (Female, 40 years)

TABLE 2 KEY CONCEPTS FOR THE 12 PACKAGES SERVICE UTILIZATION

Key concepts	Themes
Facilitators for the service utilization	Field connect with the beneficiaries by ASHAs
	Patient-centric behavior by the service providers
	Ease of access to the facility
	No Financial barrier to access and trust in the healthcare system
	Social Network Influence
Barriers to the service utilization	Fear of lack of confidentiality and associated stigma
	Lack of Patient-centric behaviour
	Lack of Follow-up and social influence
	Difficulty in accessing the facility
	Gender barriers and infrastructure issues

	Shortage of medicine
	Fear/Distrust
	General lack of awareness about the services at AAM.

PERCEIVED BARRIERS INFLUENCING THE BENEFICIARY'S DECISION FOR SERVICE UTILIZATION AT AAM:

Fear of lack of confidentiality and associated stigma:

Lack of confidentiality regarding Tuberculosis status was a perceived barrier. During one of the conversations, the beneficiary highlighted her Tuberculosis status and the associated stigma. According to her family members, there was a lack of confidentiality regarding her Tuberculosis status while availing required services from AAM, hence they chose a private clinic for her treatment.

".....that permission was not given to me by my family to visit AAM at that time because we did not want the villagers to know about the disease because of privacy reasons" (Female, 30 years)

Lack of Patient-centric behavior from the staff:

The lack of effective communication with the beneficiaries appeared to be a barrier to service utilization. According to them, no message was conveyed by the staff or ASHAs about the operational hours of AAM. Another beneficiary expressed disappointment with the healthcare providers due to the lack of proper instructions on the prescribed medicines, which led her to switch to a private clinic for her treatment. Another beneficiary said that the newly recruited field staff did not see them regularly and had a poor rapport with them.

"Whenever the clinic was close, we had to come back and go again when it opens...no one used to inform us that the clinic was closed." (Female, 52 years)

"CHO don't give in writing that this medicine should be taken at this time, so the medicines kept on changing" (Female, 60 years)

"Sister who retired... ..she used to visit every home...but now, from the new staff, no one even comes to see us and share information with us". (Female, 65 years)

Social influence:

In one of the IDIs, a beneficiary who was diabetic mentioned the ineffectiveness of the medicines from AAM as a reason to not avail the services. The suggestion from a trusted friend (who was also a doctor) to visit a private clinic for better and effective medicines for diabetes convinced him to visit a private clinic over AAM.

"There was a camp near our village and from there I came to know about diabetes, then I started medicines from here for 10 days but it didn't suit me... when I checked diabetes from a private clinic it was not under control...and then I started visiting a private clinic on the suggestion of my friend...he is a doctor at that clinic" (Male, 51 years)

Difficulty in accessing the facility:

Beneficiaries reported difficulty in finding the AAM whenever it was located inside the village in a rented place, additionally made it difficult for those from nearby villages to find. They had also requested locating the facility at a place that is convenient for everyone to visit.

"Who will find it in a corner... If this clinic is on the road, then other persons from the nearby village can also take medicine" (Male, 70 years).

Gender barriers and infrastructure issues:

Results also highlight that beneficiaries have privacy concerns whenever there is a lack of a separate/private room to consult the service provider. Additionally, due to gender barriers, some respondents reported feeling uncomfortable talking to staff of the opposite gender.

"For ladies, if they want to ask something because sir (male doctor) is there, they feel shy and are not able to talk openly. For gents also, if there is a madam (female doctor), they cannot talk..., in case of no water in the facility, there is an issue in using toilet and bathroom" (Female, 30 years)

Shortage of medicines:

Stock out of medicines at AAM was another factor hindrance in the uptake of AAM. During the IDIs, beneficiaries mentioned that due to the lack of availability of medicines and frequent stockouts of drugs at AAM, they refrained from visiting AAM.

"I went two times there at the center, but every time they say medicines are out of stock and ask me to come when the stock is available, but I cannot wait till then because my diabetes was 240 at that time....so I started taking them from a private facility" (Female, 62 years)

Fear/Distrust:

Fear or distrust in the public system was an effective factor. Beneficiaries expressed their lack of trust in medicines at AAM and shared that medicines distributed at AAM can lead to unwanted side-effects, hence they avoid going to the center and visit private clinics and pharmacies instead.

"I bring my blood pressure medicines from a Private pharmacy...I don't take medicines from the center because I have a fear of reaction due to medicines...what if I get a reaction" (Female, 62 years)

General lack of awareness about the services at AAM:

According to the beneficiaries, obtaining information about available services beyond their immediate needs was of no use to them. Their indifferent attitude led to their lack of awareness about the initiative in general.

"We know only about the services and medicines that we need, and we are taking...rest, we don't know about anything" (Male, 51 years)

"I only know about my medicine...how do I know about every service and medicine" (Female, 56 years)

DISCUSSION

This study examined demand-side facilitators and barriers influencing beneficiaries' utilization of the 12 C-PHC service packages (expanded range of services) at AAMs. The findings are broadly consistent with existing evidence from primary healthcare settings in India [7,10–12], while providing qualitative insights into the functioning of AAMs, an initiative under which beneficiary-level perspectives on service utilization remain limited despite the availability of broader programmatic evidence.

Routine engagement by ASHAs emerged as a key facilitator for service uptake. Beneficiaries highlighted that regular household visits, information sharing, and familiarity with ASHAs motivated them to seek services. This aligns with findings from Kerala and Maharashtra, where proactive engagement by ASHA, built trust and supported community mobilization for PHC services[7,8]. Our study additionally shows that inconsistent communication regarding facility operating hours discouraged beneficiaries, underscoring the need for reliable and predictable service availability, an operational gap not extensively discussed in existing PHC studies.

Infrastructure readiness, ease of access to the facility, and positive provider-patient interactions also emerged as strong facilitators. These findings support previous evidence that accessible locations, functional infrastructure, and adequate facility conditions influence PHC utilization [11,13]. Beneficiaries' appreciation of respectful behaviour by provider contrasts with studies reporting limited accountability and weak communication in public facilities [14], suggesting that the C-PHC initiative may be contributing to improvements in interpersonal aspects of care in certain AAMs.

Affordability further enabled service uptake. Consistent with evidence results of this study highlight that financial incentives and cost-free services increase utilization [15], beneficiaries valued the availability of free medicines and low-cost care. While earlier studies highlighted accountability gaps and medicine shortages as deterrents [12,16], several beneficiaries in our study perceived staff responsiveness and free medicines as advantages of the AAM system. Social networks also influenced service-seeking, aligning with literature showing that family and peers' experiences shape trust in healthcare and influence decisions [17].

Barriers identified in this study also reflect broader evidence. Stigma and concerns about confidentiality particularly for TB remained major deterrents, similar to findings from TB stigma research in India and other LMICs [18]. Enhancing confidential counselling, staff communication on privacy, and stigma-reduction IEC activities may improve service uptake. Concerns regarding the perceived low efficacy of generic medicines also discouraged some beneficiaries, reflecting previously documented skepticism toward unbranded drugs in public facilities [19,20].

Gender and socio-cultural norms significantly shaped service utilization. Women frequently reported discomfort consulting male providers, and expressed hesitancy due to the lack of private consultation spaces. These findings are consistent with evidence that modesty norms, gendered expectations around bodily privacy, and stigma influence women's engagement with formal healthcare [21].

The findings provide actionable insights for policymakers and program managers to strengthen uptake of AAM services among eligible beneficiaries and contribute to the literature by highlighting demand-side barriers. As this qualitative study involved 30 beneficiaries, the findings offer rich insights but are not generalizable beyond the study sites. Beneficiaries were identified in coordination with AAM teams and ASHAs, which may have inadvertently introduced selection bias. Future research should include diverse populations and provider perspectives to assess barriers, facilitators, and intervention impacts, while engaging the entire healthcare ecosystem to enhance accessibility, trust, and service utilization.

CONCLUSION:

Overall, the C-PHC initiative has been well-received among the beneficiaries and they are willing to visit AAMs. However, provider-side efforts to engage with the community must be undertaken. Challenges such as infrastructure issues, physical access, and shortage of medicines should be addressed. Facilitators such as beneficiaries' trust in the system, and patient-centric behavior of the staff must be strengthened and implemented to increase the uptake of AAM services by the eligible beneficiaries.

AUTHORSHIP

SS was involved in the study conceptualization, conducted the data collection and analysis, and led the manuscript writing. AS contributed to the conceptualization of the study, provided oversight during data collection, and supported the manuscript writing and finalization. AS(a) played an instrumental role in the study design and conceptualization, facilitated and supervised the data collection process, and contributed to data analysis. All authors have reviewed and approved the final version of the manuscript and meet the authorship criteria as defined by the International Committee of Medical Journal Editors (ICMJE).

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CONFLICT OF INTEREST

The Authors declares that there is no conflict of interest.

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IDENTIFYING FACTORS AFFECTING BIOMEDICAL WASTE MANAGEMENT IN THE CONTEXT OF UNITED NATIONS' SUSTAINABLE DEVELOPMENT GOALS IN INDIA

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ABSTRACT

OBJECTIVE:

The objective of the study is to capture the perceptions of the variables of knowledge, attitude, practice and compliance-monitoring and their role in biomedical waste management in the context of United Nations' Sustainable Development Goals (SDG).

DESIGN:

The authors used interviews and survey questionnaire to capture perceptions of biomedical waste management. Convenience sampling was employed in the state of Goa, India. The data was analysed using partial least squares, structural equation modelling (PLS-SEM).

SETTING:

Doctors, nurses, pharmacists and other paramedical staff across 10 private hospitals in Goa, India, participated between June 2024 and November 2024 and sample of 85 was obtained.

MAIN OUTCOMES AND MEASURES:

Knowledge, attitude, practice and compliance-monitoring were found to be four factors (variables) that affect biomedical waste management.

RESULTS:

The major challenges to implementation of biomedical waste management were found to be lack of funding (35.3%), competing priorities (23.5%), lack of expertise (17.6%), resistance to change (11.7%). Eighty eight percent of the respondents felt the need for proper training and expected the training to be conducted once a quarter (52.9%), monthly (23.5%) or at least twice a year (17.6%). While the respondents understood biomedical waste management, 70.2% were not aware of United Nations' Sustainable Development Goals (SDG 3, 12, 17). While awareness of SDG was low, 94.1% of the respondents mentioned that impact of biomedical waste on environment was advocated by the hospital and 88.2% felt that the hospital ensures environmentally safe disposal of biomedical waste either themselves or through a partner. Interestingly, only 56.5% of the respondents were aware of any government initiatives promoting sustainability in hospitals, indicating low levels of awareness.

CONCLUSION:

Knowledge, attitude, practice and compliance-monitoring positively affects biomedical waste management. Proper training will improve the biomedical waste management and the awareness of UN SDGs.

KEYWORDS

biomedical waste management, sustainable development goals, SDG, PLS-SEM, Hospital, KAP

INTRODUCTION

During and post COVID-19 pandemic developing countries have struggled to manage biomedical waste generated during the pandemic, this raises a lot of questions regarding sustainable disposal of biomedical waste to protect public health and environment. It also mandates a better future preparedness [1]. Improper biomedical waste management continues to plague developing countries like India and there is a need to better manage hospital waste [2] and is revealed to spread infectious disease and cause environmental degradation [3]. Asian developing countries are also densely populated and rapidly urbanizing, this, along with resource constraints make the management of biomedical waste difficult [4].

A healthy society needs a healthy balance between the external macro (ecological) and internal human body (micro) and a healthy inter-relation between these two factors. Any imbalance could have serious effects on the national wellbeing and on an individual [5]. While a healthcare system exists to bring humans back to health, it can also pose a risk to society if it is not able to manage its biomedical waste [6].

Biomedical waste is the waste arising during the diagnosis, treatment or immunization of human beings, animals or research activities related to them or arising during the production and testing of biological material and health camps [7]. This waste needs to be handled properly to avoid harm of healthcare workers and often leads to spread to infectious disease and environmental degradation and can be both hazardous and non-hazardous in nature. [3,8]. India generates approximately two kg/bed/day of biomedical waste which consists of anatomical waste, cytotoxic waste, sharps etc and if not properly treated could lead to deadly infectious diseases like hepatitis B, hepatitis A and human immunodeficiency virus amongst others and can have adverse social, environmental and ecological impact [9]. Understanding biomedical waste management involves studying knowledge, attitude and practice (KAP) of biomedical waste management by the healthcare professionals and is an often used method [10]. There is a need to follow proper guidelines, especially from World Health Organization regarding biomedical waste management to overcome difficulties of proper segregation, handling and disposal [11].

World Health Organization (WHO) estimates that between 75% and 90% of the healthcare waste is non-hazardous, while the balance (10% to 25%) remains hazardous and may pose both environmental and health risk [12]. Due to the nature of the healthcare waste and its potential threat and risk to life and environment it has taken central stage in national health policy in many countries. In developing countries it however has not received much attention since it competes with other priorities [13]. While globally, there is an increased awareness amongst healthcare professionals regarding biomedical waste, the problem with India is the lack of awareness about health hazards, insufficient funds and resources and poor control of waste management processes [14]. Financial funds in Indian hospitals get spent in hospital expansion and purchase of advanced equipment and there is lack of funds spent on improvement of biomedical waste management due to the focus of administrators on primary activities on delivering patient care [15]. Many hospitals in India lack proper protocol of collection, segregation, transportation and disposal of biomedical waste [16].

The solving of medical waste disposal is an interdisciplinary issue and affects various aspects of United Nations Sustainable Development Goals (SDG). It directly relates to SDG 3, 12 and 17 and indirectly to SDG 1, 2, 5, 6, 9, 11, 13, 14, 15. SDG 3.9 specifically calls for reduction of deaths and illnesses from hazardous chemicals and air, water and soil pollution. SDG 12.4

calls for ecologically sound management of chemicals and all wastes throughout their lifecycle and SDG 12.5 calls for reduction in waste generation, through prevention, reduction, recycling and reuse. SDG 17 calls for transfer, dissemination and diffusion of ecologically sound technologies to developing countries [17]. For sustainable green healthcare it is important to raise awareness, manage operations, medical waste, conduct proper environmental assessment and train the staff for proper waste management procedures [18]. A connected sensor based monitored health system may be a good way to align with the sustainable development goals [19].

The Indian Government has formulated biomedical waste management rules (1998) which made it mandatory for all hospitals above 1,000 beds to obtain authorization of segregation, sanitising, and disposing of the waste in an ecologically safe manner. Similarly, in 2016, the Government has also issued rules for safe handling of biomedical waste [20].

Most of the studies in biomedical waste management are centred around defining what biomedical waste is and the types of biomedical waste. Very few studies exist to understand the perceptions of medical and paramedical staff and their attitudes towards biomedical waste reduction. What are the main factors (variables) that drive biomedical waste management? What are the main challenges and hindrances in biomedical waste management in India? Do the medical staff understand biomedical waste management from the perspective of United Nations Sustainable Development Goals (SDGs)? The aim of this study is to understand the factors affecting biomedical waste management in a developing Asian country like India in the context of United Nations sustainable development goals (SDGs). The objective is to capture the perceptions regarding knowledge, attitude, practice and compliance-monitoring and its role in biomedical waste management. The motivation for the study is to understand biomedical waste management by examining factors affecting it within the broader goal of sustainability.

LITERATURE REVIEW

BIOMEDICAL WASTE MANAGEMENT (BMWM)

Biomedical waste management is important since it has an overall impact on the society at large and lack of infrastructure and improper behaviour of healthcare workers are major barriers or hindrances to proper biomedical waste management [1]. Proper waste management includes, waste characterization, segregation, generation, collections, storage, transportation, treatment and final disposal. Biomedical waste remains a public health issue and most hospitals do have a policy for waste management and better biomedical waste management depends upon human resource allocation, budget for biomedical waste management, sustainability, attitude amongst many other factors [21–23]. Good objectives of biomedical waste management are to prevent transmission of disease, prevent injury to healthcare workers and prevent exposure to hazardous waste [24]. Biomedical waste management remains a shared framework between all stakeholders and requires constant backing of the government to be successful [25]. While biomedical waste management is important for a hospital from the perspective of infection, it could also have financial implications [26]. Biomedical waste management is a problem in developing countries like India due to lack of resources and low healthcare expenditure spend by the government [2]. Training programs are known to improve the knowledge, attitude and practice of biomedical waste management [27].

KNOWLEDGE

Having proper knowledge about biomedical waste remains the starting point in proper biomedical waste management [28]. Being aware of what needs to be done while handling biomedical waste and managing its disposal. This knowledge is built through multiple trainings [29]. Improvement in knowledge of biomedical waste management is known to improve biomedical waste management [30]. While proper biomedical practices are important, it is equally important to constantly assess and raise awareness and knowledge regarding the same among medical and paramedical staff through proper trainings regarding, risks and protective measures [31]. Understanding the fundamentals of managing biomedical waste is important in terms of colour coding, usage of personal protective equipment and is helpful in improving biomedical waste management practices [32]. Knowledge about infectious waste is important in hospitals and

lack of knowledge and training is a barrier to proper biomedical waste management [15]. The developing Asian countries it is important to improve the knowledge to have better biomedical waste management [4]

Hypothesis 1 (H1): Knowledge affects biomedical waste management (BMWM)

Attitude

Attitude consists of how we feel, what we think and what are we inclined to do about something [33]. Attitude includes the inclination to respond in a specific manner to different situations and the ability to perceive and interpret events based on personal pre-dispositions [30]. The personal attitude of healthcare workers, including nurses and house-keeping staff has a direct impact on biomedical waste management [21]. Positive attitude towards the implementation for proper biomedical waste management practices from generation to final disposal is needed or the policy to succeed [29]. Historically biomedical waste management tended to be basic waste management involving cleaning, collection, storage, transport and disposal. As healthcare institutions focus and promote sustainability to focus needs to shift towards waste awareness and waste reduction through careful policy making and requires the positive attitude of the top management [31]. Many hospitals outsource the disposal of biomedical waste and at times commitment is questionable. Having a positive attitude in administrators and management improves biomedical waste management practices [15].

Hypothesis 2 (H2): Attitude affects biomedical waste management (BMWM)

Practice

Having a policy for biomedical is the first step, however its success depends on putting it into practice [29]. Practice is the implementation of the rules and knowledge that results in taking action [30]. Training regarding maintaining health of the community also helps to improve practice of biomedical waste management [34]. Hospital acquired infections is good indicator for proper biomedical waste management and accounts to 10% of the infections. These are known to be due to improper practice of biomedical waste management for example, WHO estimated a 50% reuse of syringes meant for single use [34]. Proper practice of handling biomedical waste includes proper segregation of waste, proper storage, proper transportation and proper handling [16]. In developing Asian countries with resource constraints it is important to improve the implementation of policy to drive better biomedical waste management [4].

Hypothesis 3 (H3): Practice affects biomedical waste management (BMWM)

Compliance-monitoring

Apart from knowledge, attitude and practice, monitoring and surveillance (compliance) are the key to successful biomedical waste management [29]. Compliance and monitoring helps to keep track whether the biomedical practices are implemented properly specially when there are behavioural issues among healthcare workers like resistance to change [1]. Lack of compliance and monitoring is known to increase in negligence while managing biomedical waste apart from lack of knowledge. This problem is more critical in developing countries [31]. Proper biomedical waste management requires sufficient funds for monitoring, training, procurement of resources and treatment. This has also to be backed up by proper supervision [32]. Apart from knowledge and attitude, monitoring and control, regarding management of waste remains a contributing factor in India in biomedical waste management [14]. Monitoring operational processes is important to provide continuous feedback and improve existing systems and is definitely resource and time consuming but a necessary activity in biomedical waste management [15].

Hypothesis 4 (H4): Compliance affects biomedical waste management (BMWM)

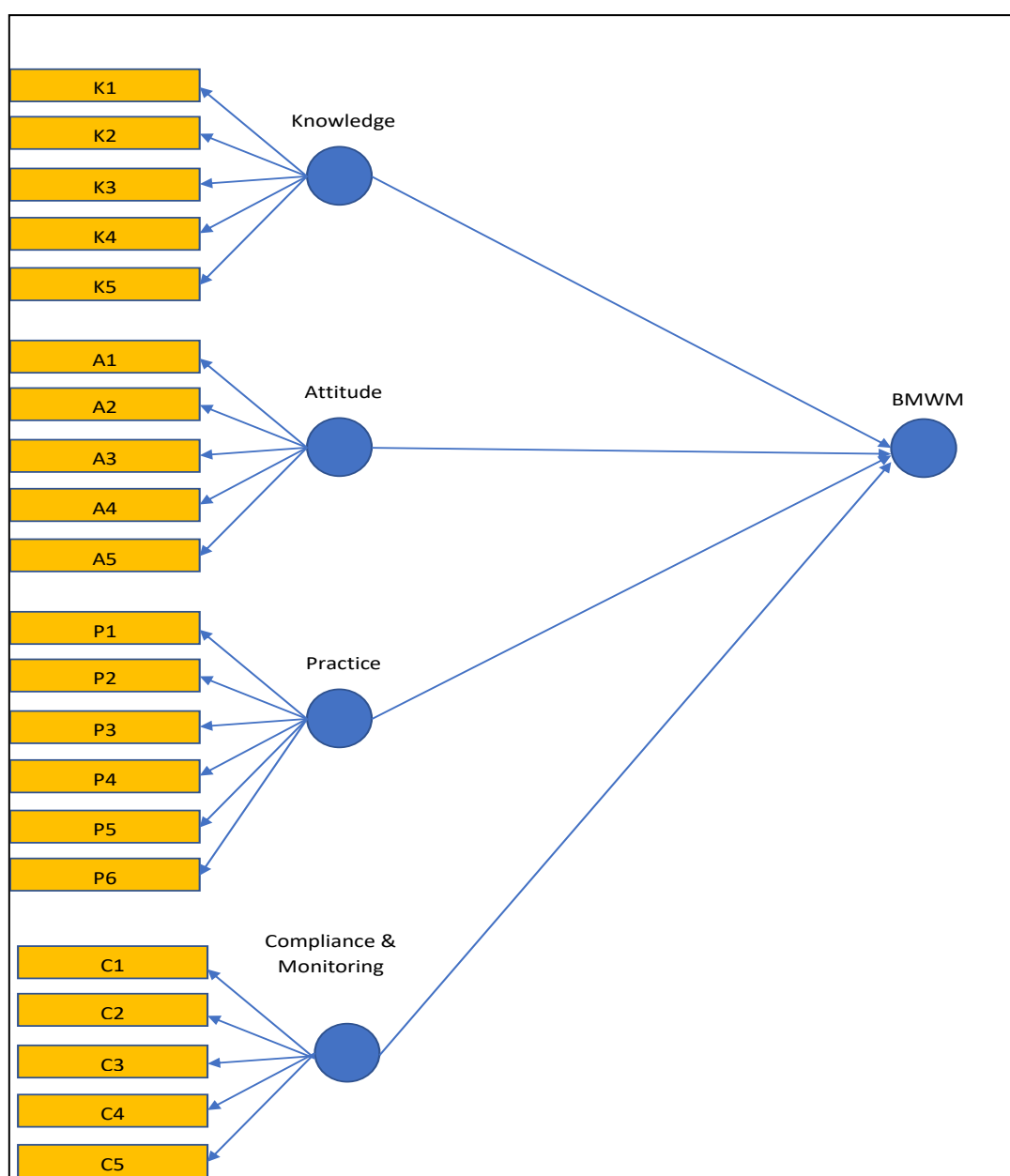
Building on the foregoing review, it is evident that biomedical waste management is not solely a technical or regulatory issue, but a multidimensional health system challenge shaped by behavioural, organisational, and governance-related factors. While prior studies have predominantly examined knowledge, attitude, and practice (KAP) as key determinants, there remains limited integration of these constructs with system-level mechanisms such as compliance-monitoring, which is critical for ensuring sustained adherence to biomedical waste protocols in resource-constrained settings. Furthermore, the alignment of biomedical waste management practices with broader sustainability frameworks, particularly the United Nations Sustainable Development Goals (SDGs), has received insufficient empirical attention in the context of developing healthcare systems. Addressing these gaps, the present study adopts an integrated perspective that combines

behavioural (knowledge, attitude, practice) and organisational (compliance-monitoring) dimensions to better understand biomedical waste management within hospital settings. This approach not only extends the traditional KAP framework but also situates it within a health systems and sustainability context. Accordingly, a conceptual model is proposed to examine the relationships between these constructs and their collective influence on biomedical waste management.

MODEL

Based on the synthesis of the literature, this study proposes a conceptual model that integrates behavioural and organisational determinants of biomedical waste management within hospital settings. Specifically, knowledge, attitude, and practice are conceptualised as key behavioural factors, while compliance-monitoring represents an organisational and governance mechanism that supports implementation and accountability. Together, these constructs are hypothesised to influence biomedical waste management as a higher-order outcome. The proposed model reflects a health systems perspective, recognising that effective waste management requires not only individual awareness and behaviour but also structured monitoring and institutional support. Basis the review of literature, the below model is proposed

FIGURE 1: PROPOSED MODEL



Source: Authors own work

METHODOLOGY

Study Approach: The study is designed to be exploratory and cross sectional in nature using a structured questionnaire to capture the perceptions of the healthcare professionals. The study is also a context-specific investigation (biomedical waste management) within a regional healthcare system. A quantitative approach is chosen using PLS-SEM since its ability to give robust results involving complex models with even small data sets [35–37].

PLACE AND DURATION OF STUDY:

For the purpose of the study, data was collected between June 2024 to November 2024, from healthcare professionals (doctors, nurses, pharmacists and other paramedical staff) employing questionnaires. The healthcare professionals represent 10 private hospitals in Goa, India out of the 29 major private hospitals operating in the state.

SAMPLING FRAME, DESIGN AND SAMPLE SIZE:

A list of private hospitals was developed basis the hospitals listed on the Government of Goa website (<https://www.goa.gov.in/wp-content/uploads/2021/06/List-of-Private-Hospitals-in-Goa.pdf>) Convenience sampling was employed and a final sample consisted of 85 respondents. The sample represents 34% of all the major private hospitals operating in the state. The sample of 85 respondents is consistent with the requirements of Partial Least Squares Structural Equation Modelling (PLS-SEM). PLS-SEM is particularly suitable for exploratory research, complex models, and studies with relatively small sample sizes [35–37]. Using the Inverse Root Square Method proposed by Kock and Hadaya (2018), minimum sample size (n) in PLS SEM is calculated by the formula $n = (|pathmin|/threshold)^{-2}$, where $|pathmin|$ is absolute value of the minimum expected path coefficient and threshold is typically 0.1 for a significance level of 0.05. n in this case works out to be $(0.15/0.1)^{-2} = 0.444 \times 100 = 44.4$ (rounded up to 45) [38,39]. Similarly, from a minimum R^2 value method as proposed by Hair et al (2014), for a R^2 value of .75 and the number of structural paths directed towards the endogenous variable (in this case BMWW) is 4. The minimum sample size requirement from the table is 34 [39]. Similarly, following the “10-times rule,” the minimum sample size should be at least ten times the maximum number of structural paths directed at any construct in the model [38,39]. In the present study, the maximum number of paths directed at the endogenous construct (BMWW) is four, indicating a minimum required sample size of 40. The obtained sample size of 85 therefore exceeds these three thresholds and is considered adequate for robust model estimation in PLS-SEM. Given the exploratory nature of this study and its focus on a specific healthcare context, the sample size is appropriate for generating meaningful insights while maintaining analytical rigour.

INSTRUMENT DEVELOPMENT:

The questionnaire was designed keeping in mind the literature review. The questionnaire included five constructs, namely, knowledge, attitude, practice, compliance-monitoring and biomedical waste management. Each of the items associated with each construct was measured using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Items were adapted and refined for clinical relevance (See Appendix A). The questionnaire was discussed and views sought from administrators of the ten hospitals to establish face validity. The administrators were particularly happy on the inclusion of compliance-monitoring of biomedical waste management which according to them was extremely important for private hospitals in India. The questionnaire was pilot tested with non-sampled respondents (10) to establish whether responses are in line with expectations and language in the questionnaire was modified accordingly.

ETHICAL CONSIDERATIONS:

Written informed consent was obtained from all participants, and anonymity and confidentiality were maintained throughout the study. The research did not involve patients, clinical interventions, or sensitive personal data. In accordance with institutional norms applicable during the study period, formal ethics committee approval was not required for non-invasive, perception-based surveys involving healthcare professionals. However, the absence of formal ethical clearance is acknowledged as a limitation, and future studies should seek institutional ethics approval to strengthen methodological rigour.

DATA ANALYSIS:

Collected data was analysed using PLS SEM 4.0 to test the hypothesis. PLS-SEM has been widely applied in health management research where data collection is constrained by access to specialised respondents such as healthcare professionals (small sample sizes). Excel was used for tabulation and for descriptive statistics. Keeping in mind the objectives of the study, frequencies and percentages were calculated for describing the sample characteristics. The measurement model and structural model was tested. The model was also tested for model fit and predictive ability.

RESULTS

The sample showed a good representation of both the genders, male (43.5%) and female (56.5%). The sample had both permanent (82%) and contractual (18%) respondents with 43.5% respondents having less than two years' experience, 38.8% of respondents having two to five years of experience and 17.7% of the respondents having more than five years of experience. A more details description of the sample is given below (See Table 1).

TABLE 1: FREQUENCY AND PERCENTAGE DISTRIBUTION OF SAMPLE

Sample Statistic	Number	Percentage
Total Respondents	85	
Gender		
Male	37	43.5
Female	48	56.5
Designation		
Doctors	20	23.5
Nurses	45	52.9
Pharmacist	10	11.8
Other Paramedical	10	11.8
Employment Status		
Permanent	70	82
Contract/Probation	15	18
Years of Experience		
<2 years	37	43.5
2-5 years	33	38.8
>5 years	15	17.7
Main Challenges for implementing BMWM practices (Reported)		
Competing priorities	20	23.5
Resistance to change	10	11.7
Lack of funding	30	35.3
Lack of expertise	15	17.6
Other	5	5.8
Felt Need of training in improving BMWM		
Yes, need more Training	75	88.2
No, don't need more training	10	11.8
Expected frequency of training		
Monthly	20	23.5
Once a quarter	45	52.9
Twice a year	15	17.6

Once a year	5	5.8
Awareness of WHO Sustainability Development Goals (SDG 3, 12, 17)		
Yes	25	29.4
No	65	70.6
Is there a pre-treatment plant for handling liquid biomedical waste (corresponding to SDG 12)		
Yes	45	52.9
No	40	47.1
Is the Environment impact of biomedical waste was advocated at the hospital (corresponding to SDG 12)		
Yes	80	94.1
No	5	5.9
Are you aware of government initiatives promoting sustainability in hospitals (corresponding to SDG 17)		
Yes	48	56.5
No	37	43.5
Does your organization ensure environmentally safe disposal of biomedical waste (corresponding to SDG 12)		
Yes	75	88.2
No	15	11.8

Source: Authors own work

CONCURRENT MODELLING USING PLS SEM

The five factors (variables), namely, knowledge, attitude, practice, compliance-monitoring and biomedical waste management were captured using a Likert scale. The respondents were asked to indicate their agreement or disagreement (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 strongly agree). PLS-SEM 4.0 software was used in the analysis. The measurement model and structural model analysis was conducted, including testing of the four hypotheses.

MEASUREMENT AND STRUCTURAL MODEL ANALYSIS

TABLE 2: MEASUREMENT MODEL

Dimension	Item		Factor Loading	Cronbach's Alpha	Rho_A	CR	AVE
Knowledge	K1		0.812	0.910	0.902	0.918	0.625
	K2		0.787				
	K3		0.823				
	K4		0.761				
	K5		0.790				

Attitude	A1		0.811	0.912	0.916	0.922	0.617
	A2		0.802				
	A3		0.749				
	A4		0.716				
	A5		0.782				
Practice	P1		0.846	0.900	0.926	0.923	0.613
	P2		0.817				
	P3		0.734				
	P4		0.794				
	P5		0.809				
	P6		0.851				
Compliance-Monitoring	M1		0.791	0.905	0.932	0.901	0.602
	M2		0.822				
	M3		0.779				
	M4		0.813				
	M5		0.789				
Biomedical Waste Management	BMWM1		0.762	0.889	0.912	0.907	0.620
	BMWM2		0.778				
	BMWM3		0.812				
	BMWM4		0.841				
	BMWM5		0.752				

Source: Authors own work

The model for this study used five constructs. Knowledge, attitude, practice and compliance-monitoring and biomedical waste management (BMWM) were configured as reflective first-order constructs.

The individual factor loading of each of the items in the construct was found to be greater than 0.8 indicating acceptable item reliability [40]. The composite reliability (CR) values for each of the constructs of knowledge, attitude, practice and compliance-monitoring exceeded the recommended value of 0.7 [41]. Similarly the Average Variance Extracted (AVE), which indicates the amount of variance accounted for by the latent constructs exceeded the recommended value of 0.5 [41]. Similarly the Cronbach's Alpha and rho A were found to be greater than 0.7 [41]. This indicates that the model exhibited good convergent reliability.

TABLE 3: FORNELL-LARCKER CRITERION

	Knowledge	Attitude	Practice	Monitoring	BMWM
Knowledge	0.823				
Attitude	0.767	0.790			
Practice	0.751	0.712	0.812		
Monitoring	0.753	0.716	0.727	0.779	
BMWM	0.682	0.663	0.669	0.687	0.712

Source: Authors own work

The square root of Average Variance Extracted is provided in the diagonals is found to be greater than the corresponding correlation coefficients indicating good discriminant validity among the constructs [41].

CROSS-LOADING CRITERIA

Each of the indicator items AVE were found to be higher than the AVE of the corresponding items of other variables, showing good discriminant validity [41].

TABLE 4: HETEROTRAIT-MONOTRAIT RATIO

	Knowledge	Attitude	Practice	BMWM
Knowledge				
Attitude	0.814			
Practice	0.781	0.790		
Monitoring	0.765	0.745	0.823	
BMWM	0.693	0.689	0.700	0.688

Source: Authors own work

The Heterotrait-Monotrait (MTMT) ratio for each of the constructs is less than 0.9 showing good discriminant validity [41].

STRUCTURAL MODEL

TABLE 5: PATH COEFFICIENTS

	Original Sample [O]	Rank	SD	T-Statistic	Result
Knowledge -> BMWM	0.273***	2	0.005	32.4	Significant
Attitude -> BMWM	0.235***	3	0.007	32	Significant
Practice -> BMWM	0.282***	1	0.009	23.4	Significant
Monitoring-> BMWM	0.219***	4	0.007	28.4	Significant

Note: *** P Values <0.001

Source: Authors own work

All the probability values are found to be less than 0.001 indicating that all the hypotheses H1-H4 are to be accepted, that is to say that knowledge, attitude, practice and compliance-monitoring all positively affect biomedical waste management.

MODEL STRENGTH

Model fit was assessed using the Standardized Root Mean Square Residual (SRMR), which was found to be 0.05 which is within acceptable thresholds (<0.08), indicating a good model fit. The coefficient of determination (R^2) for biomedical waste management (BMWM) was found to be 74% which demonstrates substantial explanatory power, suggesting that knowledge, attitude, practice, and compliance-monitoring collectively explain a meaningful proportion of variance in the outcome construct. Similarly, Q^2 was found to be greater than 0, confirming predictive relevance.

DISCUSSION

The present study examined biomedical waste management (BMWM) through a health systems lens by integrating behavioural (knowledge, attitude, practice) and organisational (compliance-monitoring) determinants. The findings confirm that all four constructs significantly and positively influence BMWM, with practice emerging as the strongest predictor, followed by knowledge, attitude, and compliance-monitoring. This reinforces the view that while awareness and attitudes are necessary, effective biomedical waste management ultimately depends on consistent implementation and operationalisation within healthcare settings.

From a health management perspective, the results highlight the interdependence between individual-level competencies and institutional mechanisms. Knowledge and training form the foundation for appropriate waste handling, yet without supportive organisational structures, such as monitoring systems, standard operating procedures, and accountability mechanisms, these capabilities may not translate into sustained practice. The inclusion and significance of compliance-monitoring as a determinant extends the traditional KAP framework and underscores the importance of governance and supervision in ensuring adherence to biomedical waste protocols, particularly in resource-constrained environments.

The study also provides important insights into systemic challenges affecting BMWM implementation. The findings indicate that lack of funding (35.3%), competing priorities (23.5%), and lack of expertise (17.6%) are key barriers. These research findings support and extend similar findings from other countries [42,43]. These constraints reflect broader structural issues within healthcare systems in developing economies contexts, where biomedical waste management often competes with core clinical priorities for limited resources. This suggests that BMWM must be repositioned not as a peripheral function but as an integral component of patient safety, infection control, and environmental health within hospital management systems.

A critical contribution of this study lies in its examination of policy awareness and implementation gaps. Despite the existence of regulatory frameworks such as the Biomedical Waste Management Rules (1998; revised 2016), the findings reveal limited awareness (43.6%) of government initiatives among healthcare professionals. This indicates a disconnect between policy formulation and operational execution at the facility level. The effectiveness of regulatory frameworks is therefore contingent not only on their design but also on dissemination, enforcement, and institutional integration. Strengthening compliance mechanisms, conducting periodic audits, and embedding policy awareness within routine training programs are essential to bridge this gap.

The study further highlights a significant deficiency in awareness of the United Nations Sustainable Development Goals (SDGs), with 70.6% of respondents indicating a lack of familiarity. This finding is particularly important in the context of global health and sustainability agendas, as biomedical waste management is closely linked to SDG 3 (Good Health and Well-being), SDG 12 (Responsible Consumption and Production), and SDG 17 (Partnerships for the Goals). This finding reinforces similar finding in other low resource constrained countries [43]. The low level of awareness suggests that sustainability frameworks have not been adequately translated and internalised into operational practices within healthcare institutions. Addressing this gap requires targeted capacity-building initiatives, including the integration of SDG-linked content into training programs, the use of visual and data-driven communication tools, and alignment of hospital performance metrics with sustainability indicators.

From an operational standpoint, the findings emphasise the need for structured and continuous training interventions. The majority of respondents (76.4%) expressed a preference for quarterly or more frequent training, indicating recognition of the dynamic nature of biomedical waste management practices. Training programs should move beyond compliance-based instruction to include behavioural change strategies, role-specific responsibilities, and real-world simulations to enhance retention and application.

In addition, the study points to the potential role of technological innovations in strengthening BMWM systems. Digital and IoT-enabled waste tracking solutions can enhance monitoring, improve segregation accuracy, and provide real-time data for decision-making. Such technologies can support hospital administrators in ensuring compliance, optimising resource utilisation, and aligning operational practices with environmental sustainability goals. These solutions are particularly relevant in the Asia-Pacific context, where healthcare systems are increasingly adopting digital tools to improve efficiency and accountability and have found success [44,45].

Overall, the findings emphasize that effective biomedical waste management requires a coordinated, multi-level (health system) approach encompassing behavioural change, organisational support, policy enforcement, and technological enablement. By situating BMWM within a broader health systems and sustainability framework, this study provides

actionable insights for healthcare administrators, policymakers, and practitioners seeking to improve environmental and public health outcomes.

The uniqueness of the study was that it was able to identify compliance monitoring as an important factor in developing countries like India that affects biomedical waste management apart from knowledge, attitude and practice. This is a premier study to capture perceptions of biomedical waste management in the context of United Nations' Sustainable Development Goals in a developing Asian country like India.

IMPLICATIONS FOR THEORY, HEALTH SYSTEMS, MANAGEMENT AND PRACTICE

The findings of this study offer contributions across four interconnected levels, theoretical, policy, managerial, and practice highlighting the multi-level nature of biomedical waste management within healthcare systems.

Theoretical Implications

This study contributes to the existing literature on biomedical waste management by extending the traditional Knowledge–Attitude–Practice (KAP) framework through the inclusion of compliance-monitoring as an organisational and governance construct. While prior research has predominantly focused on behavioural determinants, the present study demonstrates that effective biomedical waste management is shaped by both, individual-level factors and institutional mechanisms. This integrated perspective advances the conceptualisation of biomedical waste management from a purely behavioural model to a health systems-oriented framework that incorporates elements of governance, accountability, and organisational control. Furthermore, by situating biomedical waste management within the context of the United Nations Sustainable Development Goals (SDGs), the study bridges micro-level healthcare practices with macro-level sustainability agendas. This linkage provides a novel theoretical contribution by connecting operational hospital practices with global public health and environmental sustainability frameworks. The study also contributes methodologically by applying PLS-SEM to validate a higher-order construct of biomedical waste management, thereby offering a structured and empirically tested model that can be extended and validated in other healthcare settings.

Policy Implications

At the policy level, the study highlights the need to strengthen the implementation of existing biomedical waste management regulations, such as the Biomedical Waste Management Rules (1998; revised 2016), through improved enforcement and monitoring mechanisms. The observed gaps in awareness of government initiatives and sustainability frameworks suggest that policy effectiveness is constrained by limited dissemination and engagement at the facility level. Policymakers should prioritise the integration of biomedical waste management into broader health system governance through mandatory training standards, periodic compliance audits, and alignment with accreditation frameworks. Additionally, embedding Sustainable Development Goal (SDG) indicators within national and institutional health policies can facilitate greater accountability and alignment with global sustainability agendas.

Managerial Implications

From a hospital management perspective, the findings highlight the importance of adopting a structured and system-oriented approach to biomedical waste management. Administrators should ensure adequate allocation of financial and human resources, establish clear standard operating procedures, and institutionalise compliance-monitoring mechanisms. The relative importance of practice and knowledge suggests that investments in continuous training and capacity-building initiatives are critical. Hospitals should implement periodic, role-specific training programs, supported by performance monitoring systems and internal audit mechanisms. Furthermore, leadership commitment is essential in fostering a culture of accountability and environmental responsibility within healthcare organisations.

Practice Implications

At the operational level, the study emphasises the need to translate knowledge and attitudes into consistent and compliant practices. Healthcare workers should be supported through regular training, clear guidelines, and access to necessary resources to ensure proper segregation, handling, and disposal of biomedical waste. The low awareness of SDGs indicates the need to embed sustainability concepts into day-to-day practices through practical tools such as visual aids, workflow integration, and feedback systems. Additionally, the adoption of technology-enabled solutions, including

digital tracking and IoT-based monitoring systems, can enhance compliance, improve efficiency, and provide real-time data to support decision-making. These interventions can contribute to safer healthcare environments and improved environmental outcomes.

Limitations and Future Research

This study is based on a sample of 85 healthcare professionals from private hospitals in Goa, India. While the sample size represents 34.5% of the private hospitals in the state and is consistent with the requirements of PLS-SEM for exploratory modelling, the use of convenience sampling and a single-state context may limit statistical generalisability. However, the findings offer analytical insights that may be transferable to similar healthcare settings in other parts of India and comparable Asia-Pacific contexts. Future research should expand and adopt multi-site and cross-country designs to validate and extend the proposed model. A future study could also adopt both private and public hospitals for a comparative analysis.

CONCLUSION

This study advances the understanding of biomedical waste management (BMW) by adopting a health systems perspective that integrates behavioural and organisational determinants. The findings demonstrate that knowledge, attitude, practice, and compliance-monitoring all significantly influence BMW, with practice emerging as the most critical driver. This highlights that effective waste management in healthcare settings is not solely dependent on awareness, but on the consistent translation of knowledge into practice, supported by institutional mechanisms of monitoring and accountability. The study further reveals important systemic challenges, including resource constraints, competing priorities, and gaps in expertise, which continue to hinder effective implementation of biomedical waste management practices. These findings emphasize the need to reposition BMW as a core component of healthcare delivery, closely linked to patient safety, infection control, and environmental sustainability, rather than as a peripheral administrative function. A key contribution of this study lies in identifying the disconnect between policy frameworks and on-ground implementation. Despite the presence of regulatory guidelines, limited awareness of government initiatives and sustainability frameworks, particularly the United Nations Sustainable Development Goals (SDGs), suggests that policy translation into practice remains inadequate. Addressing this gap requires stronger governance mechanisms, structured training systems, and alignment of institutional practices with broader sustainability objectives. From a health management perspective, the findings emphasise the importance of coordinated, multi-level interventions encompassing policy enforcement, organisational commitment, and frontline behavioural change. Investments in continuous training, compliance-monitoring systems, and technology-enabled solutions such as digital tracking and IoT-based monitoring can enhance efficiency, transparency, and adherence to biomedical waste protocols.

While the study is context-specific to private hospitals in Goa, it offers a theoretically grounded and practically relevant framework that can inform biomedical waste management strategies in similar healthcare settings across India and the Asia-Pacific region. Future research should extend this model across diverse institutional contexts and explore the role of emerging technologies and policy innovations in strengthening sustainable healthcare waste management systems.

DECLARATION OF CONFLICTS

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APPENDIX A: QUESTIONNAIRE

	(1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree and 5 = strongly agree)				
Correct Knowledge of Biomedical Waste Management		1	2	3	4
1	All health-care waste is hazardous				
2	Disease spreads due to improper BMWM				
3	Received adequate training for BMWM				
4	I know the rules governing BMWM				
5	I understand how to carry out BMWM				
Favourable Attitude towards Biomedical Waste Management		1	2	3	4
1	Important to know the generation, hazards and legislation of BMWM				
2	Safe management of BMW is an issue of concern				
3	Necessary to segregate waste at the point of origin				
4	BMWM is a part of our professional responsibility				
5	Necessary to wear PPE				
Proper Practice of Biomedical Waste Management		1	2	3	4
1	Institute has a tie-up with waste disposal agency				
2	Know the place where BMW treated				
3	Maintain BMW records at work place				
4	Follow segregation at work place				
5	Practicing the correct method for collecting BMW				
6	Operational resources are adequate				
Compliance and Monitoring		1	2	3	4
1	There is a committee to oversee implementation of BMWM				
2	There is an SOP for BMWM monitoring				
3	Enough financial resources have been allocated for BMWM Monitoring				
4	Monitoring plan exists				
5	Periodic updates are undertaken				
Biomedical Waste Management		1	2	3	4
1	Adequate knowledge exists to manage BMW				
2	Right attitude exists towards proper management of BMW				
3	Adequate safe practices exist to manage BMW				
4	Adequate monitoring exists to manage BMW				
5	Management of BMW is important to me				
Other Information					
Gender					
	Male				
	Female				

Designation						
	Doctor					
	Nurse					
	Pharmacist					
	Other Paramedical					
Employment Status						
	Permanent					
	Contract/Probation					
Years of experience						
Main Challenges for implementing BMW practices						
	Competing Priorities					
	Resistance to change					
	Lack of funding					
	Lack of expertise					
	Other					
Need for training in improving BMW						
	Yes					
	No					
Expected frequency of training						
	Monthly					
	Quarterly					
	Twice a year					
	Once a Year					
Awareness of WHO Sustainability Development Goals (SDG 3, 12, 17)						
	Yes					
	No					
Is there a pre-treatment plant for handling liquid biomedical waste (corresponding to SDG 12)						
	Yes					
	No					
Is the Environment impact of biomedical waste was advocated at the hospital (corresponding to SDG 12)						
	Yes					
	No					
Are you aware of government initiatives promoting sustainability in hospitals (corresponding to SDG 17)						
	Yes					

	No					
Does your organization ensure environmentally safe disposal of biomedical waste (corresponding to SDG 12)						
	Yes					
	No					

PERSON-ORGANIZATION FIT AS A DETERMINANT OF EMPLOYEE EFFECTIVENESS IN ENHANCING HEALTH SERVICES AT COMMUNITY HEALTH CENTERS IN INDONESIA

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ABSTRACT

Employees' perceptions of Person-Organization Fit (P-O Fit) can positively influence both individual work outcomes and overall organizational performance. This study aimed to examine the impact of P-O Fit on employee performance in enhancing health services at Community Health Centers.

A quantitative study with an observational-analytic design and cross-sectional approach was conducted. A total of 188 respondents were selected from the population using stratified sampling. Data were analyzed using chi-square tests and multiple logistic regression.

The results showed significant associations between value congruence ($p=0.000$), goal congruence ($p=0.005$), need fulfillment ($p=0.002$), and personality–culture congruence ($p=0.002$) with employee performance in improving health services. Among these, value congruence was the most influential factor ($\text{Exp(B)}=9.859$, $p=0.012$). These findings indicate that P-O Fit—particularly value congruence—is a critical determinant of employee performance and service quality in primary healthcare.

KEYWORDS

person organization fit; employee performance; value congruence; health services; community health center

INTRODUCTION

To meet national health development goals, health initiatives must be organized in a comprehensive and hierarchical manner [1]. Community Health Centers (Puskesmas) are the primary facilities for implementing these initiatives. As technical implementation units of District/City Health Offices, they are responsible for providing first-level health services at the sub-district level. According to Ministry of Health Regulation No. 43 of 2019, Puskesmas offer comprehensive and sustainable public and personal health services [2].

In the era of globalization, organizations—including healthcare facilities—face increasing challenges in developing strategies to strengthen human resources and enhance performance [3]. Human resource management (HRM) is crucial

for the efficiency of primary healthcare facilities, as employees are key drivers of organizational progress. Effective HRM enables organizations to attract, retain, and motivate employees, ultimately improving performance [4,5]. However, performance can decline due to factors such as demotivation, poor time management, non-compliance with regulations, and the absence of role models [6].

One crucial concept in HRM is Person-Organization Fit (P-O Fit), which pertains to the alignment between individual characteristics—such as values, personality, and goals—and the organizational culture. A high P-O Fit promotes positive perceptions, job satisfaction, and organizational commitment, whereas a low P-O Fit can detract from employee performance [7-10]. Previous research on the impact of P-O Fit on performance has yielded mixed results: some studies report positive and significant effects while others find no influence [11-13]. These inconsistencies highlight the need for further investigation.

In South Sulawesi Province, there are 469 Puskesmas, including 38 in Bone Regency. The Watampone Health Center, serving eight villages, has experienced performance declines in several key programs, such as communicable and non-communicable disease prevention and traditional health initiatives. These challenges are linked to limited resources, insufficient personnel, and inadequate facilities [14]. In addition, patient satisfaction surveys reveal ongoing issues, including unfriendly staff, unclear information, complex procedures, and unsanitary service environments. Employee discipline, as measured by attendance, is also low at 48%. These findings suggest a misalignment between employees and organizational expectations, indicating low P-O Fit. Such misalignment adversely affects performance and service quality. Therefore, this study aims to examine the role of Person-Organization Fit as a determinant of employee effectiveness in enhancing health services at Community Health Centers in Bone Regency.

METHODS

RESEARCH TYPE

The research conducted is quantitative, employing an analytical observational design with a cross-sectional study approach, in accordance with the STROBE guidelines for observational studies (<https://www.strobe-statement.org/>).

POPULATION AND SAMPLE

The study encompassed 188 healthcare employees from Watampone Health Center, Biru Health Center, and Bajoe Health Center in Bone Regency. The sample size was determined using the Slovin formula and selected through probability sampling, specifically employing a proportional stratified random sampling method as detailed below:

Slovin formula:

$$n = \frac{N}{1 + N (e^2)}$$

Keterangan:

n= sample size

N= population size

e= sampling error rate (α: 5%)

$$n = \frac{354}{1 + 354 (0,05^2)}$$

$$n = \frac{354}{1 + 354 (0,0025)}$$

$$n = \frac{354}{1 + 0,885}$$

$$n = \frac{354}{1,885}$$

$$n = 188 \text{ sampel.}$$

Furthermore, proportional stratified sampling is illustrated in Table 2.

TABLE 1. PROPORTIONAL STRATIFIED SAMPLING FOR SAMPLE

Community Health Centers (Puskesmas)	Population	Formula	Sample
UPT Puskesmas Watampone	151	$\frac{151 \times 188}{354} = 80$	80
UPT Puskesmas Biru	92	$\frac{92 \times 188}{354} = 48,8$	49
UPT Puskesmas Bajoe	111	$\frac{111 \times 188}{354} = 58,9$	59
Total	354		188

RESEARCH LOCATION

The current study was conducted in Bone District at three community health centers situated in urban areas: the Watampone Community Health Center, the Biru Community Health Center, and the Bajoe Community Health Center. These centers are notable for having the largest populations and the highest number of patient visits within Bone Regency.

INSTRUMENTATION OR TOOLS

This study utilized validated questionnaires adapted from a prior investigation on the Person-Organization Fit (P-O Fit) and Performance scales. The P-O Fit was employed to assess value congruence, goal conformance, needs fulfillment, and personality-culture congruence [15]. Value congruence refers to the extent of harmony between the values held by individuals and the institutional values practiced within the work environment, which include professionalism, excellent service, empathy, discipline, responsibility, teamwork, and integrity. Goal conformance refers to the degree to which an individual's objectives align with those established by the organization, encompassing alignment with the goals of superiors, coworkers, and the institution as a whole. Needs fulfillment refers to the alignment between individual needs and the organization's system, structure, and work environment. Personality-culture fit describes the extent to which an individual's personality traits, which are distinct from values, align with the organizational climate or culture. Moreover, a performance assessment tool was developed using key performance indicators specifically designed for Community Health Centers. These indicators include Quality, Quantity, Timeliness, and Employee perception. The reliability test results are as follows: value congruence ($\alpha=0.825$), goal conformance ($\alpha=0.890$), needs fulfillment ($\alpha=0.870$), personality-culture fit ($\alpha=0.946$), and performance ($\alpha=0.949$).

DATA COLLECTION PROCEDURES

Data collection was conducted from March to April 2025. The research team distributed structured questionnaires to healthcare professionals at the Watampone, Biru, and Bajoe Community Health Centers. Respondents were chosen through proportional stratified random sampling. Before distribution, informed consent was obtained, and participants were briefed on the study's objectives and the confidentiality of their data. Enumerators were trained to ensure consistency in completing the questionnaires. Completed forms were reviewed for completeness and consistency prior to data entry.

DATA ANALYSIS

Data were analyzed using SPSS version 23.0 with a 95% confidence interval ($\alpha=0.05$). The analysis will proceed through three stages: univariate, bivariate, and multivariate. The univariate analysis is designed to ascertain the frequency (n) and percentage (%) distribution of the variables. For the bivariate analysis, the chi-squared test will be employed. The

multivariate analysis will assess the impact of multiple independent variables on a single dependent variable through logistic regression analysis.

ETHICAL APPROVAL

This study received ethical approval from the Faculty of Public Health (number: 428/UN4.14.1/TP.01.02/2025).

RESULTS

TABLE 2. FREQUENCY DISTRIBUTION OF RESPONDENT CHARACTERISTICS

Variable	Frequency (n=188)	Percentage (%)
Gender		
Male	20	10.6
Female	168	89.4
Age		
17 - 25 Years	21	11.2
26 - 35 Years	84	44.7
36-45 Years	51	27.1
46-55 Years	21	11.2
56-65 Years	11	5.9
Last Education		
Diploma	97	51.6
S1	55	29.3
S2	52	1.1
S3	1	0.5
Profession	30	16.0
Other	3	1.6
Employment Status		
ASN	97	51.6
Non ASN	91	48.4
Puskesmas		
Watampone Health Center	80	42.6
Biru Health Center	49	26.1
Bajoe Health Center	59	31.4
Period of Employment		
≤ 5 years	77	41
6-10 years	29	15.4
11-15 years	42	22.3
16-20	20	10.6
≥ 21 years	20	10.6
Salary (Indonesian Rupiah; IDR)		
≤ 1,999,999	94	50
2,000,000 – 2,999,999	8	4.3
3,000,000 – 3,999,999	33	17.6
≥ 4,000,000	53	28.2

ASN=Aparatur Sipil Negara or Civil Servant; Puskesmas or Community Health Centers

Table 2 shows that among the 188 respondents, 20 individuals (10.6%) were male, while 168 individuals (89.4%) were female. The age group with the highest representation was 26-35 years, comprising 84 respondents (44.7%). This was followed by the 36-45 age group, with 51 respondents (27.1%). Both the 17-25 and 46-55 age groups had an equal number of respondents, each with 21 individuals (11.2%). The 56-65 age group had the fewest respondents, totaling 11 individuals

(5.9%). Regarding educational attainment, the majority of respondents, 97 individuals (29.3%), held the most recent diploma qualification. Only one respondent (0.5%) had attained an S3 level of education. In terms of employment status, 97 respondents (51.6%) were employed as ASN, while 91 respondents (48.4%) held non-ASN status. The distribution of respondents across three health centers: Watampone Health Center, with 88 respondents (42.6%); Biru Health Center, with 49 respondents (26.1%); and Bajoe Health Center, with 59 respondents (31.4%), resulting in a total of 188 respondents. Of these, 77 individuals (41%) had a work tenure of ≤ 5 years, 29 individuals (15.4%) had a tenure of 6-10 years, and 42 individuals had a tenure of 11-15 years. Furthermore, there were 20 respondents each (10.6%) with tenures of 16-20 years and ≥ 21 years. In terms of income, the highest income was $\geq$ IDR 4,000,000, with 53 respondents (28.2%), while the largest group, comprising 94 respondents (50%), reported lowest income of $\leq$ IDR 1,999,999.

TABLE 3. DISTRIBUTION OF RESPONDENTS BASED ON EMPLOYEE PERFORMANCE

Variable	Frequency (n=188)	Percentage (%)
Performance		
Good Performance	138	73.4
Poor Performance	50	26.6
Value Congruence	136	72.3
Appropriate		
Inappropriate	52	27.7
Goal Conformance	173	92
Appropriate		
Inappropriate	15	8
Needs Fulfillment	167	88.8
Appropriate		
Inappropriate	21	11.2
Culture-Personality Fit	172	91.5
Appropriate		
Inappropriate	16	8.5

Table 3 shows 138 individuals (73.4%) demonstrated good performance, whereas 50 respondents (26.6%) exhibited poor employee performance. Regarding the value congruence, 136 individuals (72.3%) were deemed appropriate, while 52 individuals (27.7%) were considered not appropriate. In terms of goal conformance, 173 individuals (92%) were appropriately aligned, whereas 15 individuals (8%) were not. Concerning the fulfillment of needs, 167 individuals (88.8%) reported adequate fulfillment, while 21 individuals (11.2%) reported insufficient fulfillment. The variable assessing Culture-Personality Fit indicated that 172 individuals (88.8%) were suitably appropriate, whereas 16 individuals (8.5%) were not.

TABLE 4. EFFECT OF STUDY VARIABLES ON EMPLOYEE PERFORMANCE

Variable	Employee Performance				Total		P-Value
	Good		Not Good				
	n	%	n	%	n	%	
Value Congruence							
appropriate	119	87.5	17	12.5	136	100	<0.001
inappropriate	19	36.5	33	63.5	52	100	
Goal Conformance							
appropriate	132	76.3	41	23.7	138	100	0.005
inappropriate	19	36.5	33	63.5	50	100	
Needs Fulfillment							
appropriate	129	77.2	38	22.8	167	100	0.002
inappropriate	9	42.9	12	57.1	21	100	
Culture-Personality Fit							

appropriate	132	76.7	40	23.3	172	100	0.002
inappropriate	6	37.5	10	62.5	16	100	

chi square test

Table 4 shows that the indicators of Person-Organization Fit are significantly associated with employee performance, including value congruence ($p < 0.001$), goal conformance ($p = 0.005$), needs fulfillment ($p = 0.002$), and culture-personality fit ($p = 0.002$).

TABLE 5. MULTIVARIATE OF VALUE CONGRUENCE, GOAL CONFORMANCE, NEEDS FULFILLMENT, PERSONALITY-CULTURE FIT WITH EMPLOYEE PERFORMANCE

Variables	Sig (Hosmer and Lemeshow Test)	Sig.	Exp (B)	Nagelkerke R Square	Overall Percentage (%)
Value Congruence		0.000	9.859		
Goal Conformance		0.453	1.781		
Needs Fulfillment		0.133	2.431		
Culture-Personality		0.095	3.171		
Fit	0.078			0.370	80.9

Table 5 shows the logistic regression analysis, incorporating all variables in the model, which revealed that value congruence significantly impacts employee performance at the multivariate level, while other variables did not show statistical significance. The model did not exhibit a significant Hosmer and Lemeshow test, indicating a good fit. The Nagelkerke R square value is 0.370, suggesting that the independent variables in this study account for 37% of the variance in the dependent variable. Furthermore, the overall percentage value was 80.9%, demonstrating that the validity of the analysis model in this study was 80.9%.

DISCUSSION

This study found that Person-Organization Fit (P-O Fit) is significantly correlated with employee performance, particularly across four dimensions: value congruence, goal alignment, need fulfillment, and culture-personality fit. These findings underscore the importance of aligning employee characteristics with organizational values and expectations in order to improve effectiveness [16].

Value congruence is central to P-O Fit theory. Employees whose values align with organizational values tend to demonstrate consistent, high-quality, and sustainable performance. This result is consistent with Trisnadewi and Suputra [17] and Kamirullah et al. [18], who showed that competence, motivation, and commitment positively affect performance. Conversely, low value congruence can lead to decreased motivation and weaker outcomes.

Goal alignment is equally important in healthcare settings, where employees are expected to prioritize community service objectives in addition to financial incentives. Employee performance reflects the ability to carry out responsibilities according to organizational standards. Prior studies found that alignment of individual and organizational goals fosters harmony, motivation, and job satisfaction, which in turn enhances performance [19,20]. Job satisfaction itself is a well-documented predictor of better outcomes [21]. Thus, organizations must ensure that employees' personal and professional goals align with broader institutional missions [22].

Need fulfillment, based on Maslow's hierarchy, further influences performance. Physiological and safety needs (salary, job security), social needs (relationships), esteem needs (recognition, promotion), and self-actualization (growth, meaningful work) all contribute to higher intrinsic motivation [23]. When needs are met fairly and transparently, employees are more enthusiastic, responsible, and innovative [24]. Conversely, perceptions of unfairness in reward distribution or promotion

can erode morale and create internal conflict [26]. Therefore, equity in reward systems is essential to sustaining performance and team cohesion.

Organizational culture and personality fit also shape outcomes. A culture that is inclusive, collaborative, and supportive of well-being fosters engagement, loyalty, and stronger performance [27]. Personality traits such as consistency, responsibility, and emotional stability reinforce this alignment [28,29]. When employee expectations regarding work patterns, communication, and responsibilities match the prevailing organizational culture, stress is reduced, and performance improves. Conversely, misalignment can lead to burnout and dissatisfaction [30].

In healthcare organizations, such as the Watampone, Biru, and Bajoe Health Centers, the interconnected nature of services requires cooperation, discipline, and transparency across teams. However, performance issues such as low attendance discipline, inconsistent work behavior, and inadequate information dissemination reflect gaps between employee values and organizational expectations. These misalignments highlight the practical consequences of weak P-O Fit on service delivery and patient satisfaction.

Thus, this study demonstrates that P-O Fit is a key determinant of employee performance. Aligning values, goals, needs, and culture–personality fit enhances motivation, satisfaction, and productivity, thereby strengthening service quality in primary healthcare. Addressing P-O Fit gaps—particularly value congruence, identified as the most influential factor—should be a strategic priority for health centers seeking to optimize resources and improve public health outcomes.

CONCLUSION

Based on the findings of this study, there is a significant association between Person-Organization Fit with employee performance, including value congruence, goal conformance, needs fulfillment, and culture–personality fit. In addition, the value congruence is the most dominant factor influencing employee performance.

CONFLICT OF INTEREST

The Author(s) declare(s) that there is no conflict of interest.

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FACTORS INFLUENCING NURSING FACULTY INTENT TO STAY AND NOT TO STAY AMIDST SHORTAGE

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ABSTRACT

This study understands how different factors impact nursing faculty members' decisions to continue or leave from their academic roles. The factors include the perception of the institution's academic reputation, working conditions, sense of belonging, work-life balance, workload, financial benefits, career advancement, job satisfaction, relationships with colleagues and department, and student-teacher relationships. Each factor significantly contributes to the job satisfaction and professional fulfillment of nursing educators.

An electronic survey was conducted with nursing faculty members in Cebu City, Philippines (N=72). Data analysis utilized Pearson's correlation to explore the relationship between various factors and the nursing school faculty's intent to remain in their positions.

The results showed a significant correlation ($p < .001$), suggesting that these factors strongly influence nursing faculty members' decisions to stay. These findings underscore the importance of addressing these factors, as enhancements could improve job satisfaction and strengthen institutional commitment.

In conclusion, this study emphasizes the significant impact of the identified factors on nursing faculty members' decisions to continue in their academic roles. Addressing these factors is vital for cultivating a supportive and motivating academic environment, which is critical for ensuring the retention of nursing educators in Cebu City's baccalaureate nursing programs.

KEYWORDS

nursing faculty, intent to stay, job satisfaction, faculty retention, faculty shortage

INTRODUCTION

Nursing schools have historically thrived due to the dedication of skilled clinical instructors and the potential of their students to serve as future nurses. However, a growing shortage of qualified nursing instructors now threatens the quality of education and clinical training these schools can provide. This shortage presents a serious challenge as institutions struggle to meet demand for undergraduate and graduate nursing programs [1,2]

The Philippines is experiencing a shortage not only of healthcare workers but also of nursing educators, according to recent reports [3]. This shortage hampers the ability to train new nurses effectively, as limited educator availability, high turnover rates and uneven workforce distribution strain the system [4]. The scarcity of qualified educators restricts nursing school's capacity to admit more students while maintaining educational standards, making the shortage of educators a critical factor in addressing the country's broader healthcare workforce crisis [5].

This study draws on Herzberg's Two-Factor Theory as a conceptual foundation but adapts its elements to address specific factors influencing nursing educators' intent to stay in academic roles [6]. Rather than grouping these factors into traditional "hygienic" and "motivational" categories, the study examines each factor independently. Nursing faculty retention is influenced by both intrinsic and extrinsic factors. A recent study [7] highlighted that factors such as workload, resources, and the physical environment significantly influence faculty members' decision to stay or leave. The sense of belonging among nursing faculty has been linked to their intention to stay in academic positions [8]. A positive work-life balance makes employees feel job satisfaction towards their work and increase their productivity [9–11]. Work hours play a critical role in determining the intent to remain or leave among nursing school faculty members, significantly influencing their job satisfaction and commitment to their academic roles [12–14]. Income level is a critical factor influencing the intent to remain among nursing faculty members [14]. A collegial environment and the student-faculty relationship are areas associated with faculty retention in the academe [15,16].

Although existing research has examined nursing shortages and the intent of healthcare workers to remain in Philippine facilities, limited studies have specifically investigated the influencing factors on nursing instructors' decisions to stay or not in their academic positions, particularly within Cebu City. The study seeks to address this by analyzing the various factors influencing nursing faculty retention or turnover within the college department. Specifically, the research explored the personal, relational, and work-related factors influencing their decisions.

Hence, the study determined the factors such as sense of belonging, work-life balance, amount of workload, financial benefits, career advancement, job satisfaction, relationship with colleagues, and student-teacher relationship that correlate with the nursing faculty's intent to stay in the academe in the Philippines. This further explores the factors that influence nursing faculty members of nursing schools' intent to remain or leave, focusing on the important issue of faculty retention in nursing education. By identifying these factors, the study offers valuable insights for nursing schools on how to better support and retain their faculty members. Additionally, the results will contribute to the broader body of knowledge on nursing school faculty retention, providing evidence-based data that can inform future research and help address this issue on a global scale.

METHODS

A descriptive-correlational approach was utilized to determine the predictors influencing nursing school faculty intent to stay or not among institutions. The intricate relationship between various factors and intention to stay or not to stay is sought to be understood. Specifically, the study investigated how a variety of factors correlate with the intention to stay or not among nursing faculty. The objective of the descriptive-correlation design was to describe the intent to stay or not to stay, and investigate the connections between them and associated factors.

The research concentrated on seven specific public and private universities in an urbanized City in the Philippines that are experiencing a deficiency in nursing faculty. The selection process relied on data gathered from diverse sources, encompassing government reports, academic research, and professional organizations specializing in nursing education. By focusing on universities experiencing faculty shortages, the study aimed to delve into the distinct obstacles and influences that exacerbates retention challenges within this setting.

Seven out of fourteen schools offering Bachelor of Science in Nursing were selected as clusters as basis for sampling selection. This study specifically focused on academic nursing educators who teach baccalaureate nursing students at these universities. The researchers randomly selected at least 10 participants from cluster school, except for one university, which had at least 11 participants. Utilizing the G*Power Application software, with an error probability of 5% and 10 number of predictors, there was a total sample size of at least 72 participants.

Instruments utilized in the study measured certain variables in the study such as Dimensions of Part Time Faculty Job Satisfaction [17] (alpha-0.87) measured amount of workload, financial benefits, job satisfaction, relationship with colleagues and department, student-teacher relationship, working conditions, work-life balance; Survey on Opportunities for Promotion and Professional Factors [18] (alpha-0.812) measured career advancement, Intent to Stay in Academe Scale [19] (alpha-0.898) measured intent to stay; Newcomer Socialization Questionnaire [20] (alpha-0.90); Utrecht Work Engagement Scale [21] (alpha-0.70) measured sense of belonging and New Faculty Success Scale [22] which measured work life balance.

Structured questionnaires and surveys designed to collect relevant data and participants were encouraged to complete the survey via Google Forms. Once data collection was complete, the responses were coded and saved into an Excel file for analysis using the Statistical Package for the Social Sciences (SPSS) free version. The data was stored securely on a password-protected computer. To maximize response rates, the survey was kept open for two weeks, with reminder emails sent one week after the initial distribution and a final reminder 24 hours before the survey's closure. To explore the relationships between the variables, Pearson's Correlation and Linear Regression analyses were applied. Pearson's correlation coefficient analyses was conducted to make it easier to determine which variables will be strongly connected with faculty intent to stay and not to stay. Finally, Linear Regression was utilized to evaluate the distinct contribution of each predictor variable while accounting for the effects of other factors by incorporating several predictors into the analysis.

The researchers made sure that faculty members were given clear and thorough information about the study's objectives, procedures, and potential risks prior to obtaining their informed consent to participate. Participation was voluntary, without any form of coercion. Strict confidentiality and anonymity was maintained for all participant responses, and robust data security measures were in place to protect the integrity of the data. Efforts were made to minimize potential risks to participants while maximizing the study's potential benefits.

The study was also approved by the University Research Ethics Committee (REC) to ensure it adhered to ethical standards and regulations. This helped protect participants' rights and maintain the credibility of the research.

RESULTS

The demographic analysis reveals that the majority of the participants in the nursing faculty group are female (62.5%), married (47.2%), hold a master's degree (44.4%), work full-time (70.8%), and have an average age of 41.3 years (Table 1).

TABLE1. PROFILE OF THE RESPONDENTS (N=72)

Profile		Freq	Percentage
Gender	Male	25	34.7
	Female	45	62.5
	Others	2	2.8
Marital Status	Single	31	43.1
	Married	34	47.2
	Widowed	5	6.9
	Separated	1	1.4

	Register Partnership	1	1.4
Educational Attainment	College	20	27.8
	Masters	32	44.4
	Doctorate	20	27.8
Employment Status	Full Time	51	70.8
	Part Time	21	29.2
		Mean	Standard Deviation
Age		41.33	12.54

Table 2 illustrates the respondents' characteristics related to their intent to remain, focusing on various factors such as the academic reputation of the institution, working conditions, sense of belonging, work-life balance, workload, financial benefits, career advancement, job satisfaction, relationships with colleagues and departments, and student-teacher relationships.

TABLE 2. CHARACTERISTICS OF THE RESPONDENTS IN TERMS OF FACTORS INFLUENCING INTENT TO STAY

Variables	Mean	Standard Deviation
Intent to Stay	3.981	0.910
Perception of Academic Reputation	3.986	0.847
Working Conditions	3.991	0.778
Sense of Belonging	3.946	0.731
Work-life Balance	3.934	0.693
Amount of workload	3.892	0.656
Financial Benefits	3.868	0.639
Career advancement	3.798	0.639
Job satisfaction	3.767	0.630
Relationship with colleagues and department	3.791	0.629
Student-teacher relationship	3.840	0.617

Table 2 shows that among the characteristics of intent to stay, the factor with the highest mean score is the Working Condition ($x = 3.991$; $SD = 0.778$). The factor with the lowest mean score is Job Satisfaction ($x = 3.767$; $SD = 0.630$).

Table 3 displays the relationship between various factors and the intent of nursing faculty to remain in their positions.

TABLE 3. CORRELATION OF THE FACTORS WITH NURSING FACULTY INTENT TO STAY

Variable	Correlation	P-Value	Interpretation
Perception of Academic Reputation of the Institution	.000	$p < 0.01$	Significant Reject null hypothesis
Working Conditions	.000	$p < 0.01$	Significant Reject null hypothesis
Sense of Belonging	.000	$p < 0.01$	Significant Reject null hypothesis
Work-Life Balance	.000	$p < 0.01$	Significant Reject null hypothesis
Amount of Workload	.000	$p < 0.01$	Significant Reject null hypothesis

Financial Benefits	.000	p<0.01	Significant Reject null hypothesis
Career Advancement	.000	p<0.01	Significant Reject null hypothesis
Job Satisfaction	.000	p<0.01	Significant Reject null hypothesis
Relationship with Colleagues and Department	.000	p<0.01	Significant Reject null hypothesis
Student-Teacher Relationship	.000	p<0.01	Significant Reject null hypothesis

Table 3 shows that all examined factors are significantly correlated with nursing school faculty members' intent to stay, with p-values less than 0.01 ($p = 0.000$) for each variable. These factors include the perception of academic reputation of the Institution, working conditions, sense of belonging, work-life balance, workload, financial benefits, career advancement opportunities, job satisfaction, relationships with colleagues and departments, and student-teacher relationships. This indicates strong statistical significance across all variables. The significance of these correlations suggests that the observed relationships are statistically meaningful and not due to random chance. Therefore, the null hypothesis, which assumes no relationship between these factors and the intent to stay, can be rejected. Each factor plays a critical role in faculty retention, implying that improvements in any of these areas could directly influence nursing faculty members' decisions to remain in their roles. Addressing these factors can enhance faculty satisfaction, engagement, and commitment, ultimately leading to reduced turnover and improved retention rates in academic institutions.

Table 4 presents the results of a regression analysis examining various factors that influence nursing faculty members' decisions to remain in their roles. The table includes factors such as the Perception of Academic Reputation, Working Conditions, Sense of Belonging, Student-Teacher Relationship, and more, displaying their corresponding coefficients, standard errors, t-values, and significance levels.

TABLE 4. REGRESSION OF SIGNIFICANT FACTORS WITH NURSING FACULTY INTENT TO STAY

Model	Unstandardized coefficients		Standardized Coefficients	t	Significance
	B	Std. Error	Beta		
Constant	0.130	0.055	-	2.353	0.022*
Perception of Acad. Reputation	-1.51	0.146	-.223	-1.035	0.305
Working Conditions	-0.20	0.231	-0.027	-0.84	0.933
Sense of Belonging	0.341	0.163	0.430	2.095	0.040*
Work-Life Balance	-0.174	0.185	-0.206	-0.941	0.350
Amount of Workload	-0.32	0.198	-0.036	-0.163	0.871
Financial Benefits	0.016	0.195	0.017	0.081	0.935
Career Advancement	0.103	0.229	0.107	0.448	0.655
Job satisfaction	-0.219	0.206	-0.227	-1.064	0.291
Relationship with Colleagues	-0.334	0.219	-0.341	-01.526	0.132
Student-Teacher Relationship	1.44	0.143	1.472	10.060	.000*
R square		0.990			
F		610.742			
P		<0.05			

The regression analysis presented in Table 4 examines the factors significantly influencing nursing faculty's intent to remain within an institution. This model includes a range of predictors, such as perception of academic reputation, working conditions, and job satisfaction, yielding an exceptionally high R-squared value of 0.990. This suggests that 99% of the variance in faculty intent to stay can be explained by the predictors in the model. The F-statistic of 610.742, with a p-value <0.05, confirms that the model is statistically significant, indicating that the combined influence of these predictors is substantial for explaining nursing faculty retention.

An analysis of the standardized coefficients (Beta) highlights the relative impact of each predictor. Among the factors, "Student-Teacher Relationship" exhibits the highest beta value (Beta = 1.472, $p = 0.000$), indicating a significant effect on faculty retention. This finding suggests that fostering meaningful interactions between faculty and students substantially increases faculty's likelihood of remaining at the institution. The high significance level ($p = 0.000$) underscores this variable as the most impactful predictor in the model. The second highest beta value is "Sense of Belonging" (Beta = 0.430, $p = 0.040$), which is also statistically significant. This result implies that a supportive, inclusive environment in which faculty feel connected to the institution significantly influences their intent to stay, reinforcing the importance of an institutional culture that fosters faculty attachment. Subsequent variables display no significance. Overall, the hierarchy of beta values, from highest to lowest, emphasizes the paramount importance of relational factors, namely, student-teacher relationships and a sense of belonging, over structural or material elements such as workload, financial benefits, or career advancement. These findings suggest that efforts to enhance nursing faculty retention should prioritize creating a supportive institutional environment that fosters interpersonal connections and a sense of belonging, rather than focusing exclusively on structural elements like workload or benefits.

DISCUSSION

The correlation analysis conducted in this study reveals that all factors related to nursing faculty's intent to remain show a statistically significant relationship. Specifically, the factors examined include Perception of Academic Reputation of the Institution, Working Conditions, Sense of Belonging, Work-Life Balance, Amount of Workload, Financial Benefits, Career Advancement, Job Satisfaction, Relationship with Colleagues and Department, and Student-Teacher Relationship. The significance of these correlations indicates that each of these variables is associated with the intent to stay, leading to the rejection of the null hypothesis for all factors. This suggests that improvements or changes in any of these areas could significantly influence faculty retention. However, the findings from the regression analysis reveal a more nuanced and complex landscape. While correlation implies that there is a relationship, regression analysis allows us to explore the strength and significance of these relationships when accounting for other variables.

Within this framework, the results indicate that Sense of Belonging and Student-Teacher Relationship are the most significant predictors of nursing school faculty's intent to remain. These results suggest that social dynamics play a pivotal role in faculty retention. It aligns with the study that faculty members who feel integrated and valued within their institutions are more likely to remain committed to their roles [23,24]. This supports the notion highlighting that fostering a supportive and inclusive academic environment can significantly enhance faculty retention. Specifically, when nursing faculty members perceive that they belong to their institution and have meaningful connections with their colleagues, their intent to stay increases, thereby contributing to a more stable workforce. The correlation between Student-Teacher Relationships and faculty retention is particularly significant. This finding emphasized the critical role of faculty-student interactions in enhancing student outcomes and faculty satisfaction. In nursing education, where the quality of clinical instruction is vital, strong relationships with students can directly influence faculty's job satisfaction and commitment to their teaching roles. The current study underscores the importance of cultivating student interactions, suggesting that institutions should invest in improved communication and engagement between faculty and students.

Interestingly, the study found that Perception of Academic Reputation, Working Conditions, and Work-Life Balance did not significantly influence faculty intent to stay. This contrasts with the findings of Anderson et al. [25,26], who posited that

these factors are crucial determinants of faculty retention. The current study suggests that perceptions of institutional reputation may not hold the same weight for nursing faculty as they do in other academic fields [27,28]. Faculty members may prioritize immediate relationships and their sense of belonging over abstract perceptions of institutional prestige. Moreover, the non-significant influence of Work-Life Balance could be attributed to the demographic characteristics of the respondents, and employed full-time. These factors indicate that faculty members in this age group have adapted to their work-life demands, leading them to prioritize job satisfaction derived from their professional relationships over a strictly balanced work-life approach [29]. This observation is consistent with the results of Aamir et al. [30] and Cusipag, et al. [31], who noted that as faculty members gain experience, their perceptions of work-life balance may shift toward valuing job fulfillment and engagement.

The study indicated that financial benefits, career advancement, and job satisfaction did not reveal a significant effect on faculty retention. This finding is crucial since the previous research has often highlighted financial incentives as critical motivators in faculty retention [32]. The current study suggests that for many nursing faculty, particularly those with higher degrees, intrinsic motivators such as the quality of their relationships with students and a sense of belonging, may outweigh extrinsic rewards like salary and promotions. The role of relationships with colleagues and departments also merits discussion. While it showed some impact, it did not reach statistical significance. This could indicate that while collegial relationships contribute to faculty satisfaction, they may not be as critical as direct student interaction [33]. This finding emphasizes that nurturing faculty-student relationships can enhance the overall academic environment and faculty retention rates [34].

Moreover, while the correlation analysis demonstrates that all examined factors are significantly related to the nursing school faculty's intent to stay, the regression analysis elucidates the critical importance of specific relational dynamics. The results of this study carry significant implications for nursing program institutions grappling with faculty retention. With the nursing shortage exacerbating, retaining qualified faculty is essential for expanding nursing programs and meeting the increasing demand for nursing professionals [35]. Institutions should prioritize initiatives that foster a sense of belonging and enhance student-teacher relationships.

The study limitation was on the sample size due to digital limitations of some faculty participants and the period of data gathering has constraints. Moreover, the study focus was on numerical information and actual reasons and experiences could not be captured in the study.

CONCLUSION

The findings of this study resonate with existing literature on faculty retention and highlight the importance of relational dynamics in the workplace. The significant roles of Sense of Belonging and Student-Teacher Relationships underscore the necessity of fostering an inclusive academic environment where faculty feel valued and connected to their students. This emphasized the impact of supportive relationships on faculty retention. The lack of significance associated with hygienic factors like Perception of Academic Reputation and Working Conditions may suggest a shift in the priorities of nursing faculty. As the profession becomes increasingly demanding, faculty may prioritize their immediate work environment and interpersonal relationships over broader institutional characteristics. This finding is particularly relevant as nursing programs face increasing pressure to retain qualified faculty amid national shortage. Moreover, the study's findings on Financial Benefits and Career Advancement challenge traditional assumptions about what motivates faculty. The results indicate that intrinsic factors, such as meaningful engagement with students and a sense of community within the institution, may outweigh the importance of financial incentives.

The study recommends that employers of nurse educators consider the personnel support not only focused on extrinsic but maximizing on intrinsic motivations. Strategies may include mentorship programs that connect junior faculty with experienced mentors, workshops focused on developing interpersonal skills and creating an inclusive environment where faculty feel valued and connected. Investing in faculty development programs that enhance the quality of student

interactions could be particularly effective. This approach not only benefits faculty retention but also directly improves student learning outcomes, creating a feedback loop that enhances the educational environment. The strong relationship between student-teacher interactions and faculty retention underlines the need for institutions to adopt a holistic approach to faculty engagement that prioritizes interpersonal connections, thereby contributing to the stability and growth of nursing education. Future research could make the survey shorter by focusing on the most important factors related to job satisfaction. Also, separate studies on socialization factors for new faculty could provide valuable insights into their early experiences and needs, helping to improve their orientation and support. Lastly, expanding the sample to include faculty from a more diverse range of nursing programs could also provide a broader understanding of nursing faculty retention dynamics across educational settings and gain more accurate results. Cross-program comparisons could identify common factors and program-specific challenges impacting job satisfaction and retention, leading to more tailored and effective retention strategies.

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EMPOWERING HEALTH: DISCOVERING COMMUNITY AND STAKEHOLDER NEEDS FOR INTEGRATED ADOLESCENT, MATERNAL, AND CHILD HEALTH APPS

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ABSTRACT

This study explores the needs of communities and stakeholders to support the development of an integrated digital health platform for adolescents, pregnant women, and mothers with toddlers.

Using a sequential mixed-method explanatory design, quantitative data were collected from 296 women of reproductive age in Petungsewu Village, Malang, Indonesia through structured questionnaires, followed by qualitative insights from 15 participants in Focus Group Discussions (FGDs). Results showed that 95.61% of respondents agreed to use electronic media to access information and record health services, highlighting the perceived benefits of improving health status. Sociodemographic factors such as education, marital status, and parity were associated with media use and health service preferences. The FGDs reinforced the need for web-based, user-friendly, and validated applications that support information access, digital recording, community empowerment, and health worker involvement.

The study's novelty resided in the integration of quantitative and qualitative evidence to co-design a health informatics system personalized to the specific needs of the life stage. These findings provide a practical basis for policymakers to support digital transformation in public health services by integrating these platforms into primary health care and strengthening the facilitation of health workers and digital literacy.

KEYWORDS

adolescent health services, community networks, maternal-child health services, needs assessment, public health informatics.

INTRODUCTION

Maternal and child mortality remain major public health challenges in Indonesia. The maternal mortality rate (MMR) in 2023 was 189 per 100,000 live births, and the infant mortality rate (IMR) was 16.85 per 1,000 live births [1]. These rates are still significantly higher than the global targets set in the sustainable development goals (SDGs), specifically an MMR of 70

per 100,000 live births and an IMR of 12 per 1,000 live births by 2030. [2]. These indicators reflect not only the accessibility and quality of health services, but also broader systemic issues such as education, equity, and public health literacy. Improving reproductive health outcomes must start early, during adolescence, because health conditions at each stage of life influence future health pathways [3][4].

To address this issue, the Indonesian Ministry of Health is transforming primary health services, with digital health as the main pillar [5]. Health Information Systems (HIS), such as SIMPUS (Community Health Center Management Information System), have been developed as structured digital tools to support clinical documentation and health service monitoring [6] [7]. SIMPUS integrates internal Community Health Center (*Puskesmas*) services but does not have a broader public interface for health education or engagement at the community level. At the same time, several independently developed mHealth applications exist [8]. In addition, various mobile health applications have emerged to support reproductive health and maternal care, including *Health Titeer* for teenage pregnancy prevention [10], *Rumah Bidanku* for reproductive health education [9], *Bumilku* in Kulon Progo [10], *Sayangi Ibuku* [11], and *Sicantik* [12]. However, many of these applications are sourced from grey literature and lack rigorous evaluation. Their reported effectiveness has not been critically appraised in terms of study design, measurable outcomes, or potential biases, highlighting the need for stronger evidence and peer-reviewed validation in future digital health interventions [13][9][10][11][12].

In Indonesia, digital readiness between village and urban populations varies significantly, particularly in terms of smartphone ownership, digital literacy, and internet access. In Petungsewu Village, for example, factors such as shared device usage, data accessibility, and education levels influence the adoption of digital health solutions. However, these contextual aspects are rarely integrated into system development. Although policy-level frameworks such as *SIMPUS* and application-level innovations already exist, the gap lies in co-designed, interoperable, and evidence-based systems that are accessible, acceptable, and equitable.

To address this gap, the technology acceptance model or TAM by Davis and Granic [14] provides a basic framework, stating that perceived usefulness and perceived ease of use influence users' acceptance of new technologies. In this context, survey indicators such as internet access, smartphone usage, and educational background can be mapped onto TAM constructs. For example, users' perceptions that health applications will improve their health behaviours reflect perceived usefulness, while digital literacy and proficiency in using smartphones are related to ease of use. In addition, Rogers' Diffusion of Innovations (DOI) theory [15] further explains the role of compatibility, which refers to the extent to which innovations align with users' values and experiences, as well as observability, or how visible the results are to the user community.

In addition to individual acceptance, the implementation of digital health systems in low- and middle-income countries (LMICs) [16] must also be assessed through system-level frameworks such as the NASSS Framework (Non-adoption, Abandonment, Scale-up, Spread, and Sustainability) and RE-AIM, which emphasize real-world implementation, sustainability, and equity. Using PROGRESS-Plus as a lens for equity helps ensure attention to sociodemographic factors (place of residence, race, occupation, gender, religion, education, socioeconomic status, social capital) in the design and evaluation of health innovations. This framework emphasizes that health applications must not only be functional but also context-oriented and equitable.

Although various mHealth applications exist in Indonesia, no study has combined quantitative community needs assessments with stakeholder focus group discussions to co-design an integrated web application connected to the *Puskesmas* system for adolescent, maternal, and child health. Therefore, this study aims to analyse the needs of the community and stakeholders in developing an integrated information system that supports health services for adolescents, mothers, and children, while also considering contextual readiness, user acceptance, and implementation challenges at the system level.

This study provides a new contribution by conducting a needs assessment using a mixed-methods approach, which combines quantitative survey data and qualitative focus group discussions, to guide the design of an integrated system

in the field of adolescent, maternal, and child health. By adopting the midwifery philosophy of continuity of care, this system will serve as a centralized platform for education, documentation, and reporting of health services across all stages of life.

METHODS

This study used a mixed method with a sequential explanatory design combining quantitative and qualitative methods. This research has passed the research ethics commission from the Malang Health Polytechnic by Ministry of Health (*Politeknik Kesehatan Kemenkes Malang*), with ethical No. DP.04.03/F.XXI.31/931/2023.

QUANTITATIVE

In the first phase, quantitative research was conducted using a cross-sectional design in Petungsewu village, Dau sub-district, Malang, Indonesia. The population was all women of reproductive age (15-49 years), totalling 945 people. Proportional sampling was used to determine the sample from four hamlets (currently, known to be clusters) in Petungsewu. The allocation of respondents was determined proportionally based on the number of households (KK) in each cluster. Respondents in each cluster were selected randomly from a list of mothers who had children under 5 years old and/or were pregnant.

The inclusion criteria for the sample were women of reproductive age (WRA) who were willing to be respondents, able to communicate verbally, and members of integrated health service post (*Posyandu*). Exclusion criteria include individuals who did not attend after three or more visits/rescheduling, were unable to attend the interview, or refused/withdrew consent. The sample size was calculated using the Slovin formula, based on a population of 945 pregnant women and mothers of toddlers. A margin of error of 5% was used, resulting in a theoretical value of 285 samples. To anticipate non-response, 10% of the total sample was added, resulting in a sample size of 311 respondents. The respondent recruitment flow diagram is shown in Figure 1.

The data collection method uses a survey method by distributing questionnaires to respondents who have been determined from May to June 2023. The questionnaire uses a close-ended question to choose one of the alternative answers from each available question [17]. It consists of 15 closed questions that have met the validity and reliability tests. Details regarding the questionnaire form are in Appendix 1.

The validity test estimates the extent to which the tool's content represents aspects of the conceptual framework. Content validity was evaluated using the content validity index (CVI) method by three experts in midwifery and public health. To avoid overlap between behaviour and preferences, questions were structured based on four main constructs:

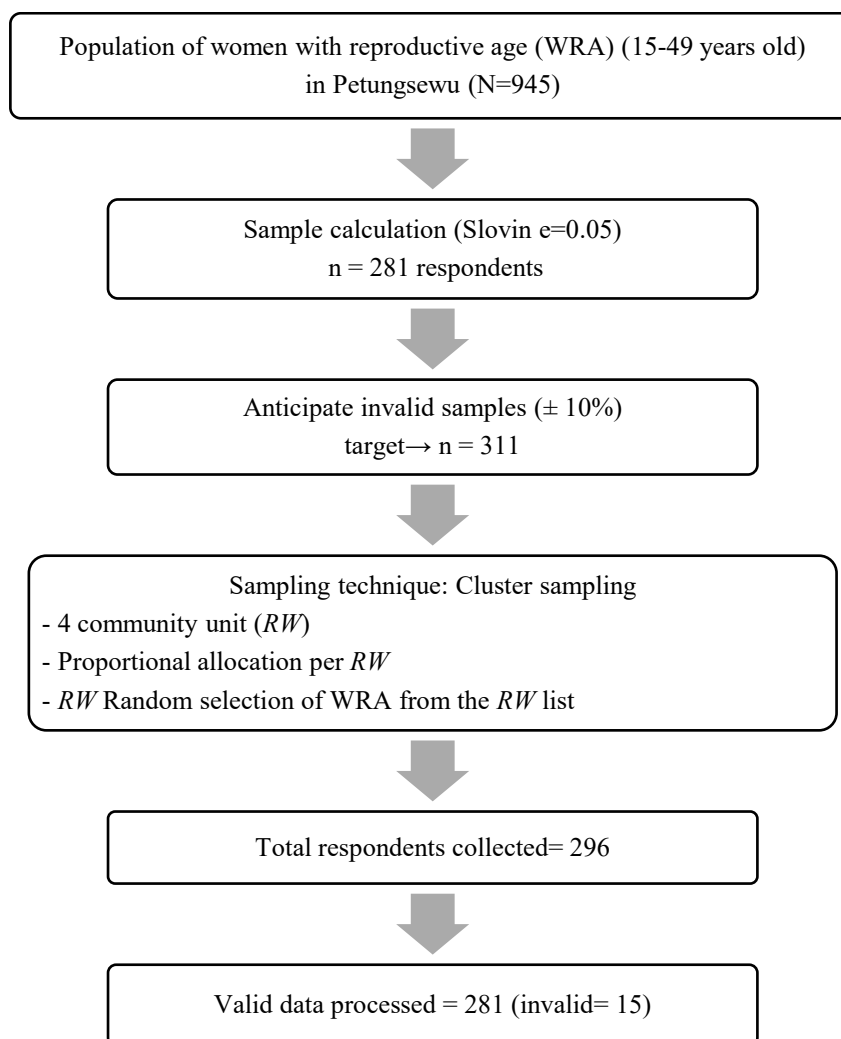
1. Behaviour: measuring actual actions, such as the type of health facilities used or the use of recording media.
2. Attitude: assessing respondents' perceptions of the benefits of health services or media.
3. Feasibility: describing ease of access and availability of supporting facilities.
4. Intention: reflecting preferences or intentions for future use of health services.

The separation of these constructs aims to improve the validity of the instrument and support a more in-depth analysis of the needs and readiness for the use of integrated health applications.

All items obtained an I-CVI score ≥ 0.80 . This instrument was tested in March 2023 with 45 respondents who were not respondents this study. After the content validity test, reliability was measured using Cronbach's Alpha, with an overall alpha value (α value) = 0.86. A pre-test was conducted on 45 respondents from similar locations. The "Technological Readiness" subscale has an $\alpha = 0.81$, and the "Perceived Benefits" subscale has an $\alpha = 0.84$. The scale structure is based on the TAM theory construct.

The data collection process began with licensing the research site and then determining research respondents based on their area, assisted by health cadres. After the purpose of the survey was explained and the consent of each respondent was obtained, the questionnaire was filled in.

FIGURE 1. RESPONDENT RECRUITMENT FLOW DIAGRAM.



The collected data was analysed quantitatively using IBM SPSS version 21 with three stages: descriptive analysis and inferential analysis that includes bivariate and multivariate.

1. Descriptive analysis was performed to examine the distribution of respondent frequencies and percentages, as well as key variables, and to display proportions with a 95% confidence interval (95% CI).
2. Bivariate analysis was performed to test the relationship between independent variables (sociodemographic characteristics of respondents: age, education, job, marital status, and parity) and dependent variables of the study using the chi-square test. The results are reported as a p-values ($\alpha = 0.05$) and preliminary interpretations. Example:
 - Agree to use electronic media for health (categorized: agree vs. others).
 - Desired type of health service.
3. Multivariate analysis was performed using multinomial logistic regression to identify the variables that most influence the desired type of health service. The independent variables included in the model were selected based on significant results in the bivariate test. The results are reported as a regression coefficient (B) and significance level ($p < 0.05$).

This inferential approach explains the influence between variables, not only describing general trends but also providing a statistical basis for recommendations for the development of integrated health applications.

QUALITATIVE

Qualitative data collection methods used *Focus Group Discussions* (FGDs) conducted in August 2023 in the Dau sub-district area. FGDs were conducted using guidelines that were developed to suit the study's purposes [18]. The informants were stakeholders, community leaders, community health cadres, and youth representatives. Stakeholders were representatives from the Malang District Health Office, the Head of *Puskesmas* in Dau sub-district, the coordinator midwife of *Puskesmas* in Dau sub-district, and the midwife staff of Petungsewu village. Meanwhile, community leaders included the village head, Petungsewu youth leaders, and the head of the Family Empowerment Movement Team (TPKK) in the Dau subdistrict.

The determination of informants was purposive and selected based on specific considerations. There were several inclusion criteria for selecting informants: (1) pregnant women or mothers with children under 5 years of age, (2) health workers from *Puskesmas* and volunteers, and (3) adolescents aged 15–19 years living in Petungsewu village. Data saturation was achieved in the fourth session (a total of 15 informants) when no new themes or information emerged from the discussion.

FGDs activities were conducted by interviewing each informant, followed by an open discussion, and were conducted for six hours. The questions discussed revolved around the survey results and the need for an integrated health information system. This qualitative research used thematic analysis, an analytical method for clustering and interconnecting codes or characteristics of specific themes. The grouping of each theme is characterized by the primary step of thematic analysis, which determines the point of view of the phenomenon being analysed [19].

Thematic analysis was conducted based on the research by Braun and Clarke [20]. The codebook was developed based on initial reading and discussions among coders. There are six stages: (1) familiarization with the data, (2) initial coding, (3) development of initial themes, (4) review of themes, (5) definition and naming of themes, and (6) report writing. Two independent researchers completed the initial coding. This study did not calculate Cohen's Kappa, but agreement between coders was obtained through consensus discussion. All differences in code interpretation are collaboratively addressed and recorded in an audit log (audit trail).

In order to ensure the trustworthiness of the results, audit trail, data triangulation (informants from different groups), and translation validation were carried out. An audit trail was conducted by writing down coding decisions and compiling theme summaries. In this study, data sources were triangulated [18]. All recruited respondents agreed to sign a written informed consent form before data collection. The overall data transcription process was carried out verbatim in Bahasa by trained research assistants. Translations were performed by bilingual researchers and double-checked by independent linguists. This study also performed back-translations of the quotes used to ensure consistency of meaning. The confidentiality of the informants' data from the interviews was protected and used responsibly [21].

RESULTS

SURVEY

In this study, the majority of respondents were in the productive age range of 20-35 years (59.80%), had a secondary education (junior high school/high school) (34.12%), predominantly domestic workers (63.51%), most were married (73.99%), and the majority had more than one child/were multiparous (54.73%). Table 1 shows the characteristics of these respondents.

TABLE 1. CHARACTERISTICS OF RESPONDENTS

No	Characteristics	Category	Frequency (n)	Percentage (%)
1	Age	1) <20 years old	87	29.39
		2) 20 – 35 years	177	59.80
		3) >35 years	32	10.81
		Total	296	100.00
2	Education	1) Elementary School	84	28.38
		2) Middle school equivalent	101	34.12
		3) High school equivalent	85	28.72
		4) College	26	8.78
		Total	296	100.00
3	Job	1) Housewife	188	63.51
		2) Labour	5	1.69
		3) Private Officers	27	9.12
		4) Civil servants	2	0.68
		5) Students	51	17.23
		6) Other	23	7.77
		Total	296	100.00
4	Marital status	1) Yes/ Never	219	73.99
		2) Never	77	26.01
		Total	296	100.00
5	Parity	1) Nullipara	85	28.72
		2) Primiparous	49	16.55
		3) Multiparous	162	54.73
		Total	296	100.00

After analysing the characteristics of respondents based on age, education, occupation, marital status, and parity, the distribution of respondents' answers to the main variables of the study is presented in Appendix 2 (survey results). These variables include access and utilization of health services, ownership of supporting facilities such as insurance and health monitoring books, sources and exposure to health information, digital media usage, and perceptions of the benefits of electronic media in improving health status. This explanation aims to obtain a comprehensive overview of the level of need and readiness of respondents for integrated health applications.

Characteristics such as age, education, job, marital status, and parity were found to influence access, preferences, and utilization of health services and information. The type of health facility used, ownership of a maternal and child health book (*KIA* book), availability of recording media, and choice of health services showed a significant relationship with most of these factors. Conversely, *BPJS* (social insurance) membership was evenly distributed and was not influenced by sociodemographic background. Sources of information and the use of media for health recording are also influenced by social characteristics, particularly education. However, some aspects did not show a significant relationship, such as exposure to valid information and the habit of recording services digitally, which are still individual behaviours.

In terms of purpose and duration, the use of smartphones and electronic media is influenced by education, employment, and marital status. Therefore, integrated health applications need to be flexible, inclusive, and adaptive to the user's background. This application must be able to respond to specific needs at every stage of life, from adolescents, expectant mothers, pregnant women, to families with children. To facilitate the mapping of the integrated application design, Table 2 shows the implications of each sub-variable.

TABLE 2. SUMMARY OF VARIABLES AND THEIR IMPLICATIONS

No	Variable	Significant relationship	Applications implications
1	Healthcare facilities type	Age, marital status, and parity	Features must be customized by age, marital status, and number of children.
2	BPJS (social insurance) membership	None	BPJS integration must be made general and inclusive.
3	Ownership of KIA books	All characteristics	The digitalization of KIA books must be inclusive.
4	Availability of recording media	All characteristics	Digital recording features must be customized to user characteristics.
5	Health information sources	Age, education, marital status, and parity	The application must provide various information channels according to the usage background.
6	Exposure of valid information	None	Communication strategies can be general in content.
7	Media for information access	Education	Provide various formats of information media.
8	Digital recording (electronic media)	None	Encourage the use of digital recording with a simple design.
9	Access to information via the internet	Education	Provide content with various literacy levels.
10	Purpose of smartphone use	Education, job, and marital status	Multi-functional design according to social background.
11	Smartphone usage duration	All characteristics	Flexible and easy-to-access features.
12	Electronic media usage duration	Education, job, and marital status	Develop a desktop version for specific groups.
13	Purpose of using electronic media	Education and job	Desktop features are customized for users with more access.
14	Perspectives on electronic media for health	Education, marital status, and parity	Highlight the practical benefits of digital media.
15	Desired health services	All characteristics	Services are customized to the user's stage of life.

Multivariate test results can be seen in Appendix 3. In this multivariate analysis, the dependent variable used was the type of health services desired by respondents. This variable consisted of seven categories of services, ranging from adolescent and premarital services to services for infants and toddlers. This variable was analysed against ten relevant and significant independent variables based on bivariate tests. The independent variables consisted of the type of health facility used, ownership of KIA books, availability of recording media, access to health information, use of the internet for health information, purpose and duration of smartphone use, purpose and duration of use of electronic media other than smartphones, and perspective on electronic media for health. This analysis aims to identify the factors that most significantly influence health service needs, to design a more targeted and integrated health application that fits the characteristics of the users.

Multivariate analysis results show that no variable consistently and significantly influences the type of health service chosen compared to infant and toddler services as a reference. However, there are several practical trends that are worth considering. For example, hospital users tend to choose adolescent and premarital services less frequently, while

Puskesmas users are significantly less likely to choose newborn and postpartum services. Shorter smartphone usage durations (<5 and 5–10 hours per day) are also associated with a lower choice of maternity services. The existence of health records shows a lower tendency to choose services for middle-aged women and early detection of complications. Additionally, the use of non-smartphone electronic media for social networking is positively correlated with the selection of health services for middle-class women, and the use of smartphones for information access is related to the selection of newborn and postpartum services.

Overall, although not all statistically significant, these results show that the type of health facility and habits in using digital technology play a role in shaping service preferences. Therefore, the design of integrated health applications needs to consider access to formal services, the duration and purpose of digital device use, and the availability of health record media.

FOCUS GROUP DISCUSSIONS (FGDS)

Focus group discussions (FGDs) were conducted to explore the quantitative results and gain insights from the community and stakeholders regarding the development of a web-based integrated health application for adolescents, mothers, and children. Five main themes were identified from the thematic analysis. Table 3 shows the FGDs participants role.

TABLE 3. PARTICIPANTS OF FOCUS GROUP DISCUSSION

No.	Role	Frequency (n)	Percentage (%)
1	Stakeholder	5	34
2	Community Leader	3	20
3	Community Health Volunteer	5	33
4	Adolescent	2	13
	Total	15	100

Theme 1: The Need for Integrated and Easily Accessible Health Information

FGD participants assessed that the community is in high demand for integrated health information media that can be accessed via the internet and smartphones and covers all stages of women's lives. The application is expected to be usable anytime and anywhere.

"The strategy for integrating health services must use a website application that can be accessed via smartphones and the internet. It must include education, information, and public health." (Participant 2)

"I would prefer if this application adopts the contents of the KIA Book, but in an electronic version that can be accessed online." (Participant 5)

"Health services through websites make it easier to search for information and learn anytime without the need for direct consultation." (Participant 8)

Theme 2: Digital Recording and Reporting is More Effective than Manual Media

Most participants stated that manual recording and reporting (using paper) was no longer effective. Digital applications were considered to be able to overcome data loss and facilitate the continuous tracking of health information.

"Web-based applications are much better because manual data can be damaged or lost, and is difficult to recover." (Participant 3)

"The recording and reporting functions of Puskesmas must be integrated and accessible to the Health Department and other relevant agencies." (Participant 1)

Negative cases/ different opinions:

One participant was concerned about whether village residents who are unfamiliar with digital applications would be able to access this system independently without training.

"But what about people who are not familiar to using the apps? I'm worried they'll be confused and need guidance too." (Participant 6)

Theme 3: Content Validity and the Need for Interactive Educational Media

There are concerns about the validity of health information. Therefore, the content of the application must be validated by health professionals and presented in an attractive format, such as through videos or animations.

"The information in the application must be validated. It would be better if there were a video to simplify the understanding." (Participant 8)

"That is why there must be a verifier from the health worker at the Puskesmas." (Participant 15)

"I agree. Its use can be supervised by certain workers." (Participant 12)

Theme 4: The Application Must Improve Community Independence and Accessibility

Participants emphasized that the application should make it easy to monitor and maintain health independently, especially for people who have difficulty accessing health facilities or have limited time.

It is important for people who cannot travel so far to be still able to get health information via the internet." (Participant 2)

"It is effective for busy people like me. I can access it anytime, and complications can be detected more quickly." (Participant 14)

"To monitor people's health without medical assistance, just open the application." (Participant 4)

Theme 5: The Role and Responsibilities of Cadres and Health Professionals

Most participants stated that the application should involve cadres and health workers in management, training, and supervision. Village midwives are expected to be the primary coordinators for implementing the application in the community.

"This application should be a platform for education and community empowerment, involving cadres and monitored by health professionals." (Participant 7)

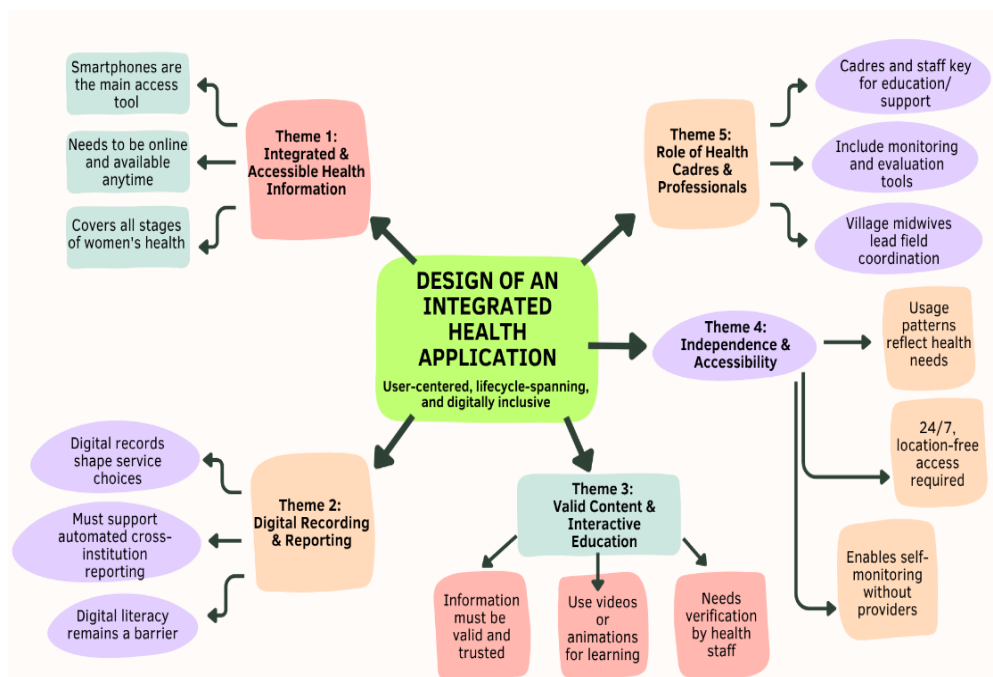
"There must be a monitoring and evaluation system for Puskesmas activities, integrated with existing applications." (Participant 8)

"Village midwives can coordinate recording and reporting, assisted by cadres, so it can be an additional record besides the KIA book." (Participant 2)

THEMATIC MAP OF SURVEY AND FGD RESULTS

The thematic map is shown in Figure 2. This figure illustrates the relationship between FGD themes, quantitative analysis (survey) results, and implications for application design.

FIGURE 2. THEMATIC MAP OF THE RELATIONSHIP BETWEEN QUANTITATIVE ANALYSIS (SURVEY) RESULTS AND FGD THEMES, AND IMPLICATIONS FOR APPLICATION DESIGN.



FGDs showed strong support for the development of integrated web-based health applications, with particular attention to accessibility, validity of information, involvement of health workers, and functionality of service recording. Although some participants highlighted potential barriers in digital literacy, the majority expressed readiness and a need for adaptive digital platforms. However, the general implication is that applications must be designed based on the real needs of users, across all stages of life, and be digitally inclusive.

DISCUSSION

The majority of respondents in this study were women in their reproductive age with primary education. Most of them worked as housewives, were married, and had children. The survey results showed that most respondents accessed health information independently through the internet and smartphones to obtain information and to record the health services they received. Their preferences for health services were also influenced by the type of facilities used, exposure to the media, and the availability of recording media. Although not all variables showed statistical significance in the multivariate analysis, important practical trends were found. Focus group discussions (FGDs) also confirmed that the community needs an integrated, web-based health information system that is easily accessible and can comprehensively cover health information for adolescents, mothers, and children.

These findings are in line with Goutam's research [22]. This study states that marital status, education, media exposure, and religion influence women's autonomy in health decision-making [22]. High internet exposure is also supported by data from the Ministry of Communication and Information Technology (Kominfo), which shows that 56% of Indonesians are active internet users, with 53% accessing the internet via smartphones [23].

Recently, the internet has been used in the health sector, especially in health information systems. This information is based on the recommendations of the Indonesian Ministry of Health (Kemenkes) as stipulated in Government Regulation No. 46 of 2014 concerning Health Information Systems. In this global era, health organizations have been connected to information technology networks worldwide through telecommunications technology, facilitated by the internet. The implementation of information and communication technology in the healthcare sector is known as e-health. E-health was developed to improve the quality of healthcare and develop effective and efficient work processes. In terms of the

implementation of electronic health information systems, e-health is a superset or suprasystem of electronically regulated health information systems [7] [24] [25].

Another study by Nursanti et al. [26] highlights the development of an innovative website based on an integrated health information system. This system offers a number of advantages, including simplicity, suitability, and complexity. The user-friendly interface makes navigation and easy to understand, ensuring accessibility and utility for all users. The use of websites for integrated health information systems is an innovation driven by several supporting factors, including the desire to enhance facility availability and the pressure to improve services [26].

In developing an integrated information system for adolescent, maternal, and child health, it is important to pay attention to the accessibility principle. This includes ease of access for all target groups, both in terms of website management, internet access availability, and smooth follow-up in the form of health services that can be obtained through the system. Improvements and refinements must continue to be made to ensure that this system is accessible to all parties who need it, thereby providing maximum benefits for the health of adolescents, mothers, and children [27, 28].

The results of research at *Puskesmas* of Peneleh show that the implementation of e-health services is considered quite effective and is in line with the principles of excellent public service in terms of simplicity, clarity, openness, economy, security, timeliness, and consistency. However, in terms of simplicity, not all people understand how to use e-health. In terms of transparency, there is still a need for more socialization regarding the e-health services provided by the *Puskesmas* to the community in its working area [29]. To develop an integrated health information system, which is part of the healthcare system at the *Puskesmas*, it must support the improvement of excellent service quality, implement program socialization to the user community, and supervise *Puskesmas* staff.

The use of smartphones as a platform for health promotion can reduce barriers to the use of other media. Additionally, it enhances the acceptance of electronic media-based health interventions by integrating health education and other forms of health promotion [30]. All health services, such as adolescent, premarital, maternal, and child health, can be facilitated at *Puskesmas* by utilizing e-health, which operates with health workers as facilitators [31, 32].

STRATEGIES FOR INTEGRATING ADOLESCENT, MATERNAL, AND CHILD HEALTH SERVICES

In the FGDs results, all informants agreed that the strategy was to use an integrated application for adolescent, maternal, and child health by adopting the website version of the *KIA* book. This system must include elements of education, information, and public health, which can be used to maximize the recording and reporting functions of *Puskesmas* staff to the Health Office.

Recent advances in digital technology are significantly impacting the healthcare sector. Many health applications, easily accessible via smartphones and tablets, have been launched to meet the public's need for health information. Patients are currently adapting to the growing trend of utilizing health technology. To receive valid health information that suits their needs, the public must know how to identify and search for credible health information. For this reason, monitoring the use of community-based integrated health systems by *Puskesmas* must be taken into consideration [16, 33].

THE IMPORTANCE OF INTEGRATED HEALTH SERVICES FOR ADOLESCENTS, MOTHERS, AND CHILDREN THROUGH A WEBSITE-BASED APPLICATION

All informants considered the use of a website-based integrated health information system for adolescents, mothers, and children to be necessary because it is a medium for information, recording, and reporting that uses minimal paper. A website-based system also allows for easy access to the community at any time, from anywhere. Developing an integrated information system for adolescent, maternal, and child health must consider the challenges of implementing health information systems in Indonesia. One of the challenges faced in implementing health information systems, or "SIK," is that the implementers themselves are still unfamiliar with SIK. It leads to inefficient implementation and poor-quality data. Another challenge is the low level of funding and utilization of *Posyandu* units. High maintenance costs sometimes cause the systems to malfunction. Therefore, specific strategies are necessary to effectively manage the system. *Puskesmas* can

utilize *Posyandu* community-based health units to monitor the system. Initially, this requires some effort, such as socialization and operational training. However, in the future, it will facilitate the performance of *Puskesmas* in terms of budget efficiency [6, 34].

Developing an integrated information system on adolescent, maternal, and child health requires the participation of all parties involved in public health services. All informants agreed that their responsibilities are based on their roles in the community. To improve access, community empowerment efforts are required through the involvement of health cadres as extensions of health workers at *Puskesmas* in monitoring and evaluating system-based health programs. It is expected that the integrated information system to be developed must meet the needs of the community and be in line with existing health unit programs. In public health services, there is no doubt that the work program at the *Puskesmas* must be followed. According to Government Regulation of the Republic of Indonesia Number 46 of 2014 concerning Health Information Systems, Article 58 (1), states that the development of Health Information Systems is carried out through system planning, system analysis, system design, software development, hardware provision, system testing, system implementation, and system maintenance and evaluation. All of these stages are carried out based on the results of assessments and research [7].

In addition, developing an integrated health information system for adolescents, mothers, and children must be in line with existing health programs. Health programs related to adolescent health include reproductive health, adolescent nutrition, sexual behaviour, and sexually transmitted infections. Maternal health is related to pregnancy, postpartum, breastfeeding, nutrition, and mental health. Child health includes newborn care, immunization, complementary feeding, growth and development monitoring, infant and toddler health services, childcare, daycare, environmental safety, and child protection [35].

The success of this system's development is highly dependent on data standardization and interoperability, which can be achieved through international frameworks such as FHIR (Fast Healthcare Interoperability Resources) or HL7 [36]. In this case, the system with existing information systems in primary health facilities such as *Puskesmas* [37]. This study is also relevant to various findings in low and middle-income countries (LMICs), where the successful adoption of mHealth is greatly influenced by community involvement, cultural fit, and institutional support [38]. Study by Lee et al. [39] has highlighted that the adoption of digital health technology in LMICs requires systems that are simple, accessible, yet secure and standardized. Therefore, the results of this study are not only relevant nationally but also have the potential to contribute to the global discourse on strengthening digital technology-based health systems in developing countries.

The main strength of this study lies in the use of a mixed method, namely a combination of quantitative surveys and qualitative FGDs, which provides a comprehensive representation of community needs. This approach allows for the integration of statistical data and field experience, thereby strengthening the validity of the findings in the context of health information system design. This study complements previous studies on the use of information systems in healthcare, particularly in the context of documentation, monitoring, and education, which were discussed separately. The findings of this study represent the first step in developing a truly integrated health information system for adolescents, mothers, and children, encompassing all aspects of information, service recording, and reporting. A needs analysis was conducted through a survey of a diverse target population, and the results were reinforced by FGDs to gain a more in-depth and contextual qualitative understanding. This combination of methods enables the design of a system that is not only responsive to user needs but also considers aspects of implementability, such as the involvement of cadres as facilitators and the need for a phased socialization strategy appropriate to the local context.

However, this study has several limitations. The study was conducted in a single village, so the results cannot be generalized to other areas with different sociodemographic characteristics, health infrastructure, or levels of technology access. In addition, although inferential analysis was performed using chi-square tests and logistic regression to assess relationships among variables, the overall design remained cross-sectional and based on a single community. This means that conclusions about community attitudes or readiness, including findings of high levels of agreement with the use of electronic media, must be interpreted with caution and limited to the local context. Furthermore, the study did not include

a pre-determined analysis plan, so the analysis was conducted retrospectively. Further studies with broader coverage and stronger analytical designs are needed to improve the external validity of the results of this study.

This study also did not involve non-service users, thus risking selection bias. The participation of adolescents in the FGDs in this study was very limited, which could potentially weaken the perspective of this important target group. The analysis did not systematically incorporate a SWOT approach. Therefore, it did not fully evaluate the strengths, weaknesses, opportunities, and threats associated with the system's implementation. The process of translating the FGD results from Bahasa to English also had the potential to distort the meaning. Based on these limitations, it is recommended that future studies involve a larger number of non-service users and adolescents. Future research should test the developed system prototype through usability testing, feasibility testing, and cost-effectiveness testing before it is widely implemented in the national health care system.

CONCLUSION

Based on an analysis of the needs of the community and stakeholders regarding an integrated information system for adolescent, maternal, and child health, it can be concluded that there is a need for more standardized health data recording and reporting. This is to ensure that community health data can be tracked and used as a basis for continued service management. This information must be easily accessible to health workers and patients' families anywhere and on time. Therefore, the information system developed in the future needs to prioritize these requirements to facilitate services for both health workers and patients and their families. In this way, the system has the potential to be implemented in the community health center (*Puskesmas*) service system. Policy makers can consider the results of this study to develop a system for future research. Further research can consider the design of health information systems for adolescents, mothers, and children as a basis for coding for programmers. This should focus on identifying user stories, analysing workflows, defining non-functional requirements (offline access, data security), and conducting risk analysis (use by cadres vs. the general public).

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APPENDIX 1: RESEARCH QUESTIONNAIRE: SURVEY OF PUBLIC NEEDS FOR INTEGRATED ADOLESCENT, MATERNAL AND CHILD HEALTH APPLICATIONS

CHART EXAMPLES

A. Respondent Identity

Instructions for Completing the Questionnaire for Points A and B

1. Read the questions carefully and thoroughly
2. Put a tick (V) on the answer that you think is correct.
3. Answer can be more than one item.

1. Name :
2. Home address :
3. Date of Birth / Age:
4. Gender:
 - a. Women ☐
 - b. Male ☐
5. Education:
 - a. Elementary School ☐
 - c. High School ☐
 - b. Junior High school ☐
 - d. Higher Education Institution ☐
6. Work :
 - a. Housewife ☐
 - c. Private Employees ☐
 - e. Students ☐
 - b. Laborer ☐
 - d. Civil servants ☐
 - f. Others ☐
7. Marry:
 - a. Yes / Never ☐
 - b. Never ☐
8. Pregnancy and Delivery Status
 - a. Number of pregnancies:
 - b. Number of childbirths:
 - c. Number of living children:

B. Need will Integrated Health Application For Teenagers , Mothers and Children

Questionnaire Completion Instructions

1. Read the questions carefully and thoroughly
2. Put a circle (O) on the answer that you think is correct.
3. Answer can be more than one item.

A list of questions

No.	Question	Answer
1	Agency service health benefits (can be choose more from than one item)	a. Clinic Private b. Primary Clinic c. Puskesmas (community health center) d. Hospital e. Others
2	Ownership insurance health (BPJS and similar)	a. Yes

No.	Question	Answer
		b. Don't have any
3	Ownership book monitoring health (KIA books and the like)	a. Yes b. Don't have any
4	Availability service recording results service health that can monitored at home (book print / electronic media)	a. Available b. Unavailable
5	Access to information health (can be choose more from than one item)	a. From a health service professional b. From health cadres c. From the community d. From parents / closest people e. by myself
6	Exposure to accurate/valid health information for adolescents, mothers, and children.	a. Frequently b. Sometimes c. Never
7	Use of media to obtain health-related information.	a. Print media (books, newsletters, newspapers, magazines, etc.) b. Electronic books (E-Book) c. Television d. Radio e. Social media f. Internet (web browser)
8	The use of electronic media to record information related to health services.	a. Never b. Infrequent c. Sometimes d. Frequently e. Always
9	The use of internet to access health information.	a. Never b. Infrequent c. Sometimes d. Frequently e. Always
10	The purpose of using a smartphone.	a. Communication media b. Information access c. Social media d. Health services e. Other
11	How long do you use your smartphone per day?	a. < 5 hours/day b. 5 – 10 hours/day c. > 10 hours/day
12	How long do you use electronic media other than smartphones (computers/laptops) per day?	a. <5 hours/day b. >=6 hours/day c. Sometimes d. Never
13	The purpose of using electronic media other than smartphones (computers/laptops).	a. Communication media b. Information access c. Social media d. Health services

No.	Question	Answer
		e. Others
14	The use of electronic media as a source of information and a platform for recording health services can help improve health status.	a. Agree b. Disagree c. Do not know
15	The scope of health services desired.	• Service health teenagers and pre-marriage. • Health service for pregnant women. • Maternal care Services. • Services for newborns and postpartum mothers. • Service women's health during <i>masa antara</i>. • Early detection and treatment of risk factors for complications. • Health services for infants and toddlers.

*Description:

masa antara: the period between pregnancy and childbirth and the next pregnancy.

APPENDIX 2. SURVEY ON THE NEED FOR INTEGRATED HEALTH APPLICATIONS FOR ADOLESCENTS, MOTHERS, AND CHILDREN.

No.	Questions	Variations in Responses	Frequency (n)	Percentage (%)	Bivariate Test based on Characteristics
1.	Health service institution used.	Private doctor/midwife clinic	28	9.46	Age: $p=0.001 < 0.05$
		Primary care clinic	11	3.72	Education: $p=0.157 > 0.05$
		Puskesmas	159	53.71	Job: $p=0.443 > 0.05$
		Hospital	55	18.58	Marital status: $p=0.005 < 0.05$
		Others	43	14.53	Parity: $p=0.033 < 0.05$
		Total	296	100.00	
2.	Health insurance membership (BPJS and similar services).	Yes	140	47.30	Age: $p=0.154 > 0.05$
		Don't have any	156	52.70	Education: $p=0.218 > 0.05$
					Job: $p=0.082 > 0.05$
					Marital status: $p=0.707 > 0.05$
		Total	296	100.00	Parity: $p=0.331 > 0.05$
3.	Ownership of health monitoring books (KIA books and others).	Yes	238	80.41	Age: $p=0.001 < 0.05$
		Don't have any	58	19.59	Education: $p=0.002 < 0.05$
					Job: $p=0.001 < 0.05$
					Marital status: $p=0.001 < 0.05$
		Total	296	100.00	Parity: $p=0.001 < 0.05$
4.	Availability of health service records that can be monitored at home (printed books/electronic media).	Available	183	61.82	Age: $p=0.001 < 0.05$
		Unavailable	113	38.18	Education: $p=0.001 < 0.05$
					Job: $p=0.005 < 0.05$
					Marital status: $p=0.001 < 0.05$
		Total	296	100.00	Parity: $p=0.001 < 0.05$
5.	Access to health information.	From a health service professional	72	24.32	Age: $p=0.039 < 0.05$
		From health cadres	64	21.62	Education: $p=0.001 < 0.05$
		From community	29	9.80	Job: $p=0.296 > 0.05$
		From parents/ closest people	43	14.53	Marital status: $p=0.005 < 0.05$
		by themselves	88	29.73	Parity: $p=0.039 < 0.05$
		Total	296	100.00	

No.	Questions	Variations in Responses	Frequency (n)	Percentage (%)	Bivariate Test based on Characteristics
6.	Exposure to accurate/valid health information for adolescents, mothers, and children.	Frequently	133	44.93	Age: $p=0.161 > 0.05$
		Sometimes	138	46.62	Education: $p=0.119 > 0.05$
		Never	25	8.45	Job: $p=0.485 > 0.05$
					Marital status: $p=0.054 > 0.05$
					Parity: $p=0.070 > 0.05$
		Total	296	100.00	
7.	Use of media to obtain health-related information.	Printed media (books, newsletters, newspapers, magazines, etc.)	27	9.12	Age: $p=0.362 > 0.05$
		Electronic books (E-Books)	14	4.73	Education: $p=0.013 > 0.05$
		Television	46	15.54	Job: $p=0.911 > 0.05$
		Radio	4	1.35	Marital status: $p=0.093 > 0.05$
		Social media	61	20.61	Parity: $p=0.227 > 0.05$
		Internet (web browser)	144	48.65	
		Total	296	100.00	
8.	The use of electronic media to record information related to health services.	Never	40	13.51	Age: $p=0.385 > 0.05$
		Infrequent	50	16.89	Education: $p=0.363 > 0.05$
		Sometimes	126	42.57	Job: $p=0.256 > 0.05$
		Frequently	74	25.00	Marital status: $p=0.102 > 0.05$
		Always	6	2.03	Parity: $p=0.100 > 0.05$
		Total	296	100.00	
9	The use of internet to access health information.	Never	24	8.11	Age: $p=0.090 > 0.05$
		Infrequent	41	13.85	Education: $p=0.001 < 0.05$
		Sometimes	109	36.82	Job: $p=0.270 > 0.05$
		Frequently	98	33.11	Marital status: $p=0.516 > 0.05$
		Always	24	8.11	Parity: $p=0.771 > 0.05$
		Total	296	100.00	
10	The purpose of using a smartphone.	Communication media	91	30.74	Age: $p=0.124 > 0.05$
		Information access	42	14.19	Education: $p=0.001 < 0.05$
		Social media	106	35.81	Job: $p=0.001 < 0.05$
		Health services	23	7.77	Marital status: $p=0.043 < 0.05$
		Others	34	11.49	Parity: $p=0.284 > 0.05$
		Total	296	100.00	
11		<5 hours/day	162	54.73	Age: $p=0.001 < 0.05$
		5 – 10 hours/day	95	32.09	

No.	Questions	Variations in Responses	Frequency (n)	Percentage (%)	Bivariate Test based on Characteristics
	Duration of smartphone use per day.	> 10 hours/day	39	13.18	Education: $p=0.001 < 0.05$ Job: $p=0.001 < 0.05$ Marital status: $p=0.001 < 0.05$ Parity: $p=0.001 < 0.05$
		Total	296	100.00	
12	Duration of using electronic media other than smartphones (computers/laptops) per day.	<5 hours/day	64	21.62	Age: $p=0.062 > 0.05$
		≥ 6 hours/day	39	13.18	Education: $p=0.001 < 0.05$
		Sometimes	78	26.35	0.05
		Never	115	38.85	Job: $p=0.004 < 0.05$ Marital status: $p=0.005 < 0.05$ Parity: $p=0.058 > 0.05$
		Total	296	100.00	
13	The purpose of using electronic media other than smartphones (computers/laptops) .	Communication media	57	19.26	Age: $p=0.083 > 0.05$
		Information access	74	25.00	Education: $p=0.001 < 0.05$
		Social media	12	4.05	0.05
		Health services	6	2.03	Job: $p=0.047 < 0.05$
		Others	147	49.66	Marital status: $p=0.452 > 0.05$ Parity: $p=0.622 > 0.05$
		Total	296	100.00	
14	The use of electronic media as a source of information and a platform for recording health services can help improve health status.	Agree	283	95.61	Age: $p=0.061 > 0.05$
		Disagree	1	0.34	Education: $p=0.729 > 0.05$
		Do not know	12	4.05	Job: $p=0.001 < 0.05$ Marital status: $p=0.029 < 0.05$ Parity: $p=0.008 < 0.05$
		Total	296	100.00	
15	The scope of health services desired.	Adolescent and premarital health services.	92	31.08	Age: $p=0.001 < 0.05$ Education: $p=0.024 < 0.05$
		Health service for pregnant women.	11	3.72	Job: $p=0.005 < 0.05$
		Maternal Care Services.	5	1.69	Marital status: $p=0.001 < 0.05$
		Services for newborns and postpartum mothers.	18	6.08	Parity: $p=0.001 < 0.05$
		Health services for middle-class women.	17	5.74	

No.	Questions	Variations in Responses	Frequency (n)	Percentage (%)	Bivariate Test based on Characteristics
		Early detection and treatment of risk factors for complications.	19	6.42	
		Health services for infants and toddlers.	134	45.27	
		Total	296	100.00	

APPENDIX 3. MULTIVARIATE TEST OF INTEGRATED HEALTH APPLICATION NEEDS FOR ADOLESCENTS, MOTHERS,

Code	Variable Initials	B	Sig.	Exp(B)
0	Healthcare facility: Private clinic	-0.165	0.821	0.848
1	Healthcare facility: Primary care clinic	0.375	0.994	1.454
2	Healthcare facility: Puskesmas	-0.709	0.152	0.492
3	Healthcare facility: Hospital	-1.038	0.085	0.354
5	Ownership of health monitoring books (KIA books): Yes	-0.489	0.384	0.613
7	[CatatanKesh=1]	-0.454	0.3	0.635
9	[AksesInfokes=1]	-0.952	0.1	0.386
10	[AksesInfokes=2]	0.122	0.816	1.13
11	[AksesInfokes=3]	0.73	0.188	2.074
12	[AksesInfokes=4]	-0.623	0.228	0.536
14	[TujuanSmartphone=1]	-0.386	0.519	0.68
15	[TujuanSmartphone=2]	0.207	0.789	1.231
16	[TujuanSmartphone=3]	-0.194	0.71	0.824
17	[TujuanSmartphone=4]	-0.415	0.623	0.66
19	[LamaPakaiHP=1]	-1.044	0.096	0.352
20	[LamaPakaiHP=2]	-0.414	0.49	0.661
22	[LamaPakainonHP=1]	0.427	0.358	1.532
23	[LamaPakainonHP=2]	0.51	0.384	1.665
24	[LamaPakainonHP=3]	-0.239	0.604	0.787
26	[TujuanPakaiMediaElnonHP=1]	0.267	0.595	1.306
27	[TujuanPakaiMediaElnonHP=2]	0.181	0.709	1.198
28	[TujuanPakaiMediaElnonHP=3]	0.43	0.744	1.538
29	[TujuanPakaiMediaElnonHP=4]	1.018	0.794	2.769
31	[MediaElupStatusKes=1]	-1.409	0.09	0.244
35	Healthcare facility: Private clinic	1.846	0.124	6.333
36	Healthcare facility: Primary care clinic	-0.446	0.999	0.64
37	Healthcare facility: Puskesmas	-0.054	0.96	0.947
38	Healthcare facility: Hospital	0.486	0.682	1.626
40	Ownership of health monitoring books (KIA books): Yes	-0.547	0.563	0.579
42	[CatatanKesh=1]	-0.292	0.699	0.747
44	[AksesInfokes=1]	0.908	0.391	2.479
45	[AksesInfokes=2]	1.47	0.152	4.35
46	[AksesInfokes=3]	0.904	0.48	2.471
47	[AksesInfokes=4]	-0.732	0.618	0.481
49	[TujuanSmartphone=1]	0.6	0.649	1.822
50	[TujuanSmartphone=2]	-0.547	0.795	0.579
51	[TujuanSmartphone=3]	1.071	0.394	2.919
52	[TujuanSmartphone=4]	1.985	0.205	7.278
54	[LamaPakaiHP=1]	0.803	0.619	2.233
55	[LamaPakaiHP=2]	0.794	0.624	2.212

57	[LamaPakainonHP=1]	-0.342	0.658	0.71
58	[LamaPakainonHP=2]	-1.572	0.282	0.208
59	[LamaPakainonHP=3]	-1.803	0.082	0.165
61	[TujuanPakaiMediaElnonHP=1]	0.839	0.367	2.314
62	[TujuanPakaiMediaElnonHP=2]	0.845	0.303	2.329
63	[TujuanPakaiMediaElnonHP=3]	1.625	0.369	5.08
64	[TujuanPakaiMediaElnonHP=4]	4.923	0.146	137.478

*Notes:

CatatanKesh: Health Service Records

AksesInfokes: Access to Health Information

TujuanSmartphone: Purpose of Smartphone use

LamaPakaiHP: Duration of Smartphone Use

LamaPakainonHP: Duration of (Non) Smartphone Use

TujuanPakaiMediaElnonHP: Purpose of Using Electronic Media (Non-smartphone)

MediaElupStatusKes: The use of health education media with health status

TOWARDS A BEHAVIOURAL-QUANTUM LEADERSHIP FRAMEWORK FOR MALAYSIA'S PRIVATE HEALTHCARE SECTOR

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ABSTRACT

OBJECTIVE:

To propose a Behavioural-Quantum Leadership Framework tailored to the realities of Malaysia's private healthcare sector, addressing the gap between traditional leadership models and the complex, non-linear nature of private hospitals.

DESIGN:

A conceptual synthesis integrating task-relationship-change oriented behavioural leadership with adaptive, relational, and sensemaking capacities drawn from quantum and complexity leadership theories.

SETTING:

The private healthcare sector in Malaysia, characterized by workforce constraints, digital transformation, and commercial competition.

MAIN OUTCOME MEASURES:

The development of a theoretical framework that bridges classical and modern leadership paradigms to support operational stability and adaptive responsiveness.

RESULTS:

The proposed framework integrates three domains: (1) Behavioural foundations for operational stability; (2) Quantum adaptive capacities for navigating uncertainty; and (3) Complexity-informed processes for emergent decision-making

CONCLUSIONS:

The framework offers a structured foundation for future empirical testing and provides practical guidance for leadership development, aiming to strengthen resilience and service quality in Malaysian private hospitals.

KEYWORDS

behavioural leadership, quantum leadership, complexity leadership, private healthcare, Malaysia, leadership framework, adaptive leadership

INTRODUCTION

Leadership is a critical determinant of organisational effectiveness in healthcare, particularly in environments characterised by uncertainty, rapid technological change and complex patient-care demands. In Malaysia, the private healthcare sector has expanded rapidly, driven by rising patient expectations, medical tourism, competitive market pressures and organisational growth. As private hospitals compete on service quality, efficiency and innovation, leadership at the level of frontline managers, matrons, heads of department and clinical leaders become central to shaping staff behaviour and patient outcomes.

Traditional leadership models, including behavioural approaches derived from the Ohio State [1] and Michigan [2] studies, have long guided leadership development in healthcare. These models focus on observable leader behaviours such as structuring tasks, building relationships, communicating expectations and monitoring performance. Their appeal lies in being measurable, trainable and relatively easy to embed in management systems.

However, there is a growing recognition that healthcare organisations function as complex adaptive systems. While hospitals have always operated within complex dynamics, the increasing scale, interdependence and technological density of modern healthcare have made this complexity more visible and critical to management. They rely on interdependent teams, nonlinear workflows, unpredictable clinical demands and constant technological and regulatory change. In such systems, leadership requires more than behavioural clarity; it demands the capacity to navigate uncertainty, foster adaptability, stimulate collective intelligence and respond emergently to dynamic conditions. These requirements align with the principles of quantum and complexity leadership, which emphasise interconnectedness, relational intelligence, sensemaking and influence within dynamic networks. These perspectives have gained traction in international healthcare literature but remain underdeveloped in relation to Malaysia's private healthcare sector, creating a need for an integrated, contextually relevant leadership framework.

METHODOLOGY

This paper adopts a conceptual research design to develop a hybrid leadership framework. The study integrates theoretical perspectives from behavioural leadership, quantum leadership, and Complexity Leadership Theory (CLT) through a narrative synthesis of existing literature. The synthesis focuses on aligning these theories with the specific organizational context of Malaysia's private healthcare sector.

Ethical approval was not required for this study as it is a conceptual paper based on a synthesis of existing literature and theoretical frameworks. This research did not involve human participants or animal subjects.

RESEARCH GAP

Leadership research in Malaysia continues to rely heavily on classical models such as transformational, transactional and behavioural leadership, with limited engagement with modern theories suited to complex organisational environments. Although behavioural leadership remains widely applied due to its clarity and measurability, it does not fully address the nonlinear, interdependent and rapidly evolving conditions characteristic of private hospitals.

At the same time, quantum and complexity leadership perspectives — which emphasise adaptability, sensemaking, relational intelligence and emergent decision-making — have gained recognition internationally but remain conceptually fragmented and insufficiently integrated with established behavioural approaches. Most studies focus on nursing or public-sector contexts, offering little insight into leadership needs within Malaysia's private healthcare sector, where commercial pressures and patient expectations intensify organisational complexity.

Despite the sector's growing importance, there is a lack of leadership frameworks that combine behavioural structure with quantum-informed adaptability. No existing Malaysian studies propose a hybrid model or examine how such

integration could strengthen leadership effectiveness in private hospitals. This gap highlights the need for a theoretically grounded and contextually relevant Behavioural–Quantum Leadership Framework.

PROBLEM STATEMENT

Leadership in Malaysia's private healthcare sector remains guided largely by traditional behavioural models that emphasise task structuring, supervision and relational behaviours. While these models provide necessary operational clarity, they do not equip leaders to navigate the complex, interdependent and unpredictable conditions that characterise private hospitals today.

At the same time, quantum and complexity leadership theories offer adaptive and emergent perspectives but remain insufficiently integrated into Malaysian leadership practice and research. The absence of a hybrid model that combines behavioural structure with quantum adaptability creates a critical gap, limiting the sector's ability to develop leaders suited to contemporary healthcare demands.

LITERATURE REVIEW

SECTION 1 – BEHAVIOUR LEADERSHIP THEORY (CLASSICAL FOUNDATIONS)

Behavioural leadership emerged as an alternative to trait-based models, focusing on observable actions rather than inherent qualities. The Ohio State studies identified two core dimensions that Initiating Structure and Consideration, while the Michigan studies distinguished between production-centred and employee-centred behaviours. Blake and Mouton later consolidated these ideas through the Managerial Grid, mapping leadership along concerns for task and people [1-3].

These behavioural models remain influential in healthcare because they provide clear, measurable behaviours related to communication, supervision, role clarity and staff support. Research in the Malaysian context, such as the work by Ab Hamid and Johari [4], demonstrates that behavioural leadership significantly predicts employee engagement and team motivation. However, empirical studies specifically focusing on leadership effectiveness within the Malaysian private healthcare sector remain limited, highlighting a gap in the literature that necessitates further exploration. Task-oriented behaviours contribute to operational reliability, whereas relationship-oriented behaviours strengthen trust and psychological safety outcomes essential in clinical environments.

However, behavioural approaches offer limited guidance for navigating uncertainty, interdependence or rapidly evolving conditions common in modern healthcare. They explain what leaders do, but not how they adapt, sense-make or respond to emergent challenges. As private hospitals increasingly resemble complex adaptive systems, behavioural models alone are insufficient, signalling the need for complementary perspectives such as quantum and complexity leadership that better reflect dynamic organisational realities.

SECTION 2 – QUANTUM & COMPLEXITY LEADERSHIP (MODERN PERSPECTIVES)

Complexity Leadership Theory (CLT) positions leadership as a dynamic, interactive process embedded within complex adaptive systems rather than solely the actions of individuals. Uhl-Bien, Marion and McKelvey [5] argue that in environments marked by uncertainty, interdependence and rapid change, leadership must enable adaptability, learning and emergence. This perspective is increasingly relevant in private hospitals, where multidisciplinary teams, nonlinear workflows and unpredictable clinical demands reduce the effectiveness of hierarchical or purely behaviour-based approaches.

Quantum leadership extends this logic by highlighting relational intelligence, intuition, interconnectedness and influence within dynamic conditions. It emphasises how leaders shape outcomes through awareness, sensemaking and subtle interactions rather than only through directive behaviours [6]. However, definitions of quantum leadership vary widely, creating conceptual inconsistency. Dorri, Gorji and Bayati's review [7] found that quantum leadership lacks unified

dimensions, standardised competencies and validated measurement tools, limiting empirical application despite its growing relevance in healthcare.

Empirical evidence does, however, support the value of quantum-informed approaches. Afsar et al. [8] demonstrated that leadership fostering empowerment and learning enhances innovation performance, while studies in nursing contexts show that quantum leadership can strengthen collaboration, shared decision-making and team resilience [7,9].

Despite this promise, quantum and complexity leadership remain underdeveloped in Malaysian research, and few studies attempt to integrate them with established behavioural models. This absence of synthesis underscores the need for a hybrid framework that combines behavioural clarity with adaptive, relational and emergent capacities suited to contemporary healthcare environments.

SECTION 3 – LEADERSHIP IN MALAYSIA'S PRIVATE HEALTHCARE SECTOR (CONTEXTUAL NEED)

Malaysia's private healthcare system plays an increasingly significant role in national service delivery, relieving pressure on public hospitals and supporting medical tourism. Growth in bed capacity, digitalisation and service diversification has intensified market competition and placed greater focus on leadership effectiveness [10,11]. Within this context, leaders must balance service quality, financial performance, regulatory compliance and workforce capability while navigating rapid organisational and technological change. While public hospitals also face resource constraints and organisational complexity, the private sector is uniquely distinguished by its reliance on commercial sustainability and market competition. Private hospital leaders must balance clinical outcomes with direct financial accountability to shareholders and intense competition for medical tourists and insured patients. This specific tension between 'care' and 'commerce' creates a distinct leadership challenge that differentiates the private sector from the public system, necessitating a framework that addresses both operational efficiency and adaptive market responsiveness.

Private hospitals face challenges distinct from the public sector, including high patient expectations, commercial pressures, talent shortages and accelerated digital transformation. Studies within Malaysian healthcare show that leadership practices strongly influence employee engagement, service climate and operational outcomes [4]. However, most research continues to rely on traditional models. Ramli and Ahmad [12] observed that leadership development in private hospitals remains inconsistent and still grounded mainly in classical approaches, while Salleh and Ngah [13] highlighted structural and managerial challenges that require more adaptive forms of leadership.

Despite these pressures, leadership scholarship in Malaysia remains narrow. Existing studies are predominantly behaviour-based, and very few examine adaptive or complexity-informed perspectives relevant to modern healthcare conditions. Research focusing specifically on private hospitals is limited, creating a disconnect between leadership theory and the realities of commercial, fast-paced clinical environments.

These conditions make the integration of behavioural and quantum perspectives particularly relevant. Behavioural leadership provides operational clarity, communication structure and relational consistency — all essential for clinical safety and coordination. Quantum leadership contributes adaptability, sensemaking and emergent decision-making, enabling leaders to respond effectively to uncertainty, interdependence and dynamic patient-care demands.

Yet, no existing Malaysian study proposes a hybrid behavioural–quantum model, nor does any research address how such integration could support leadership development in private hospitals. This theoretical and practical gap strengthens the justification for a Behavioural–Quantum Leadership Framework tailored to Malaysia's private healthcare sector.

THEORETICAL FOUNDATION

The proposed framework is grounded in three complementary leadership theories: behavioural leadership, quantum leadership and Complexity Leadership Theory (CLT). Together, these perspectives provide both operational structure and adaptive capacity, reflecting the realities of Malaysia's private healthcare sector.

Behavioural leadership theory offers the foundational layer by emphasising observable and trainable leader behaviours. Derived from the Ohio State, Michigan and Managerial Grid traditions, behavioural theories highlight task-oriented, relationship-oriented and change-oriented behaviours that directly influence communication, supervision and coordination [1-3]. These behaviours remain central to clinical safety and workforce management in hospital settings.

Quantum leadership contributes a second layer centred on adaptability, relational intelligence and sensemaking. Rooted in metaphors of interconnectedness and non-linearity, quantum leadership emphasises how leaders influence outcomes through awareness, emergent decision-making and subtle interactions rather than directive control [6, 9]. Although conceptually diverse, quantum perspectives offer valuable insights for environments characterised by uncertainty and rapid change.

Complexity Leadership Theory provides a third, system-level layer. CLT conceptualises leadership as a dynamic process that enables learning, emergence and adaptability within complex adaptive systems [5]. In private hospitals — where interdependent workflows, multidisciplinary teams and unpredictable clinical conditions are the norm — CLT helps explain how leadership must operate across formal, informal and relational structures.

Integrating these perspectives creates a more complete understanding of leadership suited to Malaysia's private healthcare sector. Behavioural theory provides structure and clarity; quantum leadership introduces adaptability and relational depth; and CLT explains how leadership emerges within interconnected organisational systems. This combined foundation supports the development of a Behavioural–Quantum Leadership Framework that addresses both operational demands and dynamic complexities in private hospitals.

PROPOSED BEHAVIOURAL–QUANTUM LEADERSHIP FRAMEWORK

The proposed Behavioural–Quantum Leadership Framework synthesizes the theories discussed above into a practical model for Malaysian private hospitals. It structures leadership into three operational domains: (1) Behavioural foundations, which ensure regulatory and clinical compliance; (2) Quantum adaptive capacities, which address uncertain market and patient demands; and (3) Complexity-informed processes, which facilitate cross-departmental collaboration. Unlike previous models that view these as separate styles, this framework posits them as simultaneous requirements for the private healthcare leader.

Behavioural foundations represent the structural core of leadership. They include task-oriented behaviours such as role clarification, performance monitoring and coordination, as well as relationship-oriented behaviours that support communication, trust and staff engagement. These behaviours align with established leadership scholarship and remain essential for ensuring safety, consistency and accountability in private hospitals.

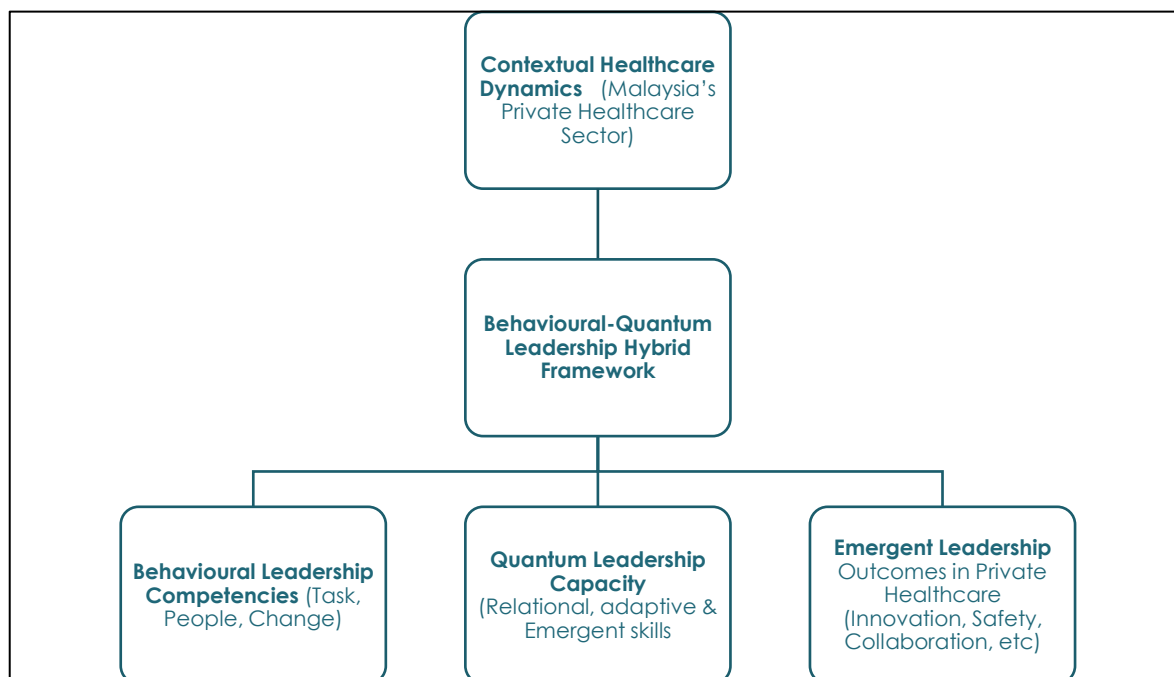
Quantum adaptive capacities form the second domain, capturing leaders' ability to navigate uncertainty, interpret emerging conditions and foster relational intelligence. This includes sensemaking, intuitive judgement, flexible decision-making and the capacity to create conditions where innovation and collaboration can emerge. These capabilities respond to the nonlinear nature of private hospital operations, where leaders frequently encounter unpredictable patient loads, shifting team dynamics and rapid technological changes.

The third domain, complexity-informed emergent processes, reflects the system-level interactions through which leadership unfolds. Drawing on Complexity Leadership Theory, this domain highlights how leadership emerges across formal and informal structures, enabling adaptability, learning and the mobilisation of distributed expertise within multidisciplinary teams.

The integration of these three domains provides a cohesive model that balances stability with adaptability. Behavioural elements anchor daily operations, quantum capacities support responsiveness under uncertainty and complexity

processes enable collective problem-solving. Together, they form a framework suited to the realities of Malaysia's private healthcare sector and provide the conceptual basis for future empirical testing.

FIGURE 1. BEHAVIOURAL-QUANTUM LEADERSHIP FRAMEWORK FOR MALAYSIA'S PRIVATE HEALTHCARE SECTOR.



DISCUSSION AND IMPLICATIONS

The integrated Behavioural–Quantum Leadership Framework advances leadership scholarship by bridging classical behavioural theory with modern complexity-oriented perspectives. Behavioural leadership remains essential for structuring communication, clarifying expectations and ensuring reliable clinical operations, yet it does not fully address the nonlinear and emergent challenges present within private hospitals. By incorporating quantum principles and complexity-based processes, the model offers a more comprehensive understanding of how leaders can navigate uncertainty, facilitate collaboration and support adaptive decision-making in dynamic healthcare environments.

Theoretical implications include expanding current Malaysian leadership research beyond traditional models and providing a foundation for future empirical validation. The framework offers a structured basis for examining how behavioural, relational and emergent leadership capacities interact, enabling new measurement tools and competency models tailored to healthcare settings.

Practical implications extend to leadership development, performance management and succession planning in private hospitals. Training programs can incorporate behavioural competencies while cultivating adaptive skills such as sensemaking, relational intelligence and real-time decision-making. Hospital administrators may also use the framework to assess leadership effectiveness and to design interventions that strengthen team coordination, staff engagement and service quality.

Policy and education implications arise as well. Healthcare training institutions and professional bodies can adopt hybrid leadership models that reflect contemporary organisational demands, while policymakers may integrate adaptive leadership competencies into leadership benchmarks for private healthcare organisations.

Overall, the framework highlights the need for leadership approaches that balance operational stability with adaptive responsiveness — a requirement increasingly critical for Malaysia's evolving private healthcare sector.

CONCLUSION

This paper proposes a Behavioural–Quantum Leadership Framework designed to address the leadership demands of Malaysia's private healthcare sector. By integrating behavioural clarity with quantum-informed adaptability and complexity-based emergence, the framework responds to organisational conditions characterised by uncertainty, interdependence and rapid change. It offers a more comprehensive approach than traditional behavioural models alone, which remain necessary but insufficient for contemporary clinical environments.

The framework provides a foundation for future empirical research, including the development of leadership competencies, measurement scales and intervention models suited to private hospitals. It also offers practical guidance for leadership development, organisational strategy and talent management. As the sector continues to evolve, hybrid leadership models such as this have the potential to strengthen resilience, innovation and service quality across Malaysia's private healthcare landscape.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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OPTIMIZING EMPLOYEE AWARENESS STRATEGIES FOR ENERGY EFFICIENCY IN HEALTHCARE: A COMPARATIVE STUDY USING PICTURE FUZZY CIMAS AND SIWEC

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ABSTRACT

BACKGROUND:

Hospitals are in the category of buildings that consume the most energy. Considering these characteristics of hospitals, energy efficiency becomes important. For this reason, healthcare professionals are seen as an important factor in ensuring energy efficiency in hospitals. The purpose of this study is to identify the priority strategies required to increase the awareness level of hospital employees on energy efficiency.

METHODS:

In line with the aim of the study, healthcare worker factors affecting efficiency in hospitals are determined based on the literature. After that, the importance weights of these criteria are calculated using the picture fuzzy criteria importance assessment (CIMAS) technique. In addition, a comparative analysis is carried out with the picture fuzzy simple weight calculation (SIWEC) approach.

RESULTS:

The main contribution of the study is to determine the optimum employee strategies to provide energy efficiency. This issue has a guiding feature for hospital managers and policymakers. It is concluded that the most important criterion for these employees is reward programs ($w=0.209$). The second most important factor is found as creating energy-saving awareness ($w=0.185$).

CONCLUSIONS:

To achieve this goal, it would be beneficial to apply motivating factors to employees. In addition, increasing the awareness level of employees makes a significant contribution.

KEYWORDS

CIMAS, SIWEC, healthcare, employee awareness, picture fuzzy

Energy efficiency means less energy consumption for the same amount of work or service [1]. With developing technology and increasing population, energy consumption is also growing. Accordingly, ensuring energy efficiency is inevitable. Hospitals are in the category of buildings with the highest energy consumption [2]. The increasing life expectancy at birth, the aging population, and increasing chronic diseases cause an increase in the level of applications to health services. Therefore, the energy consumption in hospitals is also increasing day by day. While energy efficiency is an important issue, it becomes even more crucial for hospitals when these characteristics of hospitals are taken into consideration. Also, healthcare workers are in an important position in ensuring energy efficiency in hospitals [3].

It is obvious that actions taken by healthcare professionals can affect the efficiency level in hospitals [4]. Creating energy-saving awareness among healthcare professionals can largely prevent unnecessary energy consumption. In addition, reward programs for successful healthcare professionals are a motivating factor [5]. Legal processes aimed at ensuring energy efficiency may make it mandatory for healthcare institutions to meet their energy targets [6]. The use of smart technologies such as automatic lighting and smart thermostats contributes positively to energy efficiency. In addition, the economical selection of medical devices and regular maintenance is important in terms of ensuring efficiency [7].

Energy efficiency in hospitals is important not only for sustainable healthcare services but also for economic growth [8]. Healthcare workers also play a key role in ensuring energy efficiency in hospitals. Therefore, improvements should be made in factors related to healthcare workers to ensure energy efficiency in hospitals. However, each improvement leads to an increase in costs. Making improvements to each factor can lead to cost increases that may negatively affect the performance of businesses. Therefore, making improvements to priority factors is the ideal solution. However, there are very few studies in the literature addressing this issue. In this context, a new study is needed to determine the most important variables for healthcare workers to ensure energy efficiency in hospitals.

This study aims to determine the priority strategies required to increase the awareness level of hospital employees on energy efficiency. In this process, firstly, 6 different criteria are determined as a result of a comprehensive literature analysis. After that, the importance weights of these criteria are calculated using the picture fuzzy CIMAS technique. In addition, a comparative analysis is carried out with the picture fuzzy SIWEC approach. Owing to this issue, it is possible to test the consistency of the results.

This study includes five different sections. Literature review is performed in the following step. Proposed methodology is explained in the third part. The results of this proposed model are defined in the fourth part. In the following sections, discussion and conclusion are determined.

One of the important factors affecting energy efficiency in hospitals is the creation of energy awareness among healthcare professionals [9]. Hospitals are buildings with the highest energy consumption [10]. Therefore, the awareness of hospital staff about energy consumption positively affects energy efficiency. Education and awareness activities for healthcare professionals change the energy consumption behaviors of employees. This also reveals the sustainability mission of the institution [11]. Zhang et al. (2023) examined the role of globalization and education in promoting energy efficiency. It is underlined that education has an important role in terms of energy efficiency in the development of energy policies [12]. Fang and Li (2024) carried out the relationship between corporate sustainability and highly educated employees. It is understood from the results of the study that employee education makes a great contribution to sustainability [13].

Reward programs for healthcare workers are important in terms of increasing energy efficiency [14]. To increase energy efficiency, employees need to change their behavior. The reward system is an ideal method to ensure this change and gain positive habits. In addition, the evolution of corporate culture towards increasing energy efficiency is directly related to healthcare workers [15]. Marrucci et al. (2024) conducted a study aiming to establish environmental performance

indicators. It is stated that the reward system for employees facilitates the achievement of goals [16]. Mungai et al. (2023) performed a study revealing the factors affecting the adoption of energy efficiency practices. It is argued that providing employees with training and motivating rewards will increase energy efficiency [17].

Another important issue affecting the increase in energy efficiency in hospitals is legal processes [18]. The obligation to train and raise awareness of personnel can be determined by legal limits. In addition, supervision of this process can increase efficiency practices. Determining the criteria in the performance evaluation processes of personnel according to energy efficiency can be an important step [19]. He and Wang (2024) examined the relationship between the establishment of environmental courts in China and the increase in energy efficiency. The results of the study show that the established environmental courts increase energy efficiency [20]. Yasmeeen et al. (2023) investigated energy efficiency from the perspective of the rule of law in OECD countries. It is seen that legal procedures have an important place in terms of energy efficiency [21].

As a result of the literature review, it is possible to underline some important points. Most of the studies are studying the need to achieve energy efficiency. However, the number of studies on which factors come to the forefront to ensure efficiency is quite limited. In addition, studies conducted specifically for hospitals, where energy consumption is the highest, are also limited. Besides, a significant portion of energy consumption is related to healthcare workers. Therefore, conducting a prioritization study for personnel to ensure energy efficiency can fill an important gap in the literature. A model was established with multi-criteria decision-making techniques to determine prioritization strategies.

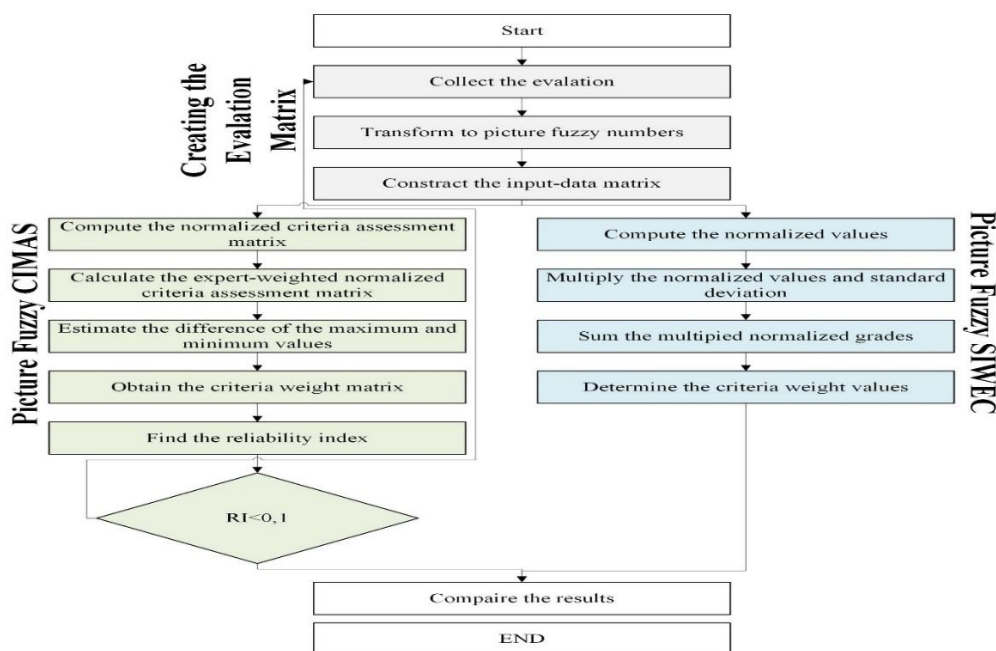
METHODOLOGY

Since strategies that can be applied to healthcare workers to ensure energy efficiency in hospitals play a critical role in achieving energy saving targets, determining the most applicable strategy constitutes the main purpose of the study. In this context, strategies need to be evaluated and prioritized. However, since numerical data is not possible for evaluations, multi-criteria decision-making techniques are used to solve this problem. The CIMAS and SIWEC methods are current methods that prioritize factors on a target using expert importance ratings [22]. The CIMAS method is preferred because the reliability of the results can be tested, and the SIWEC method is preferred because it forces experts to make more realistic evaluations [18]. In addition, the same initial matrices allow the results to be compared. In addition to these two method choices, fuzzy numbers are used to include linguistic uncertainty in the analysis. The schematic representation of the steps of the study in which the methods are integrated with picture fuzzy sets is presented in Figure 1.

ETHICAL APPROVAL

This study is based solely on professional expert assessments within the framework of multi-criteria decision-making (MCDM) methodology. The study methodology and Istanbul Medipol University's institutional guidelines and national legislation (YÖK Scientific Research and Publication Ethics Directive) exempt it from official ethics committee approval. The research does not involve any human experiments, animal experiments, clinical trials, or psychological/physical interventions. Furthermore, the study was conducted in full compliance with Law No. 6698 on the Protection of Personal Data (KVKK). No identifiable medical or personal data was collected or processed. The data used in the analysis consists solely of professional opinions provided by experts in the relevant fields for technical weighting purposes. Additionally, informed consent was obtained from all experts before their participation in the study, and expert participation was entirely anonymous and voluntary.

FIGURE 1: THE SCHEMATIC REPRESENTATION OF THE STEP



EXPERT SELECTION

The expert team consists of 5 specialists with at least 15 years of experience. They have been selected from individuals with knowledge and experience in hospital management. The experts providing opinions serve as hospital directors, hospital deputy directors, academics, and technical services directors. Their educational backgrounds are postgraduate and above.

CIMAS WITH PICTURE FUZZY SETS

The Criteria Importance Assessment (CIMAS) method is a multi-criteria decision-making technique that uses experts' evaluations of the criteria and considers the experience and knowledge level of the experts. Another advantage of this method, which emphasizes the evaluation of the best expert, is that it can provide consistent analysis of the results, as in AHP. The analysis steps performed by integrating with Picture fuzzy numbers are detailed below.

First, experts are asked to evaluate each criterion separately. The linguistic evaluations are then transformed into picture fuzzy numbers, and the input-data matrix is constructed. The input-data matrix is shown with the help of Equation (1).

$$\widetilde{ID} = \begin{matrix} & C_1 & \dots & C_n \\ \begin{matrix} E_1 \\ \vdots \\ E_k \end{matrix} & \begin{bmatrix} (P_{11}, F_{11}, S_{11}) & \dots & (P_{1n}, F_{1n}, S_{1n}) \\ \vdots & \ddots & \vdots \\ (P_{k1}, F_{k1}, S_{k1}) & \dots & (P_{kn}, F_{kn}, S_{kn}) \end{bmatrix} \end{matrix} \quad (1)$$

Where, k and n are the numbers of experts and criteria, respectively. (P_{ij}, F_{ij}, S_{ij}) is the picture fuzzy number of expert- i 's evaluation of criterion- j . Moreover, P , F and S are the positive membership, neutral membership, and negative membership of the picture fuzzy number, respectively. Afterwards, the score values of the picture fuzzy number elements of the input-data matrix are calculated with Equation (2).

$$score(P_{ij}, F_{ij}, S_{ij}) = \frac{1}{3}(P_{ij} + (1 - F_{ij}) + (1 - S_{ij})) \quad (2)$$

The matrix created by the score function in Equation (2) is normalized. The element of normalized criteria assessment matrix is computed using Equation (3)

$$n_{ij} = \frac{score(P_{ij}, F_{ij}, S_{ij})}{\sum_{e=1}^k score(P_{ej}, F_{ej}, S_{ej})} \quad (3)$$

Where, n is element of the normalized criteria assessment matrix $(\widetilde{N})$. Then, the expert-weighted normalized criteria assessment matrix is computed by Equation (4).

$$r_{ij} = n_{ij}w_i \quad (4)$$

Where w_i means the weights of expert-i, and the weight are obtained with the help of Equation (5).

$$w_i = \frac{exp_i}{\sum_{e=1}^k exp_e} \quad (5)$$

Where, exp_i represents the experience of expert-i. Afterwards, the maximum and minimum values of each criterion in the expert-weighted normalized criteria assessment matrix are identified by Equations (6) and (7).

$$x_j^{max} = \max_i r_{ij} \quad (6)$$

$$x_j^{min} = \min_i r_{ij} \quad (7)$$

Next, the differences of the maximum and minimum values are performed using Equation (8).

$$v_j = x_j^{max} - x_j^{min} \quad (8)$$

Finally, the criteria weight matrix is determined with Equation (9).

$$cw_j = \frac{v_j}{\sum_{e=1}^n v_e} \quad (9)$$

After the weights of the criteria are determined, results are tested by calculating the reliability index such as AHP. For this, a second evaluation is collected from experts. In this evaluation, the criteria are evaluated between 0-100. This evaluation expresses the percentage importance of each criterion. Using the weights obtained in the first evaluation and the percentages in the second evaluation, the reliability index is calculated with the help of Equation (10).

$$RI = \frac{\sum_{j=1}^n |100cw_j - pi_j^{2st}|}{100} \quad (10)$$

Where, pi_j^{2st} equals the percentage importance of criteria-j at the second evaluation. If the value of the reliability index is less than 0.1, the prioritization result is reliable.

SIWEC WITH PICTURE FUZZY SETS

The SIWEC method is a multi-criteria decision-making technique that uses the standard deviation of experts' evaluations as important weights. This method gives more importance to experts who show the rating of the criteria more widely and the distinction of importance of the criteria more clearly. The steps of SIWEC performed by integrating with Picture fuzzy numbers are presented below.

After the matrix in Equation (1) is created with expert evaluation, defuzzified values are obtained using Equation (2). Next, the normalized values are computed with the help of Equation (11).

$$n_{ij} = \frac{score(P_{ij}, F_{ij}, S_{ij})}{\max(score(P_{ij}, F_{ij}, S_{ij}))} \quad (11)$$

Afterwards, the standard deviations of normalized values of each expert are calculated and the normalized values are multiplied with standard deviations using Equation (12).

$$\varsigma_{ij} = n_{ij}std_i \quad (12)$$

In the next step, all multiplied normalized grades are summed by Equation (13).

$$s_j = \sum_{i=1}^k \varsigma_{ij} \quad (13)$$

Finally, the criteria weight values are determined with Equation (14).

$$cw_j = \frac{s_j}{\sum_{e=1}^n s_e} \quad (14)$$

ANALYSIS

Strategies for healthcare workers to ensure energy efficiency in hospitals are obtained through literature and field scanning. The identified strategies are shared in Appendix Table 1. The strategies in Table 1 are evaluated with linguistic expressions by 5 different experts. These experts have at least 15 years of experience. After that, linguistic expressions are transformed to picture fuzzy numbers, and the input-data matrix as Equation (1) is formed. The input-data matrix is displayed in Table 1.

TABLE 1: THE INPUT-DATA MATRIX

	ENGSAVW			EFFUSE			RWDPRG			SMRTECH			ENGEFFPL			LGLPRCS		
Expert1	.995	.000	.000	.755	.043	.050	.995	.000	.000	.825	.015	.015	.510	.135	.250	.225	.390	.263
Expert2	.755	.043	.050	.755	.043	.050	.825	.015	.015	.825	.015	.015	.650	.131	.137	.225	.390	.263
Expert3	.825	.015	.015	.650	.131	.137	.825	.015	.015	.755	.043	.050	.650	.131	.137	.150	.400	.295
Expert4	.755	.043	.050	.650	.131	.137	.650	.131	.137	.755	.043	.050	.510	.135	.250	.260	.260	.260
Expert5	.755	.043	.050	.510	.135	.250	.825	.015	.015	.650	.131	.137	.260	.260	.260	.225	.390	.263

Afterwards, with the help of Equation (2), the score values of the value in the input-data matrix are calculated. The defuzzified values are illustrated in Appendix Table 2. In the other step, the element of normalized criteria assessment matrix is computed using Equation (3). The normalized criteria assessment matrix is shown below as Appendix Table 3. Next, the expert weighted normalized criteria assessment matrix is estimated using experience of expert and Equation (4). The weights of expert's experience calculated with the help of Equation (5) are 0.238, 0.197, 0.212, 0.147 and 0.207, respectively. The expert-weighted normalized criteria evaluation matrix calculated at the end of this step is given below as Table 2.

TABLE 2: THE EXPERT-WEIGHTED NORMALIZED CRITERIA ASSESSMENT MATRIX

	ENGSAVW	EFFUSE	RWDPRG	SMRTECH	ENGEFFPL	LGLPRCS
Expert1	.052	.052	.052	.050	.047	.047
Expert2	.038	.043	.040	.041	.044	.039
Expert3	.043	.041	.043	.042	.047	.039
Expert4	.028	.029	.025	.029	.029	.032
Expert5	.040	.036	.042	.037	.033	.041

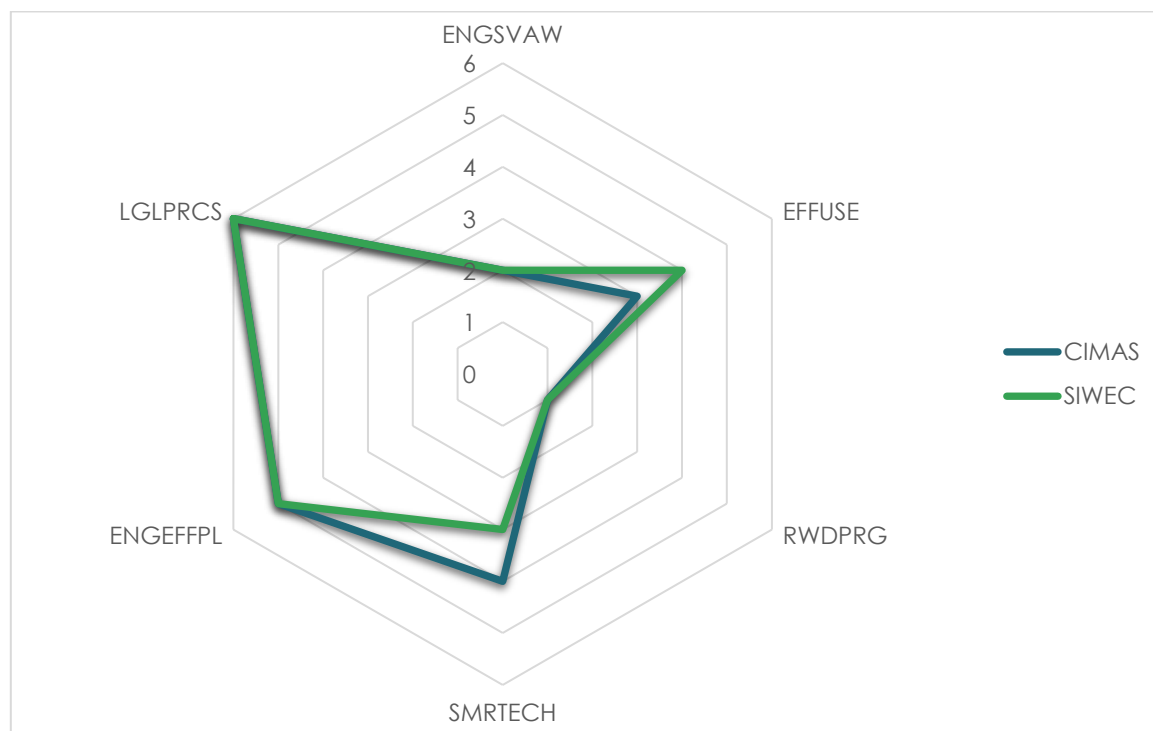
Afterwards, by Equations (6) and (7), the maximum and minimum values are obtained. Then, Equation (8) gives information about the differences between these values. These results are summarized in Table Appendix Table 4. Finally, the weight matrix of strategies is created using Equation (9). The matrix is illustrated in Table 3.

TABLE 3: THE CRITERIA WEIGHTS

	ENGSAVW	EFFUSE	RWDPRG	SMRTECH	ENGEFFPL	LGLPRCS
cw	.185	.184	.209	.163	.142	.118

The reliability index of the analyses is calculated. For this, the percentage importance is obtained from the same five experts again and Equation (10) is calculated. The calculated RI value is 0.08, which is less than 0.1. Therefore, the results are reliable. In addition, the SIWEC method is used for the validity of the results. Using Equations (11)-(14), the weights of the criteria are obtained with the SIWEC method. The comparative results are visualized in Figure 2.

FIGURE 2: THE COMPARATIVE RESULTS



Correlation analysis is performed between the priorities of the criteria obtained by the two methods. The correlation coefficient is calculated as 0.943. This shows that the results are valid. According to the results of the two methods, creating energy saving awareness and reward programs are the most important strategies for healthcare workers to ensure energy efficiency in hospitals.

DISCUSSION

The analysis results show that the most optimal strategy to be implemented for healthcare workers is the reward program. The reward system ensures that the behavioral changes in employees are in the desired direction. In addition, an effective reward system positively affects the motivation of employees. Moreover, the reward system is important to create a sustainable energy efficiency culture in the hospital. Marrucci et al. (2024) conducted a study on the establishment of environmental performance indicators to ensure corporate sustainability and reward employees. It is stated that a good reward system is needed to ensure the expected behavioral change [16]. Mungai et al. (2023) examined the factors affecting energy efficiency practices for 852 companies in 14 sectors in Kenya. It is argued that the reward system based on environmental performance is effective in energy saving [17]. The fact that the reward system is considered most important in the healthcare sector can be explained by the sector's high workload and emotionally demanding nature. There is a need to strengthen the institutional recognition mechanism so that healthcare workers do not perceive the task of saving energy while providing public services as an "additional burden."

The second most important factor affecting energy efficiency is the creation of energy-saving awareness. The high level of awareness of employees on this issue is important for the success of corporate energy management. Since employees are an important part of energy consumption, it makes it easier to achieve sustainability goals. Employees who are conscious of energy efficiency contribute to energy efficiency not only in the hospital but also in the entire environment they are in contact with. Gökalp et al. (2022) conducted a study on reducing energy costs in hospitals. The results of the study show that the most important factor affecting costs is the awareness level of employees [23]. Kotsopoulos et al. (2023) examined the determinants of energy consumption and savings of employees in the workplace. It is seen that the awareness level has an important place in consumption and savings [24]. Due to the nature of the services provided in hospitals, medical priorities may take precedence over technical efficiency. Therefore, raising awareness has become an important requirement for achieving energy efficiency.

CONCLUSION

This study aims to develop strategies for healthcare workers to ensure energy efficiency for hospitals, which are among the buildings with the highest energy consumption. However, there are multiple factors affecting this issue. Moreover, improving all the factors would cause extra costs. Therefore, there is a need to weigh the criteria for achieving energy efficiency. For this purpose, CIMAS and SIWEC methods were used in the analysis phase. While CIMAS can test the reliability of the results, SIWEC is a method that guides experts to make more realistic assessments. In addition, fuzzy numbers were used to minimize uncertainty. It is concluded that the most optimal strategy to be implemented for the staff while achieving energy efficiency in hospitals is a reward program. Furthermore, to achieve this goal, employees need to be made aware.

A reward system is important to achieve energy efficiency. Some strategies can be considered to serve this goal. Motivating employees on energy efficiency helps to achieve the target. While providing this motivation, salary payment or extra leave rights can be applied. Determining the employee of the month is also an effective practice to ensure efficiency. Furthermore, the unit that achieves the greatest energy savings should be awarded the title of "Environmental Unit of the Year." Covering the participation fees of employees who meet savings targets for international conferences is an important motivational tool. In addition, training to raise the awareness of employees would be useful. The main contribution of this study is the combination of CIMAS, which tests the reliability of the results, and SIWEC, which provides more realistic expert assessments, resulting in more accurate results. Also, it provides a comparable structure, which is an important feature. Furthermore, it is an important contribution that this study is conducted on employees to ensure energy efficiency. The main limitation of this study is that it was conducted in hospitals. Future studies can be applied to other sectors such as automotive and textile.

AVAILABILITY OF DATA AND MATERIALS:

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

COMPETING INTERESTS:

The authors declare that they have no competing interests

AUTHORS' CONTRIBUTIONS:

YA wrote the abstract and the background section; SE wrote the methods and result section; SA and SH wrote the conclusion.

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APPENDICES

APPENDIX TABLE 1: THE IDENTIFIED STRATEGIES

Definitions	Codes
Creating energy saving awareness	ENGSAW
Effective use of medical devices	EFFUSE
Reward programs	RWDPRG
Use of smart technologies	SMRTECH
Energy efficiency policy of the institution	ENGEFFPL
Legal processes	LGLPRCS

APPENDIX TABLE 2: THE DEFUZZIFIED VALUES

	ENGSAW	EFFUSE	RWDPRG	SMRTECH	ENGEFFPL	LGLPRCS
Expert1	.998	.887	.998	.932	.708	.524
Expert2	.887	.887	.932	.932	.794	.524
Expert3	.932	.794	.932	.887	.794	.485
Expert4	.887	.794	.794	.887	.708	.580
Expert5	.887	.708	.932	.794	.580	.524

APPENDIX TABLE 3: THE NORMALIZED CRITERIA ASSESSMENT MATRIX

	ENGSAW	EFFUSE	RWDPRG	SMRTECH	ENGEFFPL	LGLPRCS
Expert1	.217	.218	.218	.210	.198	.199
Expert2	.193	.218	.203	.210	.221	.199
Expert3	.203	.195	.203	.200	.221	.184
Expert4	.193	.195	.173	.200	.198	.220
Expert5	.193	.174	.203	.179	.162	.199

APPENDIX TABLE 4: THE MAXIMUM, MINIMUM AND DIFFERENCE VALUES

	ENGSAW	EFFUSE	RWDPRG	SMRTECH	ENGEFFPL	LGLPRCS
Max	0,052	0,052	0,052	0,050	0,047	0,047
Min	0,028	0,029	0,025	0,029	0,029	0,032
Dif.	0,023	0,023	0,026	0,020	0,018	0,015

THE MEDIATING ROLE OF SAFETY CLIMATE PERCEPTION IN THE RELATIONSHIP BETWEEN QUALITY OF WORK LIFE LEVEL AND JOB SATISFACTION IN PUBLIC HEALTH SECTOR EMPLOYEES

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ABSTRACT

The importance of health sector workers in delivering effective and high-quality services within the healthcare sector is significant. Besides various job burdens, the challenging working conditions also negatively impact the job performance of health sector workers. The direct impact of these negatives on crucial factors such as job satisfaction and quality of life increases the importance of these factors.

This study aims to determine the effect of perceived safety climate on the levels of job satisfaction and quality of life, and the relationships among these parameters, by examining 500 health sector workers employed at a public hospital in Bakırköy, İstanbul, Türkiye. By identifying the socio-demographic variables of the sample, the study investigates the effect of perceived safety climate on these variables and their relationship with job satisfaction and quality of life at work.

The results showed a positive and very strong correlation between the total scores of the safety climate scale and job satisfaction scale ($r=0.766$, $p=0.001$) and between the total scores of the safety climate scale and quality of life scale ($r=0.769$, $p=0.000$). According to these results, an increase in participants' perceptions of safety climate directly affects their levels of job satisfaction and quality of life, with a directly proportional relationship between them. Mediation analysis using the Sobel test (Sobel Test Statistic=9.962; Std. Error=0.435; $p=0.001$) revealed that the safety climate plays a mediating role in the relationship between job satisfaction and quality of life.

In conclusion, it was determined that the safety climate affects health sector workers' levels of job satisfaction and quality of life in the healthcare sector and plays a mediating role in the relationship between these two scales.

KEYWORDS

Safety climate perception, job satisfaction, quality of work life, health sector workers.

INTRODUCTION

The efficient delivery of healthcare services is closely related to the role of healthcare professionals. However, heavy workload and stressful working conditions negatively affect job satisfaction and quality of life, leading to loss of motivation [1, 2]. In this profession where health sector workers face high risks and have no tolerance for making mistakes, stress and

anxiety cause decreases in job satisfaction and quality of life [3]. Safety climate plays a critical role in preventing these negativities and its effects on job satisfaction and quality of life in the healthcare sector are becoming increasingly [4, 5]. The main purpose of this study is to examine the effects of health care workers' perception of safety climate on job satisfaction and quality of work life. In addition, the mediating role of safety climate perception on this relationship was evaluated in a sample of health sector workers working in a public hospital in Bakırköy, İstanbul, Türkiye. In this context, the study aims to fill the gaps in the literature on the dynamics between these concepts in the health sector and to provide practical suggestions specific to the sector.

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

1. SECURITY CLIMATE

Safety climate was defined by Zohar (1980) as the perception of organizational safety by employees, and Brown and Holmes (1986) defined it as the totality of perceptions and beliefs that individuals have about certain entities [6]. Safety climate is related to the perceptions developed against the risks in the work environment and increases continuity and productivity in the workplace with high business awareness and risk measures [7]. The literature emphasizes that safety climate is shaped by employees' beliefs and values about safety [8].

Health sector workers are defined as professionals who protect and improve the health of society [9]. The health services provided by these workers are directly related to both working and living conditions. Occupational risks encountered during the provision of health services vary depending on the nature of the work performed [10]. It has been reported that the risk factors to which health sector workers are exposed are categorized into five main groups: biological, physical, ergonomic, chemical and psychosocial [11]. In the report published by the American National Institute for Occupational Health and Safety (NIOSH), it was stated that there are 29 different physical, 25 chemical, 24 biological, 6 ergonomic and 10 psychosocial risk factors in hospitals [12]. It was also emphasized in the report that these risk factors differ in each health institution and that these factors vary depending on the units where health workers work [13].

In studies on occupational health and safety, it has been determined that health sector workers are the main group affected by occupational accidents and occupational diseases [14]. In studies on occupational health and safety of health sector workers in Turkey, it is seen that knowledge, awareness, perception and safety culture levels are at the forefront [15]. However, the limited number of studies on occupational health and safety of health sector workers increases the lack of information in this field. In particular, it is of great importance to close this gap in terms of evaluating the measures to be taken against occupational risks of health sector workers and taking the necessary measures. The effectiveness of OHS activities and employees' perceptions of these activities play a major role in preventing occupational accidents and occupational diseases. It has been reported that the knowledge and competence levels of health sector workers are important in terms of crisis management and that the perception of OHS competence is effective in identifying deficiencies during and after a crisis [10, 16].

2. QUALITY OF WORK LIFE

When the definitions of quality of work life are examined, it is seen that this concept develops under certain standards and the motivation level of employees plays an important role in the formation of these standards. In an organization with low motivated employees, the quality and efficiency of work decreases, indicating that the quality of work life is also low [17]. Therefore, it should be kept in mind that organizations aiming to improve the quality of work life should first ensure the morale and motivation of their employees [18]. Determining an organization's priorities for quality of work life constitutes the first step towards achieving the goals; these priorities include determining the quality of work and improving the quality of work life and motivation of employees [1].

Increasing quality of work life is possible by integrating elements such as motivation and personal experiences into work life [19]. The level of employees' quality of work life is related to the employment provided by the organization and the potential to meet personal needs; therefore, quality of work life is recognized as an important production element in the

health sector [20]. In the health sector, quality of work life is directly related to the physical and psychological conditions of employees and the quality and efficiency of health services [7]. Health sector workers are the key elements in this sector and their level of quality of work life affects the efficiency of the services they provide [21]. The importance of quality of work life in the health sector is higher than in other sectors because employees in this sector have to work selflessly and carefully to meet the health needs of people [22]. Considering that the factors that negatively affect the quality of work life of health sector workers may have irreparable consequences, it is of great importance to integrate these factors [23].

3. JOB SATISFACTION

The service provided within the scope of the health sector is a concept that includes the evaluation of parameters such as quality, effectiveness and efficiency together [24]. Data on the parameters of the service provided are more critical in the healthcare sector due to the inability to compensate for errors [25]. While errors in other sectors can be corrected with checkpoints, negative situations are of greater importance in healthcare services as these errors can directly affect people's lives [26]. Job satisfaction in healthcare organizations develops due to the fact that mistakes cannot be compensated. Mistakes negatively affect job satisfaction levels [27].

In recent years, it has been determined that changes in health policies have decreased job satisfaction in employees and negative changes in health policies have effects such as deterioration of working conditions, decrease in salaries, and increase in work intensity [28] [29] (In hospitals providing healthcare services, it has been stated that the number of employees varies depending on the characteristics of the organization and the satisfaction of patients depends on the compliance of hospital employees [30]. It has been found that low compliance can negatively affect the quality of patient care [31].

The relationship between job satisfaction and service quality has also been accepted as an important indicator in studies [32, 33]. Factors affecting job satisfaction levels include factors such as workload, relationships, job descriptions, and promotion opportunities [34]. The negative application of these factors reduces the quality of healthcare services and job satisfaction levels [35]. It is important for institutions to carry out monitoring and preventive activities to correct these negativities [36]. In order to increase the job satisfaction levels of health sector workers, it is emphasized that the working environment should be improved and the psychological health of employees should be prioritized [37]. Increasing research on the concept of job satisfaction has an impact on employees both physically and mentally [38]. Negative situations and stress factors can negatively affect organizations by causing job dissatisfaction [39], which can lead to a decrease in the productivity of organizations [40].

4. PERCEPTION OF SAFETY CLIMATE IN THE RELATIONSHIP BETWEEN JOB SATISFACTION AND QUALITY OF WORK LIFE

Preventing occupational accidents and occupational diseases is one of the most important goals of organizations today [41]. To achieve these goals, it is essential to comply with legal regulations and use Occupational Health and Safety Management Systems (OHSMS) [42]. The purpose of OHSMS is to identify hazards that may threaten the health and safety of employees, measure risk levels and strengthen control mechanisms by taking them under control [43]. A safe working environment positively affects work performance and contributes to the development of businesses [44]. Occupational health and safety are associated with job satisfaction and quality of work life levels; in this context, positive perceptions of safety climate help prevent accidents [45, 46]. Safety climate plays a critical role in determining the authority and responsibilities of organizational members and has an impact on job satisfaction and quality of work life [47]. An increase in employees' perception of safety climate positively affects job satisfaction and quality of life by increasing the quality of service provided by the organization [48].

The factors that make up the safety climate are shaped by organizations' safety management systems and employees' individual attitudes [49]. Safety climate has a direct relationship with job performance and quality of work life, and high job performance is associated with the importance given to safety climate [50, 51]. Moreover, supporting safety climate with a positive organizational climate increases job satisfaction and quality of work life [52]. As a result, positive perceptions of safety climate affect employees' job performance by increasing both job satisfaction and quality of work life and

positively affect the overall productivity of organizations [53]. These findings suggest that strengthening safety climate perceptions makes significant contributions to occupational health and safety and employee satisfaction.

MATERIALS AND METHODS

The increasing demand for health services necessitates the development of alternative approaches to improve employee performance. In this context, the importance of the human factor in the prevention of occupational accidents is emphasized, and understanding the effects of health care workers' behaviors in the organization on job satisfaction and quality of life emerges as a basic need. The aim of this study is to contribute to the scientific literature in these areas by examining the effect of safety perception on job satisfaction and quality of life and to prepare the ground for strategies to strengthen the safety climate in health organizations. The strong infrastructure provided by public hospitals and the inclusion of health managers' evaluations in this study provide a holistic perspective of the results obtained. In addition, the research findings are expected to serve as a model for future larger-scale studies.

This study was approved by the Istanbul Aydin University Social and Human Sciences Ethics Committee (Approval No: 2023/11, Date: 13 November 2023). The questionnaire used in this study was reviewed and deemed ethically appropriate by the committee. The study was conducted in accordance with accepted ethical standards.

The main hypothesis is that perceptions of safety climate have a statistically significant effect on these two parameters. In addition, how demographic characteristics such as gender, age, marital status and education affect the relationship between perceptions of safety climate and job satisfaction and quality of life were evaluated within the scope of sub-hypotheses.

HYPOTHESES

H1 The increase in the safety climate perceptions of public health employees has a statistically significant and positive effect on their job satisfaction levels.

H2 An increase in the perceptions of safety climate of health care employees in the public sector has a statistically significant and positive effect on their quality of work life levels.

H3 Safety climate perceptions play a mediating role in the relationship between job satisfaction and quality of work life in public health employees.

H4 There is a significant relationship between safety climate and job satisfaction and demographic characteristics of public health employees.

H4a There is a statistically significant relationship between safety climate and job satisfaction and gender.

H4b There is a statistically significant relationship between safety climate and job satisfaction and marital status.

H4c There is a statistically significant relationship between safety climate and job satisfaction and age.

H4d There is a statistically significant relationship between safety climate and job satisfaction and educational level.

H4e There is a statistically significant relationship between safety climate and job satisfaction and the unit of employment.

H5 There is a significant relationship between safety climate and quality of work life and demographic characteristics of public health employees.

H5a There is a statistically significant relationship between safety climate and quality of work life and gender.

H5b There is a statistically significant relationship between marital status and safety climate and quality of work life.

H5c There is a statistically significant relationship between safety climate and quality of work life and age.

H5d There is a statistically significant relationship between safety climate and quality of work life and educational level.

H5e There is a statistically significant relationship between safety climate and quality of work life and the unit of employment.

These hypotheses are formulated based on the assumption that safety climate is not only a technical component of occupational safety but also a key organizational factor influencing employees' psychosocial well-being and organizational outcomes. Testing these hypotheses allows for examining whether safety climate functions as a central mechanism linking organizational context to job satisfaction and quality of work life in healthcare settings.

The Mediating Role of Safety Climate Perception in The Relationship Between Quality of Work Life Level and Job Satisfaction in Public Health Sector Employees

The population of the study consists of physicians, nurses and other healthcare professionals working in a public hospital in Bakırköy, İstanbul. The sample size of the study is 500 people. The data were collected electronically through Google Forms and a link to the questionnaire was sent to the hospital employees and they were asked to respond, and the collected data were analyzed with IBM's SPSS Statistics (v27.0) statistical package program.

The questionnaire consisted of two parts. The first part included questions on the demographic and general characteristics of the participants (age, gender, educational status, professional seniority, etc.). The second part comprised three validated instruments: the quality of work life scale originally developed by Van Laar, Edwards and Easton (2007) and adapted into Turkish by Akar and Üstüner (2017); the quality of work life scale developed by Choudhry, Fang and Lingard (2009) and adapted into Turkish by Türen et al. (2014) [7], for which reliability and validity analyses were reported; and the job satisfaction scale developed by Brayfield and Rothe (1951), abbreviated by Judge, Locke, Durham and Kluger (1998), and adapted into Turkish by Başol and Çömlekçi (2020) [15]. The original development and Turkish adaptation details of these instruments are reported in references [7] and [15].

TABLE 1: NORMALITY ANALYSIS RESULTS FOR THE SCALES

<u>Scales</u>	Number of Expressions	Min	Max	Normality Test		p
				Skewness	Kurtosis	
Security Climate	14	14	70	-0,295	-0,476	0,075
Job satisfaction	5	5	25	-0,893	0,158	0,097
Quality of Work Life	23	30	115	0,073	-0,326	0,081

Prior to the main analyses, the distributional properties of the study variables were examined. As shown in Table 1, skewness and kurtosis values for all scales were within acceptable limits, and the One-Sample Kolmogorov-Smirnov test indicated no significant deviation from normality ($p > 0.05$ for all scales). Accordingly, the data were considered to be normally distributed and suitable for subsequent parametric analyses.

TABLE 2: RELIABILITY ANALYSIS RESULTS FOR THE SCALES

Scales	Cronbach's Alpha Values
Security Climate	
Management Perspective and Rules	0,941
Colleague and Safety Trainings	0,737
Job Satisfaction Scale	0,884
Quality of Work-Life Scale	
Job career satisfaction	0,870
General Well-Being	0,856
Controlling the Work	0,847
Working Conditions	0,849
Stress in Business Life	0,827
Family-Work Life Balance	0,812

As shown in Table 2, the reliability analyses indicated that all scales and subdimensions met the recommended criteria for internal consistency. KMO and Bartlett's tests for the safety climate, job satisfaction and quality of work life scales showed that the data groups were suitable for exploratory factor analysis (KMO values were 0.962; 0.820; 0.951, respectively). The factor loadings of all scales were found to be above acceptable limits and confirmed that they were compatible with their original structures. The reliability of the scales was ensured as Cronbach's Alpha values were greater than 0.70 for all three scales and all item-total correlations were above 0.20. The research was conducted in a way to ensure reliable

results, and the difference between the branches was analyzed with the Tukey-HSD Post-HOC test. Statistical significance level was accepted as $p < 0.05$.

FINDINGS

In this section of the study, the results of the analyzes related to the hypotheses in the study are presented.

1. PERCENTAGE DISTRIBUTION OF PARTICIPANTS' SOCIO-DEMOGRAPHIC CHARACTERISTICS

TABLE 3: FINDINGS ON DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS

Socio-Demographic Characteristics of Participants		Frekans	Percentage (%)
Gender	Female	309	61,8
	Male	191	38,2
Age	25 years and below	14	2,8
	26-30 years old	148	29,6
	31-35 years old	228	45,6
	36-40 years and above	110	22,0
Marital Status	Married	215	43,0
	Single	245	49,0
	Widowed/Divorced	40	8,0
Education Status	High School	30	6,0
	Associate Degree	131	26,2
	Bachelor's degree	202	40,4
	Master's Degree and Above	137	27,4
Profession	Doctor (Specialist-Assistant)	81	16,2
	Nurse-Midwife	88	17,5
	İdari Personnel	86	17,1
	Security-Counseling	51	10,1
	Patient Care	27	5,4
	Secretaries	30	6,0
	Cleaning-Other Technical Staff	137	27,2
Working Unit	Emergency	77	15,4
	Intensive Care	65	13,0
	Operating Room	49	9,8
	Inpatient Service	40	8,0
	Outpatient Service	99	19,8
	Administrative Unit	99	19,8
	Security Advisor	47	9,4
	Other	24	4,8

Table 3 shows the socio-demographic information of the health workers who participated in the study. It was seen that 61.8% of the participants were female, 38.2% were male, 2.8% were 25 years old or younger, 29.6% were between 26-30 years old, 45.6% were between 31-35 years old and 22.0% were between 36-40 years old. Of the participants, 43.0% were married, 49.0% were single and 8.0% were widowed/divorced. When the educational status of the participants was examined, it was found that 6.0% were high school graduates, 26.2% associate's degree, 40.4% bachelor's degree, and 27.4% master's degree or higher. According to the choice of occupation, 16.2% of the participants were physicians, 17.5% were allied health personnel, 17.1% were administrative personnel, 10.1% were security-counseling, 5.4% were patient care personnel, 27.2% were cleaning-other technical personnel and 6% were secretaries. When the participants were analyzed according to the units they worked in, 15.4% were emergency, 13.0% intensive care, 9.8% operating room, 8% inpatient ward, 19.8% outpatient clinic, 19.8% administrative unit, 9.4% security consultant and 4.8% other.

2. CORRELATION ANALYSIS RESULTS

TABLE 4: THE RELATIONSHIP BETWEEN PARTICIPANTS' PERCEPTIONS OF SAFETY CLIMATE AND JOB SATISFACTION AND QUALITY OF WORK LIFE

	Safety Climate Scale (Total Score)	
	r	p
Job Satisfaction Scale (Total Score)	0,766	0,001*
Quality of Work Life Scale (Total Score)	0,769	0,000*

Pearson Correlation Analysis, r: correlation coefficient, * p<0.001.

As shown in Table 4, Pearson correlation analysis revealed a very strong and positive relationship between participants' perceptions of safety climate and their job satisfaction and quality of work life. It has been observed that there is a very strong and positive relationship between the total score values obtained by the participants in the Safety Climate Scale and the total score values obtained in the Job Satisfaction and Quality of Work Life Scales. In this context, Hypothesis 1 and Hypothesis 2, which were established as the main hypothesis of the study, were accepted.

3. REGRESSION ANALYSIS RESULTS

As shown in Table 5, the regression analyses indicate that job satisfaction is a significant predictor of both safety climate and quality of work life. Based on these results, safety climate was tested as a potential mediator in the relationship between job satisfaction and quality of work life using a hierarchical regression approach.

TABLE 5: RESULTS OF THE REGRESSION ANALYSIS BETWEEN VARIABLES

Independent Variable	Dependent Variable	Unstd . β	Std. Error	R	R ²	Adj. R ²	t	F	p
Job Satisfaction	Security Climate	2,178	0,082	0,766	0,587	0,586	26,58	706,99	0,000*
Job Satisfaction	Quality of Work Life	0,187	0,006	0,798	0,637	0,636	29,56	873,78	0,000*

Pearson Correlation Analysis, r: correlation coefficient, * p<0.001.

As shown in Table 6, the stepwise regression results indicate that safety climate partially mediates the relationship between job satisfaction and quality of work life.

TABLE 6: MEDIATION ANALYSIS RESULTS WITH STEPWISE REGRESSION TEST

Model	Variables	β_i	Stand.	S.E.	t value	p	Multiple Linear	
			Coefficients				Correlation Statistics*	
			β_i				Tolerance	VIF
	β_0 (Fixed)							
[1]								
Job satisfaction→ safety climate	Job satisfaction- Security climate	2,178	0,766	0,082	26,58	0,000*	1,000	1,000
	β_0 (Fixed)							
[2]								
Job satisfaction→ work life quality	Job satisfaction- Quality of work life	0,187	0,798	0,006	29,56	0,000*	1,000	1,000
	β_0 (Fixed)							
Including Intermediary Variable Issued Model Job satisfaction → quality of work life	Job satisfaction- Quality of work life	1,190	0,124	0,419	9,579	0,001*	0,363	2,755
	β_0 (Fixed)							
Safety climate	Safety climate - Quality of work life	0,289	0,029	0,435	9,962	0,001*	0,363	2,755

(*): Since VIF<10 or Tolerance>0.2, there is no multicollinearity problem in the model.

The findings indicate that a safety climate plays a mediating role in the relationship between job satisfaction and quality of work life and this mediation is partial. In this context, Hypothesis 3 is accepted.

4. COMPARISON OF PARTICIPANTS' PERCEPTION OF SAFETY CLIMATE, JOB SATISFACTION AND TOTAL SCORES OF QUALITY OF WORK LIFE ACCORDING TO DEMOGRAPHIC CHARACTERISTICS

TABLE 7: COMPARISON OF TOTAL SCALE SCORES BY GENDER (N=500)

Scales	Gender	Min.	Max.	Mean±SD	t	p
Security Climate	Female	21	65	48,15±9,10	-2,468	0,228
	Male	22	65	49,26±11,31		
Job Satisfaction	Female	7	22	14,47±3,38	-1,207	0,116
	Male	6	23	15,26±3,69		
Quality of Work Life	Female	35	100	70,19±13,87	-1,389	0,166
	Male	35	101	72,12±16,79		

As shown in Table 7, there were no statistically significant differences between male and female participants in terms of safety climate, job satisfaction, or quality of work life. As a result of the evaluation of safety climate according to gender, it was found that there was no statistically significant difference in attitudes towards safety climate, job satisfaction and quality of work life scales. Therefore, Hypothesis 4a and Hypothesis 5a are rejected.

TABLE 8: COMPARISON OF TOTAL SCALE SCORES ACCORDING TO MARITAL STATUS (N=500)

Scales	Marital Status	Min.	Max.	Mean±SD	F	p	Post-Hoc
Security Climate	Married	24	65	51,16±9,07	25,810	0,458	
	Single	21	65	45,49±9,84			
	Widowed/Divorced	35	65	53,30±9,83			
Job Satisfaction	Married	7	23	15,63±3,21	44,605	0,014*	3-2
	Single	6	22	13,51±3,35			
	Widowed/Divorced	11	22	17,90±2,68			
Quality of Work Life	Married	35	100	73,75±14,14	21,800	0,025*	2-1
	Single	35	101	66,92±14,46			3-1
	Widowed/Divorced	47	100	80,28±16,24			3-2

As shown in Table 8, marital status was not associated with differences in safety climate perceptions, but significant differences were observed for job satisfaction and quality of work life. When all the results are evaluated; since it is determined that there is no significant difference between the levels of safety climate and marital status, but there is a significant difference between job satisfaction and quality of work life, the part of Hypothesis 4b and Hypothesis 5b that includes attitudes towards the safety climate scale is rejected, while the parts related to job satisfaction and quality of work life are accepted. In this context, Hypothesis 4b and Hypothesis 5b are partially accepted.

TABLE 9: COMPARISON OF TOTAL SCALE SCORES BY GENDER (N=500)

Scales	Age	Min.	Max.	Mean±SD	F	p	Post-Hoc
Security Climate	25 years and below	30	51	41,21±5,71	30,849	0,007*	3-2 4-1
	26-30 years old	21	63	43,77±8,60			
	31-35 years old	22	67	49,42±10,05			
	36-40 years and above	32	66	54,23±8,52			
Job Satisfaction	25 years and below	8	14	11,29±1,77	40,134	0,001*	4-1 4-2
	26-30 years old	7	23	12,97±3,37			
	31-35 years old	6	21	15,08±3,22			
	36-40 years and above	7	22	16,98±2,88			
Quality of Work Life	25 years and below	49	71	59,21±6,37	28,040	0,004*	4-1 4-2

26-30 years old	35	99	63,91±14,68
31-35 years old	35	101	72,43±13,88
36-40 years and above	47	100	78,74±13,84

As shown in Table 9, age was significantly associated with differences in safety climate perceptions, job satisfaction, and quality of work life. After the analysis, it was determined that there was a statistically significant difference between the attitudes formed in the safety climate scale, job satisfaction and quality of work life scales depending on age and the age parameter. According to these results, Hypothesis 4c and Hypothesis 5c are accepted.

TABLE 10: COMPARISON OF THE TOTAL SCORES OF THE SCALES ACCORDING TO EDUCATION LEVEL (N=500)

Scales	Education Status	Min.	Max.	Mean±SD	F	p	Post-Hoc
Security Climate	High School	21	49	38,90±6,87	78,601	0,000*	
	Associate Degree	22	65	43,02±8,93			3-1
	Bachelor's degree	22	65	48,00±9,50			4-1
	Master's Degree and Above	35	65	56,77±5,21			4-2
Job Satisfaction	High School	7	19	11,87±2,56	64,976	0,039*	
	Associate Degree	6	21	12,92±2,94			3-1
	Bachelor's degree	6	22	14,53±3,36			4-1
	Master's Degree and Above	7	23	17,52±2,50			4-2
Quality of Work Life	High School	41	66	55,63±7,21	79,121	0,020*	
	Associate Degree	36	98	61,69±12,65			3-1
	Bachelor's degree	35	100	71,31±14,40			3-2
	Master's Degree and Above	51	101	82,53±9,62			3-4

As shown in Table 10, education level was significantly associated with differences in safety climate, job satisfaction, and quality of work life. According to the data obtained, a statistically significant difference was found between the safety climate, job satisfaction, quality of work life scales and educational status, and Hypothesis 4d and Hypothesis 5d were accepted.

TABLE 11: COMPARISON OF THE TOTAL SCORES OF THE SCALES ACCORDING TO THE UNIT OF EMPLOYMENT (N=500)

Scales	Working Unit	Min.	Max.	Mean±SD	F	p	Post-Hoc
Security Climate	Emergency	22	64	46,65±9,93	28,072	0,049*	
	Intensive Care	22	60	45,17±8,49			
	Operating Room	29	58	44,69±7,31			5-2
	Inpatient Service	31	60	47,10±8,43			5-3
	Outpatient Service	23	65	53,63±8,56			6-1
	Administrative Unit	24	65	55,57±8,80			6-2
	Security Advisor	21	49	40,19±7,17			6-7
	Other	29	54	40,58±6,78			6-8
	Emergency	7	23	13,84±3,20			
	Intensive Care	6	20	13,74±2,73			
	Operating Room	7	22	14,02±3,38			5-8
Job Satisfaction	Inpatient Service	8	20	13,68±3,11	16,310	0,001*	6-1
	Outpatient Service	6	21	15,94±3,24			6-2
	Administrative Unit	7	22	17,14±3,35			6-3
	Security Advisor	8	18	12,55±2,65			6-4
	Other	8	22	13,63±4,07			6-7
	Emergency	35	98	67,78±14,93			
	Intensive Care	38	100	66,63±11,31			
	Operating Room	48	99	68,37±11,80			5-3
	Inpatient Service	48	91	69,95±12,59			5-4
	Outpatient Service	42	101	75,66±12,97			6-1
	Administrative Unit	35	100	82,59±14,22			6-2
Quality of Work Life	Security Advisor	36	76	56,00±8,34	26,212	0,022*	6-7
	Other	41	96	61,13±14,68			6-8
	Emergency	35	98	67,78±14,93			
	Intensive Care	38	100	66,63±11,31			
	Operating Room	48	99	68,37±11,80			5-3
	Inpatient Service	48	91	69,95±12,59			5-4
	Outpatient Service	42	101	75,66±12,97			6-1
	Administrative Unit	35	100	82,59±14,22			6-2
	Security Advisor	36	76	56,00±8,34			6-7
	Other	41	96	61,13±14,68			6-8
	Emergency	35	98	67,78±14,93			

As shown in Table 11, the unit of employment was significantly associated with differences in safety climate, job satisfaction, and quality of work life. When all the results of the analyses were evaluated, a statistically significant difference was found between the unit of work and the scales of safety climate, job satisfaction and quality of work life, and Hypothesis 4e and Hypothesis 5e were accepted. Accordingly, according to the results of the analysis of the data obtained from the study, Hypothesis 4 and Hypothesis 5 were partially accepted due to the significant difference both within and between groups ($p<0.05$).

DISCUSSION

Safety climate is a multidisciplinary concept that plays a critical role in reducing error rates and ensuring occupational health and safety [54]. Especially in healthcare organizations, the high work performance expected from employees and policies to increase occupational safety increase the importance of this concept [24]. In the literature, it is emphasized that safety climate positively affects job satisfaction and quality of work life in high-risk areas such as the healthcare sector [49]. In this study, which was conducted to determine the effect of safety climate perceptions on the relationship between job satisfaction and quality of work life levels of employees in a public hospital serving in Bakırköy, Istanbul; physicians, nurses and all other hospital employees were included and it was aimed to discuss the results in a general framework. The findings of the study are given and discussed below.

The study's hypotheses were developed based on the theoretical assumption that safety climate represents a contextual organizational resource that shapes employees' occupational well-being and work-related outcomes in healthcare settings. In line with this framework, H1 and H2 were tested using Pearson correlation analyses between safety climate and the two main outcome variables. The findings demonstrated very strong, positive, and statistically significant associations between safety climate and job satisfaction as well as between safety climate and quality of work life, supporting the proposition that stronger safety climate perceptions are aligned with improved employee-related outcomes. To evaluate the proposed mechanism underlying these relationships, H3 was tested using the hierarchical regression steps suggested by Baron and Kenny (1986) and the Sobel test. The mediation results indicated that safety climate functions as a partial mediator in the relationship between job satisfaction and quality of work life, suggesting that safety climate explains a meaningful portion of the pathway linking these constructs while the direct relationship remains significant. This pattern is consistent with organizational climate theories that conceptualize climate as a facilitating mechanism rather than a sole determinant of employee well-being. Finally, H4 (H4a–H4e) and H5 (H5a–H5e) were evaluated through group comparisons across socio-demographic characteristics (e.g., gender, marital status, age, education, and working unit). The results showed that demographic and unit-based differences were not uniform across all variables, indicating that perceptions of safety climate and associated outcomes may vary by subgroup and organizational context. Overall, the hypothesis-driven analytical structure provides coherent empirical support for the study's theoretical model by demonstrating: (i) strong direct relationships (H1–H2), (ii) a theoretically meaningful mediating mechanism (H3), and (iii) context-sensitive variability across employee groups (H4–H5).

It was determined that there was no significant difference between the safety climate, job satisfaction and quality of work life scales used in the study and gender. In this context, it is possible to say that the gender of the participants does not affect their attitudes towards safety climate, job satisfaction and quality of work life. In a study conducted to determine the perception of safety climate, it was observed that men and women received a similar score. Depending on their similar scores, it was determined that gender did not create a significant difference in perceptions of safety climate [55]. In another study examining the work-life relationship, it was found that women and men had the same average score range, and in this context, it was determined that quality of work life levels did not differ according to gender [56]. In another study in which work life and job satisfaction scales were applied together, it was reported that a similar attitude was formed in men and women working in the same environment, so no significant difference was observed between the scores [57]. The results of these studies are similar to the findings obtained in this study.

In this study, it was determined that the attitudes in safety climate, job satisfaction and quality of work life scales differed depending on the age variable. According to the results of the analysis, the difference in the perception of safety climate occurred between the group aged 25 and below and the group aged 36-40 and above. Similarly, job satisfaction and quality of work life differ between these groups. In addition, job satisfaction differed significantly between 26-30 and 31-35 age groups, and quality of work life differed significantly between 26-30 and 36-40 age groups. Ruotsalainen et al. (2020) [58] revealed that the adaptation provided by the personnel in the working environment varies with the age factor. Although the working environment and job description remained constant, it was observed that age increased the adaptation process and created a significant change in attitudes. The findings of the study support that age affects

attitudes towards safety climate, job satisfaction and quality of work life scales. In the literature, it is argued that the age factor does not affect the levels of safety climate and quality of work life [59]. However, some studies suggest that the age factor may be effective in job satisfaction levels and may create a difference on at least one scale.

It was determined that there was no significant difference between marital status and perceptions of security climate evaluated within the scope of the study. It is possible to say that the marital status of the participants does not affect their attitudes towards the security climate. It is seen that there are similar studies in the literature. For example, in a study conducted by Fathallah Mostafa et al. [60], it was determined that the answers given regarding the security climate scale were similar in married and single participants and therefore did not create a significant difference. This result obtained in the study is similar to the finding of the study. It was observed that there was a significant difference between attitudes towards job satisfaction scale and marital status. In a study conducted by Latimer et al. [61], it was found that single people experience more stress in business life than married people, and therefore their job satisfaction scores decreased significantly. In the study, the score of singles on the job satisfaction scale was lower than the other participants. This result obtained in the study is consistent with the findings of the studies in the literature. When the results related to quality of work life were evaluated, it was found that there was a significant difference between the marital status of the participants and their attitudes towards quality of work life. In the study conducted by Abdelrehim et al. [62], it was found that the quality of work life scale scores of married employees were higher than single employees.

It was determined that there was a significant difference between the attitudes towards safety climate, job satisfaction and quality of work life measured in the study and educational status. In this context, it is possible to say that the educational level of the participants affects the attitudes towards safety climate, job satisfaction and quality of work life scale. In a study conducted by Shen et al. [63], it was found that there was a significant difference between safety climate and educational status. In another study conducted by Golzad et al. [64], it was found that educational status has a direct effect on job satisfaction and quality of work life. All these results are similar to the findings of this study.

Within the scope of the research, it was determined that there was a significant difference between the unit of employment and safety climate, job satisfaction and quality of work life. There are different results on this issue in the literature. Shdaifat et al. [65] stated that while there was no significant difference in perceptions of safety climate, job satisfaction levels varied. The fact that security risks differ between units supports that attitudes towards security climate may vary [66]. These differences become more evident especially in units with high risk levels. Rashmi and Kataria [24] reported that job satisfaction and quality of work life perceptions of administrative unit employees were higher than inpatient ward and operating room employees, and this finding was in line with the study.

According to the results of Pearson correlation analysis, very strong, positive and significant relationships were found between safety climate and job satisfaction and quality of work life. Positive improvements in safety perceptions contribute to an increase in job satisfaction and quality of work life. Zabin et al. [67] reported similar positive relationships between safety climate and job satisfaction, and Mitterer and Mitterer [68] reported similar positive relationships between safety perception and quality of work life. These findings suggest that safety perception significantly affects attitudes towards job satisfaction and quality of work life.

The study tested whether safety climate plays a mediating role in the relationship between job satisfaction and quality of work life. As a result of the stepwise regression analysis, it was found that safety climate is a partial mediator, but it does not play a full mediating role since it is a direct relationship. While Smith et al. [69] stated that there is a significant relationship between job satisfaction and quality of work life without a mediating variable, Jin et al. [70] argued that quality of work life plays a mediating role in the effect of safety climate on job satisfaction. Qaralleh et al. [71] reported that safety climate fully mediates the relationship between job satisfaction and quality of work life. The results of these studies overlap with the findings of this study and show that safety climate is an effective mediating factor in the relationship between job satisfaction and quality of work life.

This study empirically tests the direct effects of safety climate perception on job satisfaction and quality of work life, as well as its mediating role in the relationship between these two constructs, thereby supporting and extending existing organizational climate and occupational well-being theories. The findings indicate that safety climate is a multidimensional construct that influences not only safety outcomes but also broader psychosocial and work-related outcomes. In this respect, the study provides empirical support for the applicability of these theoretical frameworks within the healthcare context and contributes to their contextual generalizability.

IMPLICATIONS FOR PRACTICE AND POLICY

The findings of this study indicate that safety climate plays a crucial role not only in occupational safety but also in shaping healthcare workers' job satisfaction and quality of work life. This suggests that healthcare managers should consider safety climate as a core component of organizational performance. Management practices that promote employee participation, open communication, and a non-punitive learning culture may strengthen safety perceptions within healthcare institutions.

From a policy perspective, occupational health and safety regulations should be viewed not merely as compliance requirements but as strategic tools to enhance workforce well-being and service quality. Institutional incentives, training programs, and leadership development initiatives aimed at improving safety climate may contribute to the sustainability and effectiveness of healthcare systems.

FUTURE RESEARCH DIRECTIONS

Future studies are encouraged to employ longitudinal designs to better assess the causal structure of the relationships identified in this study. Comparative research conducted in different regions and across various types of healthcare institutions (such as private, university, and training hospitals) would enhance the generalizability of the findings. Qualitative approaches could also be used to explore healthcare workers' perceptions of safety climate in greater depth. Finally, incorporating additional variables such as leadership style, perceived organizational support, and workload may provide a more comprehensive understanding of the mechanisms linking safety climate, job satisfaction, and quality of work life.

LIMITATIONS

The findings of this study should be interpreted in light of several methodological limitations. First, the cross-sectional design of the study does not allow for causal inferences regarding the relationships among safety climate perception, job satisfaction, and quality of work life. Second, although the sample size is adequate, the data were collected from a single public hospital, which may limit the generalizability of the results to other organizational or cultural contexts. Third, all data were obtained through self-reported questionnaires, which may introduce response biases such as social desirability and common method variance. Finally, although validated measurement instruments were used, unmeasured organizational and individual factors may also influence the observed relationships.

CONCLUSION

This study was planned to reveal whether the safety climate perception of public health employees plays a mediating role in the relationship between job satisfaction and quality of work life. Examining whether safety climate has any effect on the relationship between job satisfaction and quality of work life is very important for determining the deficiencies related to safety in working individuals [72]. In addition to the deficiencies evaluated within the scope of safety climate perception, the fact that possible dangers can be prevented makes the results of the study even more important. Preventing negative situations within the organization is an effective factor in establishing a safer working environment for the personnel [73]. The adequacy of the measures taken by the organization is an important parameter that positively affects the safety climate perception of employees [71]. In the study, this parameter was evaluated in health sector workers and it was found to be effective in the relationship between job satisfaction and quality of work life levels. In this context, it is possible to say that the importance of the measures and practices taken by the organization for areas deemed risky in the working environment has increased.

Employees' perceptions of safety climate, job satisfaction and quality of work life differ according to age and education level. Employees between the ages of 36-40 are more cooperative in fulfilling the task and following the rules, which positively affected the perception of safety and job satisfaction levels. Repeating training courses with up-to-date information will help to increase the perception of safety and improve job satisfaction and quality of life. It is important that occupational health and safety training continue continuously, especially since these factors are low in the group aged 25 and below. Employees with master's degree and higher education level show higher safety perception, job satisfaction and quality of life than others. Employees working in administrative units have higher perceptions of safety climate and their job stress is lower than in other units. This can be explained by the working conditions and wages of administrative units. Working conditions and management policies of the personnel working in other units should be reviewed. It will be important for the institution to reorganize its management policies in favor of health workers in terms of safety climate and job satisfaction. Safety climate requires taking measures specific to the working environment and personnel to improve job performance. These measures increase productivity by increasing harmony among employees. Organizations that want to increase job performance should maximize the safety climate in their work environment. Paying attention to this element is important for job performance.

By establishing a positive relationship between safety climate, job satisfaction and quality of work life, it shows that employees' perception of safety directly affects job performance. A high perception of safety improves employees' judgment and work discipline by increasing the safety of the work environment. This makes employees feel safer and increases their commitment to the organization. In this study, the effect of security measures within organizations on job performance was examined. Increasing these measures had a direct positive impact on employees' job performance and played an important role in ensuring discipline. Organizations that want to provide services with high work efficiency will increase service performance by integrating security measures into the working environment. Especially in hospitals where different disciplines work together, ensuring harmony will positively affect work performance.

By examining the impact of safety climate perception on job satisfaction and quality of work life, this study shows that it is applicable for future research in different organizations. The relationship between safety climate and job satisfaction and quality of work life is strong and positive, and at the same time, safety climate plays a partial mediating role in perceptions of job satisfaction and quality of work life. The study revealed that a safe work environment increases job satisfaction and quality of work life. The results of the study are in line with national and international research. In addition, the lack of studies on the role of safety climate in the relationship between job satisfaction and quality of work life increases the value of this study.

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THE RELATIONSHIP BETWEEN SOCIOECONOMIC STATUS AND TRUST IN HEALTH WORKERS WITH EARLY PLANNING REFERRAL DECISIONS IN PASURUAN, INDONESIA

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ABSTRACT

Indonesia's Maternal Mortality Rate (MMR) remains elevated compared to other ASEAN nations. Various factors contribute to these issues, including high-risk pregnancies and delay in referral to healthcare facilities. One approach to reducing MMR is planned early referral, ensuring that high-risk pregnant women receive timely and appropriate care. However, the implementation of early referral still faces challenges, particularly related to socioeconomic status and trust in healthcare services, which influence referral decision.

The aim of this study is to examine the relationship between socioeconomic status and trust in healthcare services with planned referral decisions among pregnant women in Pasuruan Regency, Indonesia. A cross-sectional analytical observational study design was used, involving 116 pregnant women selected proportionally from a total population of 580. Data were collected by means of questionnaires and analyzed using Chi-Square and ordinal logistic regression test ($p < 0.05$).

The result indicates a significant relationship between socioeconomic status ($p = 0.043$) and trust in healthcare services ($p = 0.001$). The analysis shows that socioeconomic status and trust in healthcare services account for 35.6% of planned early referral decisions, with trust in healthcare services having a stronger influence ($OR = 6.04$) than socioeconomic status ($OR = 3.36$). These findings suggest that planned early referral decisions are significantly affected by socioeconomic status and trust in healthcare services, who play a crucial role in improving access to optimal maternal healthcare services.

KEYWORDS

Maternal Mortality Rate, Planned Early Referral, Socioeconomic Status, Trust in Healthcare Services

INTRODUCTION

Health is a fundamental aspect of human life, so equal access to health services is paramount. One of the important services is maternal and child health, which plays a role in maintaining the safety of mothers and babies. However, Indonesia noted that the Maternal Mortality Rate (MMR) is still higher than other countries in other countries in ASEAN [1]. According to a 2020 WHO report, about 287,000 mothers died worldwide, with 95% of deaths occurring in low-income countries. In Indonesia, MMR reached 4,005 cases in 2022 and increased to 4,129 cases in 2023 [2]. In East Java, MMR decreased from 499 cases in 2022 to 443 cases in 2023. Meanwhile, in Pasuruan Regency, the MMR decreased from 18 cases in 2022 to 14 cases in 2023 but still did not reach the set target [3].

The main factors that cause MMR include hypertension in pregnancy, bleeding, heart disease, and delays in referral services³. The referral system plays an important role in handling emergencies in pregnant women, where early referral is planned to be a strategic step to ensure that pregnant women at high risk receive timely care [4].

However, the quality of health services in Pasuruan Regency still needs to be improved. Nunu et al. (2023) stated that the main obstacles in the implementation of early referral include medical treatment including delays in family decisions, delays in access to health facilities, and slow receipt of help [5]. In addition, socioeconomic factors and belief in health also influence family decisions in early referrals for high-risk pregnant women [6]. Therefore, education for pregnant women and family's needs to be improved so that the understanding of the importance of early planning referral is better. Based on this, this study aims to examine the relationship between socioeconomic status and trust in health workers and planning early referral decisions for pregnant women in Pasuruan Regency, Indonesia.

METHOD

The research was carried out quantitatively and the research design was observational analysis with an approach cross sectional to analyze the relationship between socioeconomic status and trust in health workers with planning early referral decisions.

This research has gone through a review process and received approval from the Ethics Commission, No. 469/EC/KEPK-S1-KB/12/2024.

POPULATION AND SAMPLE

The study population included 580 pregnant women who underwent pregnancy check-ups at health centers of type D hospitals, type B hospitals, and Mother and Child Clinics during the study period, which was one month. The sample used was 116 pregnant women who were selected using proportionate stratified random sampling or 20% of the population. The inclusion criteria in sampling are pregnant women who undergo pregnancy examinations at health facilities in the Pasuruan Regency area and are willing as respondents, while the exclusion criteria are pregnant women who refuse to participate in the study.

The study sample size was determined using G*Power 3.1.9.7 software for ordinal logistic regression analysis. Parameters used included a significance level of $\alpha = 0.05$, statistical power $(1 - \beta) = 0.80$, two predictor variables, and an effect size estimated from previous studies (OR 3.0–6.0) [7][6]. The proportion of the outcome in the population was estimated at 85%.

The calculation indicated a minimum requirement of 92 respondents. Considering the potential for missing data of $\pm 20\%$, the sample size was increased to 116 respondents. Post-hoc power analysis validation based on actual data showed statistical power of 0.82 for the socioeconomic status variable and 0.95 for the trust in health workers variable, confirming the adequacy of the sample size to detect the observed effect (power ≥ 0.80).

OPERATIONAL DEFINITIONS AND VARIABLE MEASUREMENT

Planned early referral decisions were measured using a structured questionnaire containing 28 items that assessed knowledge regarding referral indications, readiness to accept referral, and referral planning. Each item was scored on a Likert scale, and the total score was categorized into three ordinal levels (inappropriate, somewhat appropriate, and appropriate) based on the score distribution. Ordinal logistic regression modeling was chosen because the outcome variable has a hierarchical order and meets the proportional odds assumption, as confirmed by the Brant test. The instrument demonstrated good validity and reliability (KMO 0.78; Bartlett $p < 0.001$; Cronbach's alpha 0.87).

The independent variables consisted of socioeconomic status and trust in healthcare providers. Socioeconomic status was derived from a composite score of education, occupation, and family income, then categorized as low, medium, and high. Trust in healthcare providers was measured using an adaptation of the Health Care Provider Trust Scale, which

encompasses aspects of competence, communication, and caring, and is categorized as poor, adequate, and good. This scale has excellent internal consistency (Cronbach's alpha 0.89).

DATA ANALYSIS

Data were analyzed with the Chi-Square test to determine the relationship between socioeconomic status and trust in health workers with planned early referral decisions. In addition, ordinal logistic regression analysis was conducted to determine the influence of the two variables with planned early referral decisions. All data analysis was carried out using SPSS software version 27 with a significance value of < 0.05 .

RESULT

RESPONDENT CHARACTERISTICS

Based on the data in Table 1, it is known that most of the characteristics of the respondents in this study are women of reproductive age between 20-35 years old, have a secondary level of education, do not work, and have a total average family income of between Rp2,317,000-Rp4,635,000. Most of the respondents are pregnant women who have never given birth, in other words are currently undergoing their first pregnancy and most of them are entering the first trimester third.

TABLE 1: DISTRIBUTION OF RESPONDENTS' CHARACTERISTICS

Characteristics	Category	Frequency (n)	Percentage (%)
Age	< 20 years	2	1.7
	20–35 years	107	92.2
	> 35 years	7	6.0
Education	Low	18	15.5
	Moderate	59	50.9
	High	39	33.6
Employment status	Unemployed	72	62.1
	Employed	44	37.9
Household income	< Rp 2,317,000	30	25.9
	Rp 2,317,000–4,635,000	50	43.1
	> Rp 4,635,000	36	31.0
Parity	Nulliparous	64	55.2
	Multiparous	52	44.8
Gestational age	First trimester	30	25.9
	Second trimester	33	28.4
	Third trimester	53	45.7
Total		116	100

IDENTIFY SOCIOECONOMIC STATUS

Based on Table 2, it shows that of the 116 respondents, the majority are classified as middle socioeconomic status, namely 49 respondents (42.2%). Meanwhile, as many as 36 respondents (31%) are included in the high level of socioeconomic status. Respondents with low socioeconomic status were the least, namely 31 respondents (26.7%). It can be noted that most of the respondents come from middle to upper economic backgrounds.

TABLE 2: SOCIOECONOMIC STATUS OF RESPONDENTS

Socioeconomic Status	Frequency (n)	Percentage (%)
Low	31	26.7
Middle	49	42.2
High	36	31.0
Total	116	100.0

IDENTIFY TRUST IN HEALTH WORKERS

Based on Table 3, it was found that of the 116 respondents, the majority of respondents, namely 96 respondents or (82.2%) showed a good level of trust in the services provided by health workers. Meanwhile, as many as 13 respondents (11.2%) had a sufficient level of trust, and another 7 respondents (6%) showed a lack of trust in the services provided by health workers. This indicates that most of the respondents who conduct pregnancy examinations at health facilities have good trust in health workers who have provided services.

TABLE 3. FREQUENCY DISTRIBUTION OF TRUST IN HEALTH WORKERS

Trust in Health Workers	Frequency (n)	Present (%)
Less	7	6.0
Enough	13	11.2
Good	96	82.2
Total	116	100.0

IDENTIFY PLANNED EARLY REFERRAL DECISIONS

Based on Table 4, it is known that out of 116 respondents, 102 respondents (87.9%) made the right decision in conducting early planning referrals. Meanwhile, 12 respondents (10.3%) had a fairly appropriate decision in planning early referral decisions, and the other 2 respondents (1.7%) made inappropriate decisions on planning early referral. This shows that the majority of respondents have made an appropriate decision in planning early referral planning.

TABLE 4. EARLY PLANNED REFERRAL DECISION

Early Planned Referral Decision	Frequency (n)	Percentage (%)
Inaccurate	2	1.7
Moderately accurate	12	10.3
Accurate	102	87.9
Total	116	100.0

THE RELATIONSHIP BETWEEN SOCIOECONOMIC STATUS AND EARLY PLANNED REFERRAL DECISIONS

Based on tests Chi-Square at Table 5, a meaningful positive relationship was obtained between socioeconomic status and planning early referral decisions ($p = 0.043$). With the significance used ($p < 0.05$), it shows that there is a relationship between socioeconomic status and early planning referral decisions.

THE RELATIONSHIP OF TRUST IN HEALTH WORKERS WITH EARLY PLANNED REFERRAL DECISIONS

Based on the statistical results test in Table 6, a significant relationship was obtained due to the value ($p = <0.001$). With significance ($p < 0.05$), it was found that trust in health workers had a significant relationship with planning early referral decisions in pregnant women.

TABLE 5. THE RELATIONSHIP BETWEEN SOCIOECONOMIC STATUS AND EARLY PLANNED REFERRAL DECISIONS

Socioeconomic Status	Planned Early Referral Decision			Total	p-value
	Inaccurate	Quite Precise	True		
Low	2	6	23	31	0.043
Intermediate	0	4	45	49	
Tall	0	2	34	36	
Total	2	12	102	116	

TABLE 6. THE RELATIONSHIP OF TRUST IN HEALTH WORKERS WITH EARLY PLANNED REFERRAL DECISIONS

Trust in Health Workers	Planned Early Referral Decision			Total	p-value
	Inaccurate	Quite Precise	True		
Less	0	6	1	7	<0.001
Enough	1	1	11	13	
Good	1	5	90	96	
Total	2	12	102	116	

Pseudo R-Square

Based on the calculation of the coefficient of determination in Table 7, the R-Square value approach is analyzed using various methods. Among the methods used, the Nagelkerke method produced the highest value of 0.356. This shows that the variables of socioeconomic status and trust in health workers in the study were able to influence the variable of planned early referral decisions by 35.6%, while the remaining 64.4% were influenced by other variables that were not analyzed in the study.

TABLE 7. PSEUDO R-SQUARE

Pseudo R-Square	
Cox and Snell	0.202
Nagelkerke	.356
McFadden	.270

REGRESSION EQUATION TEST

Based on the analysis in Table 8, the socioeconomic status variable shows a significance value ($p = 0.019$) and an Odds Ratio value ($OR = 3.36$). Because the significance value is smaller ($p < 0.05$), it can be concluded that socioeconomic status has an effect on the decision of early referral planning. Pregnant women with high socioeconomic status are 3.36 times more likely to make early referral decisions to plan appropriately compared to those with lower socioeconomic status. Meanwhile, the trust variable in health workers has a significance value ($p = <0.001$) and an Odds Ratio value ($OR = 6.04$). The significance value of this variable was also smaller ($p < 0.05$), which suggests that trust in health workers affects planning early referral decisions. The higher the level of trust of pregnant women in health workers received, the greater the chance of the right early planning referral decision, which is 6.04 times higher than pregnant women who have a low level of trust.

TABLE 8. REGRESSION EQUATION TEST

Variable	p-value	Odds Ratio	Information
Socioeconomic Status	0.019	3.36	Influential
Trust in Health Workers	<0.001	6.04	Influential

DISCUSSION

The determinant factors that affect referral decisions are health trust, economic status, access to facilities, medical expenses, and the need for health services [7]. This study shows that socioeconomic status affects the decision of early planning referral in pregnant women in the Pasuruan Regency area. Pregnant women who have high socioeconomic status have better access to health information and adequate financial ability to bear referral costs, so they are more likely to make the right decisions [8]. On the other hand, mothers with low socioeconomic status can experience cost constraints that have an impact on referral delays.

The findings in this study are in line with the results of a study previously conducted by Hadisusanto et al. (2018), which found that the better a person's economic status, the more likely they are to make an early referral. Although the relationship between economic status and referral decisions is positive, the effect is not significant [7]. Another study by Rusadi et al. (2019) also showed that socioeconomic status plays a role in pregnant women's referral decisions, mainly due to better access to health services in families with higher economic conditions [9]. Taken together, these studies suggest that while economic status contributes to referral readiness, its influence may vary across settings depending on financial protection mechanisms and service access.

In addition to socioeconomic status, trust in health workers is also a determining factor in referral decisions. In this study, it was found that there was a relationship between trust in health workers and the decision of early referral planning in pregnant women in the Pasuruan Regency area. This is in line with previous research that shows that the higher a person's level of trust in health services, the greater their confidence in referral decisions in emergency conditions [7]. Another study by Manuk et al. (2021) also supports these findings, with results showing that the majority of respondents with high confidence levels do not experience barriers to early referral decision [6].

The present findings further indicate that trust exerts a stronger influence on referral decisions than socioeconomic status. Theoretically, this is consistent with the Health Belief Model, where trust strengthens perceptions of susceptibility, benefits, and readiness to take preventive action, whereas economic status primarily influences perceived barriers [10, 11]. Trust also functions as social capital that facilitates information flow, reduces psychological resistance, and enhances adherence to medical recommendations [12, 13]. Dimensions of trust—technical competence, communication quality, and caring attitudes—have consistently been linked to patient decision in healthcare settings [14, 15]. From a cognitive psychology perspective, affect heuristics and authority bias further explain why recommendations from trusted health workers are more readily accepted than economic considerations [16]. In Indonesia's socio-cultural context, where interpersonal relationships and community authority figures play a central role in health decisions, trust becomes even more influential, especially in the JKN era where financial barriers have been substantially reduced.

Overall, the dominant influence of trust suggests that improving the quality of interactions between health workers and pregnant women, including communication, empathy, and technical competence, has the potential to have a greater impact on referral behavior than financial interventions alone. These findings underscore the importance of strategies to improve service quality and clinical relationships as part of efforts to strengthen the maternal referral system.

Trust in health workers is closely related to the Health Belief Model theory, which reveals that a person who has a high belief in the importance of healthy behaviors, including the use of health services, will be more likely to take preventive measures. Pregnant women's trust in health workers is influenced by various factors, such as communication, professionalism, and concern of health workers [7]. Quality services will increase pregnant women's confidence and encourage informed decision in early referral to reduce the risk of complications.

The results of this study reinforce earlier findings that affirm that socioeconomic status and trust in health workers are the main factors in planning early referral decisions in pregnant women. With optimal access to health, pregnant women with good economic conditions will be better prepared to face emergency situations and can make referral decisions more

quickly and appropriately [17]. In addition, trust in health workers is an essential factor in shaping pregnant women's decisions. Pregnant women who have good confidence in the competence of health workers and the quality of services provided, will tend to take advantage of available health facilities. This level of trust can be influenced by various factors such as previous positive experiences, good interaction with healthcare workers, and a good understanding of the benefits of planned early referral [18].

When socioeconomic factors and trust in health workers were reviewed at the same time, the results of this study revealed that the two factors are interrelated and are important factors in the referral decisions of pregnant women. By having a good socioeconomic status, it will be more appropriate for pregnant women with the risk of emergencies in deciding on early referral action planning. These two combinations of factors can help reduce the risk of pregnancy complications and reduce the Maternal Mortality Rate (MMR). Therefore, improving socioeconomic status and strengthening trust in health workers must be part of the strategy to improve the referral system for pregnant women to improve the quality of maternal health services.

The Nagelkerke R^2 value of 0.356 indicates that the model only explains about one-third of the variance in early planned referral decisions, leaving the majority of the variance attributable to other, unmeasured factors. This confirms that maternal referral decisions are complex and influenced by broader behavioral, social, and health system determinants. This underscores the need to investigate additional predictors to gain a more complete understanding of referral behaviour.

Several variables that theoretically have the potential to improve the model's predictive power should be considered in future research. Maternal health literacy, including the ability to understand and apply medical information, has been shown to influence maternal decisions and adherence to care [19, 20]. Similarly, broader perceptions of service quality, including accessibility, continuity of care, previous referral experience, and the condition of the referral facility are important determinants of maternal service utilization in various contexts [13]. Social factors, such as spousal and family support and household decision dynamics, have also been found to significantly influence referral decisions, particularly in collectivist societies [21]. Additional variables such as parity, facility distance, understanding of the National Health Insurance (JKN), psychological factors, and the quality of health worker communication likely contribute to the variance in referral behavior.

To enhance the robustness of the model in future research, mixed methods approach, longitudinal designs, and multilevel analyses are recommended. These approaches allow for a more comprehensive exploration of individual, family, community, and service system factors, thus strengthening predictions of maternal referral decisions and designing more effective interventions.

The findings of this study are consistent with those from other regions in Indonesia and Southeast Asia, where trust in health workers is a key determinant of maternal referral behavior. The proportion of correct referral decisions in Pasuruan Regency was higher than in several studies in other provinces, likely influenced by better health worker capacity and local competency-building programs. These results also align with findings in East Nusa Tenggara, where trust has been shown to facilitate referral decisions despite more challenging geographic access. Regionally, studies in Bangladesh indicate that structural and cost barriers remain dominant in contexts without health insurance [22], while in Nepal, women's autonomy is a key factor in referral behavior [23]. Findings from Vietnam and Cambodia confirm that perceived service quality and trust in providers are consistent determinants of maternal service utilization [24]. This pattern aligns with the post-JKN context in Indonesia, where financial barriers have decreased and relational factors—namely, trust, communication, and the quality of the patient experience—have become key determinants. Differences in system capacity and social context may influence the magnitude of the effect, but do not alter the general pattern that trust is a universal factor that needs to be strengthened in various interventions. These regional comparisons highlight that although context-specific factors influence the magnitude of effects, trust remains a universal determinant across diverse maternal health systems.

RESEARCH LIMITATIONS

This study has several limitations that should be considered. First, the cross-sectional design only allows for the identification of relationships between variables without establishing causality. Therefore, the possibility of reverse causality, unmeasured confounding factors, and unclear temporal sequence cannot be ruled out. Second, the use of a self-report questionnaire has the potential to introduce recall bias and social desirability bias. Third, the generalizability of the findings is limited to the context of Pasuruan Regency and may not be representative of other regions with different characteristics. Furthermore, the short data collection period may miss seasonal variations in referral patterns. Longitudinal or experimental research is needed to strengthen causal evidence in the future.

CONCLUSION

The results of this study indicate a significant association between socioeconomic status and trust in health workers and the decision to initiate early planned referrals for pregnant women in Pasuruan Regency. Both factors are important in pregnant women's referral decisions, with trust in health workers showing a stronger influence (OR = 6.04) than socioeconomic status (OR = 3.36).

These findings indicate that, in the context of the Indonesian health system with the National Health Insurance (JKN) program, socio-psychological factors (trust) play a more determinant role than economic factors in influencing maternal health behaviors. However, it should be emphasized that this study only establishes an association, not a causal relationship, due to the limitations of its cross-sectional design. Furthermore, the research model only explains 35.6% of the variance in referral decisions, indicating the presence of other important factors (such as health literacy, perceived service quality, and social support) that need to be explored in further research.

By increasing trust in health workers through structured, evidence-based interventions, while still socioeconomic status into account, it is hoped that the risk of complications during pregnancy can be reduced and maternal and infant mortality rates can be reduced in Pasuruan Regency and other regions in Indonesia.

RECOMMENDATIONS

The finding that trust in health workers is the strongest predictor of early planned referral decisions underscores the need for strategies focused on improving the quality of clinical relationships and patient-health worker interactions. Recommended priority efforts include: (1) improving the communication and counseling competencies of midwives and health workers through structured training and regular feedback mechanisms; (2) strengthening trust-based accountability systems, including routine surveys and rapid response mechanisms for complaints; (3) expanding community-based health education by involving trusted health workers and family participation; and (4) increasing transparency and coordination of the referral system through the integration of information and clear service standards. These interventions need to be supported by cross-sector collaboration, particularly in the provision of transportation, social support, and the utilization of the National Health Insurance (JKN) scheme to reduce non-medical barriers. Ongoing monitoring and evaluation are crucial to ensure program effectiveness and enable data-driven adjustments. This focus on strengthening trust is expected to result in significant improvements in planned referral decisions and contribute to reducing maternal risk in Pasuruan Regency and similar areas.

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COLLABORATIVE GOVERNANCE OF THE PENTAHHELIX MODEL IN TUBERCULOSIS CONTROL PROGRAMS IN PALOPO CITY, INDONESIA

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ABSTRACT

Tuberculosis (TB) remains a significant public health issue in Indonesia, especially in Palopo City, South Sulawesi, where TB incidence has risen sharply in recent years. Effectively tackling TB necessitates integrated, cross-sectoral governance that fosters sustained collaboration among various stakeholders. This study explores the implementation of collaborative governance in the TB control program through a pentahelix framework.

A qualitative case study design with a phenomenological approach was employed. Data were gathered via in-depth interviews with pentahelix stakeholders, including representatives from government, academia, industry, community organizations, and the media. Data analysis was conducted using content analysis based on Miles and Huberman's interactive model.

The findings reveal that cross-sectoral collaboration has improved coordination, heightened public awareness, and enhanced the effectiveness of the TB control program. However, the collaborative process remains predominantly government-driven, with non-governmental actors' involvement being more formalistic than substantively institutionalized. In Palopo City, pentahelix collaboration is mainly focused on procedural coordination, while essential aspects of systemic transformation—such as shared authority, joint decision-making structures, and institutional sustainability—are still underdeveloped.

Collaborative governance in Palopo City's TB control program has made measurable progress in strengthening cross-sectoral coordination. Nonetheless, moving towards participatory, adaptive, and sustainable TB governance requires further institutional consolidation and enhanced collaborative capacity across all stakeholder groups.

KEYWORDS

collaborative governance; pentahelix; tuberculosis; stakeholder collaboration; public health governance.

INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis*, primarily affecting the lungs. Globally, an estimated 10.6 million people develop TB each year. According to the Global Tuberculosis Report, Indonesia ranks among the countries with the highest TB burden, accounting for approximately 10% of all reported global cases. In recent years, national TB case detection in Indonesia has increased significantly. Within the country, South Sulawesi is one of the provinces with a high TB burden, with Palopo City identified as a significant contributor to reported cases [1-5].

This upward trend suggests that existing TB control efforts have not yet achieved optimal outcomes [6,7]. Current interventions outlined in the regional strategic plan include community- and school-based early detection initiatives, patient support programs, TB education classes, systematic contact tracing, and the referral of sputum specimens to designated diagnostic facilities to ensure accurate and timely case identification [5,8-10]. Moreover, the Indonesian government, particularly in Palopo regency, has adopted a pentahelix collaboration model in implementing its TB control program. The pentahelix framework emphasizes collaboration among five key actors: government, academia, industry, community or non-governmental organizations, and the media [11]. This approach underscores the importance of dynamic, cross-sectoral partnerships in fostering innovation, improving program effectiveness, and addressing complex public health problems [11]. However, several challenges must be addressed to ensure the effectiveness of this collaborative approach. One of the primary challenges is ineffective coordination among key stakeholders. Inadequate communication and limited intersectoral collaboration often result in TB control programs not being implemented as intended [12]. To date, no empirical study has evaluated the effectiveness of this collaborative governance approach in the local context. Therefore, to the best of our knowledge, this study is the first to investigate the implementation of pentahelix collaboration in TB prevention in Palopo City and to assess the extent to which this collaboration has been effective. Accordingly, this study aims to examine the implementation of collaborative governance in the TB control program through a pentahelix framework.

METHODS

STUDY DESIGN

This research employed a qualitative approach to investigate the implementation of collaborative governance involving pentahelix actors in tuberculosis control in Palopo City. A qualitative design is particularly suited for capturing the complexity of collaborative governance processes and understanding stakeholder perspectives across sectors. Additionally, this approach allows for an in-depth exploration of the dynamics of policy formulation and implementation [13].

TIME AND LOCATION

The study was conducted from June to August 2025, following ethical approval from the Health Research Ethics Committee, Faculty of Public Health, Hasanuddin University (Approval No. 117/UN4.14.1/TP.01.02/2025). The research took place in Palopo City, South Sulawesi Province, Indonesia. The institutions involved included the Palopo City Health Office (*Dinas Kesehatan Kota Palopo*), the Regional Development Planning Agency (*BAPPEDA*), regional public and private hospitals (*RSUD dr. Palammari Tandi and RS Mega Buana*), the Indonesian National Nurses Association (*PPNI*), the Social Security Agency for Health (*BPJS*), a community-based foundation for TB awareness (*YAMALI TB*), and local media outlets (*Palopo Pos and Koran Seruya*).

INFORMANTS

Informants in this study were selected through purposive sampling based on their relevance, expertise, and depth of knowledge regarding the research problem. Participants represented key stakeholders within the pentahelix framework, encompassing government, academia/health services, industry, non-governmental organizations, and the media. Informants were chosen as pivotal decision-making and implementation nodes within the tuberculosis governance network, rather than as representatives of larger populations. It is important to note that data saturation was achieved at

the level of governance processes and institutional roles, which was the primary analytical focus of the study. This clarification highlights that the study is actor-centric and process-oriented, aligning with qualitative governance research.

TABLE 1. STUDY INFORMANTS BY PENTAHELIX SECTOR

Pentahelix sectors	Institutions	Position	Number of informants
Government	Palopo City Health Office	TB Control Officer	1
		Technical Officer (TO) TB	1
	Palopo City Regional Development Planning Agency	Head of Socio-Economic and Community Development Division	1
Academician	RSUD dr. Pallemai Tandi	Nurse	1
	RS Mega Buana	Nurse	1
	The Indonesian National Nurses Association	TB Manager at Wara Community Health Center	1
Industry (Private)	The Social Security Agency for Health	Head of Benefits Assurance and Utilization	1
NGO	Community-based foundation for TB awareness	Monitoring and Evaluation Program Staff	1
Media	Palopo Pos	Journalist	1
	Koran SERUYA	Journalist	1
Total			10

PROCEDURES

The primary method for data collection involved face-to-face, in-depth interviews conducted using a phenomenological approach, with each session lasting about 15–20 minutes. All interviews were audio-recorded with participants' consent for later analysis. A semi-structured interview guide was employed to ensure consistency and effectiveness, addressing key aspects of collaborative governance, such as principled engagement, shared motivation, capacity for joint action, collaborative actions, and perceived impacts and adaptation [13].

DATA ANALYSIS

Data analysis was performed using qualitative content analysis within an interactive and iterative process that took place concurrently with data collection, analysis, and interpretation [13]. This study utilized Miles and Huberman's interactive model, which consists of three main stages: (1) **data condensation**, which involves selecting, simplifying, and transforming raw data to enhance the understanding of the phenomena under study rather than merely reducing the data; (2) **data display**, where findings were organized into visual formats like matrices and diagrams to map interaction patterns among pentahelix actors, including government, industry, community organizations, media, and academia; and (3) **conclusion drawing and verification**, which involved generating findings based on emerging patterns and repeatedly testing them to ensure their consistency, contextual validity, and relevance. This analytic process was conducted iteratively until data saturation was achieved [14]. To enhance analytical rigor and efficiency, *Computer-Assisted Qualitative Data Analysis Software* (CAQDAS) was used to facilitate automatic transcription and systematic thematic coding.

RESULTS

TABLE 2. CHARACTERISTICS OF INFORMANTS

No.	Code	Age	Institution	Position	Highest Education	Sector
1	P1	–	Palopo City Health Office	TB Control Officer	Bachelor's Degree	Government
2	P2	26	Palopo City Health Office	Technical Officer (TO) TB	Bachelor's Degree	Government
3	P3	40	Regional Development Planning Agency	Head of Socio-Economic and Community Development Division	Bachelor's Degree	Government
4	A1	41	dr. Pallemai Tandi Regional General Hospital	Outpatient Nurse	Bachelor's Degree	Academia/Health Services
5	A2	30	Mega Buana Hospital	Outpatient Nurse	Bachelor's Degree	Academia/Health Services
6	A3	45	Indonesian National Nurses Association	TB Program Manager, Wara Community Health Center	Bachelor's Degree	Academia/Health Services
7	S1	39	Social Security Agency for Health	Head of Benefits Assurance and Utilization	Bachelor's Degree	Industry (Private)
8	L1	26	TB Awareness Community Foundation	Monitoring and Evaluation Program Staff	Bachelor's Degree	Non-Governmental Organization (NGO)
9	M1	51	<i>Palopo Pos</i>	Journalist	Bachelor's Degree	Media
10	M2	29	<i>Seruya</i> Newspaper	Journalist	Bachelor's Degree	Media

Table 2 shows the characteristics of the ten informants who represent key stakeholders within the pentahelix framework for tuberculosis control in Palopo City. These participants include representatives from government institutions, academia and health services, the private sector, civil society, and the media. Government informants are officials from the Palopo City Health Office and the Regional Development Planning Agency. Representatives from academia and health services include nurses and TB program managers from both public and private hospitals, as well as members of the Indonesian National Nurses Association. The private sector is represented by the Social Security Agency for Health, civil society by a community-based foundation focused on TB awareness, and the media by journalists from local print outlets. All informants possess at least a bachelor's degree, with ages ranging from 26 to 51 years, reflecting a professionally qualified and diverse group with direct involvement and expertise in tuberculosis prevention and control.

TABLE 3. GAPS IN COLLABORATIVE DYNAMICS

Components		Ideal Conditions (According to CGR Theory)	Research Findings
Principled Engagement		Engage in structured interactions to foster a shared understanding, establish common goals, and develop theories of change through processes of discovery, definition, deliberation, and determination.	The implementation of shared principles in cross-sector collaboration for tuberculosis (TB) control in Palopo City is underway but remains less than optimal. Government actors continue to dominate leadership roles, while other sectors primarily act as implementers rather than equal partners. Existing coordination forums, such as local coordination meetings and monitoring and evaluation sessions, have yet to yield strong collective agreements or shared strategic directions, as participants often prioritize their sectoral mandates. As a result, the collaborative process remains largely procedural and formalistic, rather than genuinely participatory and integrative. The relationship among the pentahelix actors in TB control in Palopo City has been established through reasonably good cross-sector communication, but the trust built remains formal. While the common goal is understood, it has not yet been translated into concrete collaborative action. The roles of the actors are recognized, but there is still a high dependence on the Health Office. Commitment to collaboration is mostly expressed through decrees and memoranda of understanding without a sustainable framework, causing collaboration to follow the direction and momentum set by the government. The pentahelix collaboration for TB control in Palopo City is far from ideal. Its institutional structure is temporary and lacks permanence, with leadership concentrated in the Health Office, leading to minimal participation from other sectors. Information and resources flow unidirectionally from the government, without a feedback mechanism, indicating that collaboration relies on structural command rather than participatory co-governance.
Shared Motivation		Trust is established through consistent and reliable interactions, fostering a mutual understanding of each other's perspectives. Internal legitimacy stems from confidence in the process, while commitment is formalized and robust.	
Capacity Joint Action	for	Clear institutional arrangements, distributed leadership, shared and collaboratively created knowledge, and collectively pooled resources.	

Table 3 shows the significant discrepancies between the ideal conditions of collaborative governance, as described in Collaborative Governance Regime (CGR) theory, and the actual dynamics of cross-sectoral collaboration for TB control in Palopo City. While structured interactions and shared principles have started to take shape, the collaboration remains suboptimal and predominantly government-driven, with other actors serving more as implementers than as equal

partners. Although collaboration is formally recognized through decrees and memoranda of understanding, this has not translated into concrete joint actions or sustainable collaborative mechanisms. Institutional arrangements are vague and lack a permanent, inclusive structure, leading to limited participation from non-governmental sectors and a one-way flow of information dominated by the Health Office. Basic communication across sectors has helped establish an initial level of trust and a shared understanding of goals, yet this trust remains largely formal rather than substantive. Overall, the collaboration is still marked by hierarchical control, procedural engagement, and limited co-creation of resources, indicating that participatory and integrative collaborative governance has not yet been fully realized.

TABLE 4. GAPS IN COLLABORATIVE ACTION

Action categories	Ideal Conditions (According to CGR Theory)	Research Findings
Substantive, Network, Development, and Operational Actions	All substantive actions, such as addressing core issues, networking to build legitimacy, development for mobilizing resources, and operational actions to maintain CGR, are strategically executed based on a shared theory of change.	The implementation of TB control collaboration in Palopo City remains in its nascent stages and lacks optimal cross-sector coordination. Each actor tends to operate within their own sector, failing to form an integrated chain of action aimed at achieving common results. The collaboration network is still informal, relying more on personal relationships than on systematic institutional connections. Joint capacity-building efforts have not been planned due to the absence of a permanent forum for knowledge sharing and evaluation. In practice, synergy among actors is still contingent on the government's agenda and resources, with other sectors playing only a supporting role. Consequently, a consistent and sustainable collaborative working pattern has yet to be fully established.

Table 4 shows significant discrepancies between the ideal conditions for collaborative action as outlined in CGR theory and the actual implementation of TB control collaboration in Palopo City. While substantive actions such as core issue resolution, networking, capacity development, and operational activities are expected to be executed strategically and integratively, the current collaboration is still in its nascent stages and lacks effective coordination across sectors. Each actor tends to operate in a sectoral and fragmented manner, failing to form an integrated chain of action aimed at shared outcomes. The collaborative network remains informal, heavily reliant on personal relationships rather than systematic institutional arrangements. Furthermore, capacity-building efforts have not been strategically planned due to the absence of a permanent forum for knowledge sharing and joint evaluation. In practice, synergy among actors largely depends on government agendas and resources, with other sectors primarily playing supportive roles. As a result, a consistent, sustainable, and fully integrated pattern of collaborative action has yet to be achieved.

Table 5 shows a discrepancy between the anticipated collaborative impacts under CGR theory and the actual outcomes of TB control collaboration in Palopo City. Although collaboration has led to measurable improvements in coordination and program effectiveness—especially in process-related areas such as heightened cross-sectoral awareness, synergy among pentahelix actors, and increased participation in socialization, case detection, and reporting—these impacts largely remain at the individual or sectoral level. Broader systemic outcomes, including policy change, institutional strengthening, and a significant reduction in TB cases, have yet to be fully achieved. In terms of adaptation, collaborative adjustments are limited and lack structure; while some actors have modified field strategies, such as enhancing socialization methods and engaging local communities, joint learning and collective reflection have not been institutionalized. Consequently, adaptation tends to be reactive and short-term, and cross-sectoral forums have not been optimally utilized for shared learning and innovation. As a result, collaborative adaptation remains sporadic and unsustainable, limiting the long-term effectiveness of collaborative governance in TB control.

TABLE 5. COLLABORATIVE IMPACT GAPS

Impact Categories	Ideal Conditions (According to CGR Theory)	Research Findings
Results	Significant changes have been observed in the targeted issues, with an increase in the internal capacity of actors and a bolstered external legitimacy of CGR.	The collaboration results indicate enhanced coordination and effectiveness in implementing TB control programs in Palopo City. This impact is particularly noticeable in processes such as the increased cross-sectoral awareness and synergy among pentahelix actors. While participation in socialization activities, case detection, and reporting has risen, it remains confined to individual or sectoral levels. Meanwhile, systemic impacts like policy changes, institutional strengthening, and a significant reduction in cases have yet to be fully realized. The adaptation process in TB control collaboration in Palopo City remains limited and unstructured. Some actors can adjust their strategies in the field, such as by modifying socialization methods and involving local communities, but joint learning and collective reflection have not been integrated into the collaboration mechanism. Changes tend to be reactive to immediate needs, and cross-sector forums have not been optimally utilized for sharing knowledge and innovation. Consequently, collaborative adaptation remains sporadic and unsustainable in strengthening the effectiveness of collaboration governance.
Adaptation	Transformative adjustments in the objectives and dynamics of CGR have enhanced its resilience and sustainability.	The adaptation process in TB control collaboration in Palopo City remains limited and unstructured. Some actors can adjust their strategies in the field, such as by modifying socialization methods and involving local communities, but joint learning and collective reflection have not been integrated into the collaboration mechanism. Changes tend to be reactive to immediate needs, and cross-sector forums have not been optimally utilized for sharing knowledge and innovation. Consequently, collaborative adaptation remains sporadic and unsustainable in strengthening the effectiveness of collaboration governance.

DISCUSSION

This study advances collaborative governance theory by illustrating that in high-burden infectious disease contexts, pentahelix-based collaboration often develops into a lead-organization CGR rather than a shared-governance regime. In this scenario, government dominance highlights the structural aspects of public health accountability and legal mandates, indicating that power asymmetry might be a systemic feature rather than an implementation flaw in the early stages of TB governance.

PRINCIPLED ENGAGEMENT IN PENTAHELIX-BASED TB COLLABORATION

Principled engagement is the fundamental interactional process through which diverse actors develop a shared understanding, define collective problems, deliberate on solutions, and make joint decisions within a collaborative governance framework [14–17]. In the context of TB control in Palopo City, findings suggest that while principled engagement is emerging, it remains largely procedural and government-centered, rather than truly co-creative. The discovery phase was primarily driven by a mutual awareness of capacity limitations across individual sectors. Government institutions, health services, civil society organizations, and media actors recognized that TB control could not be

effectively tackled through isolated sectoral efforts. This aligns with the pentahelix framework, which underscores multistakeholder collaboration as essential for addressing complex public health issues [14]. However, the findings indicate that discovery was still predominantly shaped by government-defined priorities, limiting the emergence of alternative problem framings from non-government actors. Discovery did not occur solely at the initiation stage but continued throughout implementation as actors faced operational constraints and coordination challenges. This reflects the dynamic nature of collaboration, where partnerships evolve through repeated recognition of capacity gaps and asymmetric relationships [18]. Nonetheless, the lack of structured deliberative forums hindered the translation of continuous discovery into shared strategic commitments, as highlighted in collaborative governance theory [16,17].

DETERMINATION PROCESS AND INSTITUTIONAL DOMINANCE

Within the CGR framework, determination signifies the shift from dialogue to collective decision-making and action [17]. In Palopo City, this was implemented through agenda setting, task allocation, and scheduling of key TB control activities. This progression indicates that collaboration has moved beyond symbolic interaction to operational coordination, a pattern often seen when dominant institutions engage in stabilizing "institutional work" during early collaborative arrangements [19]. However, determination remained heavily centralized within the Palopo City Health Office. Although multiple stakeholders participated in implementation, strategic agendas were largely formulated before broader engagement. This pattern reflects a lead-organization model rather than a shared-governance regime [20]. Such dominance marks a critical point in collaboration where power asymmetries influence the trajectory and depth of collective action, potentially limiting co-ownership and shared accountability [21]. Determination was further evidenced by concrete actions such as contact investigation and tuberculosis preventive therapy (TPT). These activities align with evidence showing that contact screening is a cornerstone of TB control for identifying latent and active cases among household contacts [22]. However, the limited involvement of non-health actors in planning these interventions suggests that determination functioned more as administrative coordination than as collective decision-making.

However, the prominence of the Palopo City Health Office within the collaborative governance framework should not be viewed merely as a coordination failure or an imbalance in stakeholder engagement. Instead, it should be seen as a structural condition shaped by the institutional design of tuberculosis governance. As an infectious disease of national priority, tuberculosis control is governed by statutory mandates that assign formal authority, accountability, and reporting obligations to government health agencies. This legal responsibility is reinforced by centralized control over surveillance data, program financing, and performance evaluation mechanisms, positioning the health office as the primary locus of decision-making and risk management. Consequently, the observed government-centered collaboration reflects a lead-organization governance model, where authority concentration is driven by institutional accountability pressures rather than the exclusion of non-governmental actors. Understanding government dominance as a structural feature rather than a procedural weakness provides a more nuanced explanation of power asymmetries within the pentahelix collaboration.

GAPS IN COLLABORATIVE DYNAMICS AND SHARED MOTIVATION

The findings reveal that collaborative dynamics—comprising principled engagement, shared motivation, and capacity for joint action—have not yet formed a mutually reinforcing cycle as envisioned in CGR theory [16,23]. Trust among actors has developed through repeated interaction, but it remains largely formal and institutional, rooted in official mandates rather than relational legitimacy. This condition mirrors challenges identified in multisectoral TB governance, where shared objectives are acknowledged but difficult to translate into sustained collective action due to institutional silos and hierarchical decision-making structures [24]. Internal legitimacy in Palopo City was derived mainly from formal decrees and memoranda of understanding, rather than from confidence in inclusive and deliberative processes [25].

FRAGMENTED COLLABORATIVE ACTION

Ideally, collaborative action should arise from strategies and theories of change that are jointly constructed [15,26]. However, in Palopo City, actions remained fragmented and sector-focused, with actors working in parallel rather than as part of an integrated collaborative system. The lack of a permanent cross-sector forum limited opportunities for co-design, joint capacity development, and collective evaluation. This fragmentation stands in contrast to co-creation and co-production approaches in public health, which emphasize shared problem definition, joint design, and mutual

accountability throughout the implementation process [26]. Without institutionalized mechanisms for collaboration, collective action risks being transactional rather than transformational.

The fragmentation of collaborative action in Palopo City can be attributed to the lack of an integrated governance framework that aligns structure, process, and action. Despite the involvement of multiple actors in tuberculosis control activities, their collaborative efforts are not guided by a collectively developed theory of change or an institutionalized mechanism for joint planning. Consequently, these actors tend to operate independently within their own mandates rather than as parts of a cohesive action system aimed at shared outcomes. The absence of a permanent cross-sector forum further limits opportunities for co-design, coordinated capacity development, and collective evaluation. This structural disconnect between collaborative intent and operational execution restricts the transformative potential of the pentahelix framework and reinforces sectoral silos within the governance regime.

LIMITED COLLABORATIVE IMPACT AND WEAK ADAPTIVE CAPACITY

From an impact perspective, collaboration has primarily led to process-level improvements, such as increased awareness, better coordination, and higher participation in TB-related activities. These outcomes are typical of early-stage collaborative governance, where relational and procedural gains usually precede systemic change [16,23]. However, broader impacts—such as policy reform, institutional strengthening, and sustained reductions in the TB burden—have not yet been realized. Adaptive capacity also remains limited. Although some actors adjusted implementation strategies in response to field conditions, joint learning and collective reflection were not institutionalized. This finding aligns with evidence that collaborative governance evolves sustainably only when learning and adaptation are formally embedded into governance structures [23]. Furthermore, the absence of integrated organizational and digital tools hindered knowledge sharing and innovation across sectors. As collaboration increasingly relies on mechanisms that support transparency, coordination, and joint problem-solving, the lack of such enabling tools may limit the transformative potential of collaborative governance [27].

The limited epidemiological impact observed in this study, particularly the lack of significant reductions in tuberculosis incidence, should be interpreted with caution and within the framework of collaborative governance's temporal logic. According to CGR theory, early-stage collaboration is anticipated to yield process-level and relational outcomes—such as improved coordination, increased participation, and enhanced mutual awareness—before leading to broader systemic or population-level effects. In the context of tuberculosis control, epidemiological outcomes are shaped by various structural determinants, including socioeconomic conditions, health system capacity, and long treatment timelines, which extend beyond the immediate scope of governance arrangements. Consequently, the findings of this study suggest that the collaborative governance regime in Palopo City has primarily bolstered governance capacity and implementation processes, representing a necessary but insufficient condition for long-term reduction in disease burden. In addition, adaptive capacity within the collaborative governance regime remains constrained due to the lack of institutionalized mechanisms for joint learning and collective reflection. Although individual actors have shown situational adaptability by adjusting implementation strategies in response to field conditions, these modifications occur independently rather than through coordinated learning processes. From a CGR perspective, sustainable collaboration necessitates formal structures that enable shared reflection, feedback loops, and knowledge integration across sectors. In Palopo City, the absence of regular cross-sector evaluation forums and integrated information systems has hindered the development of collective learning and institutional memory. As a result, adaptation remains reactive and short-term, limiting the collaborative regime's ability to evolve strategically and address emerging challenges in tuberculosis control.

CONCLUSION

This study concludes that tuberculosis control in Palopo City, executed through a pentahelix collaborative approach, has enhanced cross-sector coordination, communication, and the execution of key program activities, particularly in contact investigation and tuberculosis preventive therapy. However, the collaborative governance regime is still in its nascent stage and is structurally centered around the local health office, where decision-making authority and resource control are concentrated. Although multiple stakeholders are formally involved, their roles are largely instrumental rather than co-

creative, leading to fragmented actions, limited shared leadership, and weak institutionalized learning. As a result, while collaboration has yielded significant process-level gains, it has not yet achieved broader systemic or transformative impacts. Strengthening collaborative governance will require institutional consolidation beyond ad hoc coordination. Establishing a permanent cross-sector forum, formalizing shared decision-making mechanisms, and integrating joint monitoring and learning systems are essential to foster sustainable co-governance. By embedding deliberation, shared authority, and collective accountability within institutional structures, the pentahelix framework can evolve from a procedural coordination model into a more adaptive and resilient governance regime capable of supporting long-term tuberculosis control.

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PRODUCTIVITY LOSS LINKED TO NON-COMMUNICABLE DISEASES ACROSS SOCIO-DEMOGRAPHIC PROFILES: EVIDENCE FROM SEDENTARY OCCUPATION EMPLOYEES DURING COVID-19

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ABSTRACT

BACKGROUND:

The COVID-19 pandemic has significantly transformed work dynamics, leading to a notable shift towards remote work, particularly for those in sedentary roles. This change has been linked to a heightened risk of Non-Communicable Diseases (NCDs), many of which stem from lifestyle-related factors. Such health challenges can adversely affect productivity in the workplace, causing both absenteeism and presenteeism.

AIM:

This study examines the costs of presenteeism and absenteeism related to non-communicable diseases (NCDs) across socio-demographic variables.

METHODS:

Using stratified and purposive sampling, a cross-sectional study was conducted with 426 employees in sedentary occupations in the Delhi-NCR region. Productivity losses from presenteeism and absenteeism were assessed using the WHO HPQ Questionnaire. Additionally, the General Linear Model (GLM) was utilised to analyse the relationship between loss productive time (LPT) costs associated with presenteeism and absenteeism across disease categories and socio-demographic factors.

RESULTS:

Employees diagnosed with 'NCDs Category I', 'NCDs Category II', and those with 'comorbid' conditions were estimated to lose between 40 and 48 workdays each year. Absenteeism accounts for a greater portion of productivity losses than presenteeism in all disease categories. Comorbidities contribute to the most significant losses, with costs surpassing those associated with CDs by INR 51.78 thousand (932.04 AUD) for presenteeism and INR 226.47 thousand (4,076.46 AUD) for absenteeism. Additionally, every extra year of education corresponds to an increase of INR 4.96 thousand (89.28 AUD) in costs related to LPT due to presenteeism and a reduction of INR 15.68 thousand (282.24 AUD) in absenteeism-related LPT costs.

CONCLUSION:

The research indicates that NCDs, particularly in the presence of comorbid conditions, have a substantial effect on workplace productivity. Notably, individuals with higher levels of education and Income exhibit elevated presenteeism

costs, which may be attributed to the influence of remote work arrangements. Conversely, absenteeism rates appear to be lower among highly educated employees in similar settings.

KEYWORDS

productivity loss, absenteeism, presenteeism, sedentary occupation, COVID-19, NCDs

INTRODUCTION

The COVID-19 pandemic, which emerged in early 2020, led to a dramatic shift in the work culture. It forced people into a lifestyle of lockdown, making most people undertake remote work during this time. However, this transition towards a work-from-home culture came with limitations, including limited social interaction and more sedentary time at work. Employees of a sedentary occupation are usually identified for spending six hours or more sitting, with limited movement or standing time of two hours or less in total working hours [1]. Prolonged sedentary postures raise the risk of NCDs, with studies showing increased health issues like MSD, diabetes, hypertension, and mental illness among remote workers during COVID-19 [2, 3, 4].

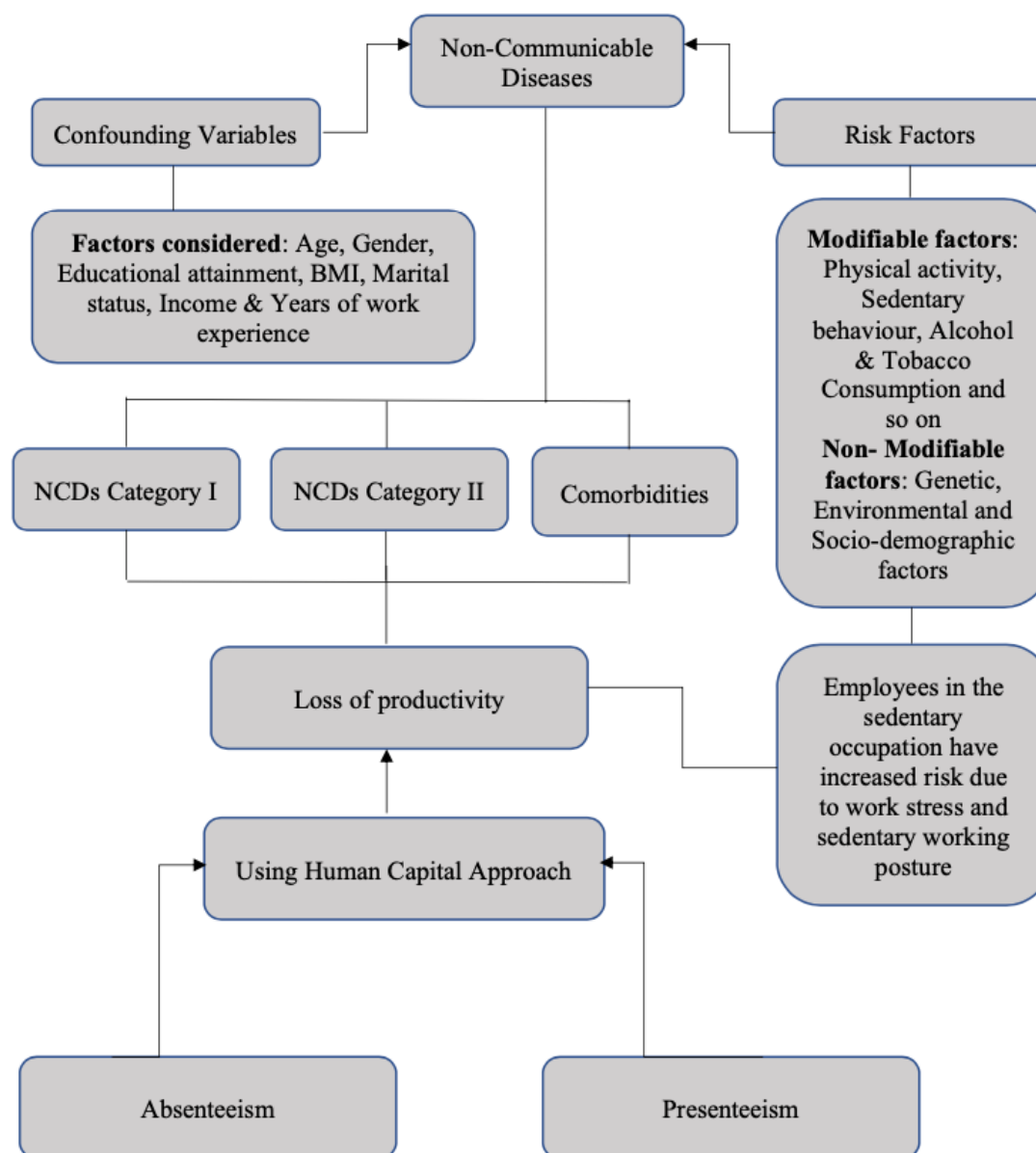
Socio-demographic variables such as Age, Gender, Educational Attainment, BMI, Income, Years of Work Experience, and Marital Status have also been identified by the literature to influence the prevalence of NCDs apart from sedentary behaviour [5, 6, 7, 8, 9, 10, 11, 12]. However, the evidence regarding their impacts is still mixed and inconclusive, highlighting a grey area in understanding their role in influencing NCDs among employees engaged in sedentary occupations.

The prevalence of ill health in the form of 'NCDs' or 'Communicable Diseases (CDs)' can significantly reduce productivity at work, posing economic challenges for both employees and employers. Presenteeism and absenteeism approaches are commonly used to quantify productivity loss in individuals with ill health at work [13, 14]. Absenteeism is used when a person does not show up at work, whereas presenteeism refers to the situation when the person, despite being ill, shows up for work.

Researchers have attempted to estimate the impact of illnesses on the productivity of individuals by using both absenteeism and presenteeism approaches [13, 15, 16, 17]. However, in the Indian context, limited literature is available examining productivity loss due to NCDs using an empirical research design [18, 19].

Given this scenario, the current study examines the presenteeism and absenteeism costs related to NCDs across socio-demographic variables. The conceptual framework highlighted in Figure 1 has been adopted to undertake this study.

FIGURE 1: CONCEPTUAL FRAMEWORK OF THE STUDY



Given the extensive nature of non-communicable diseases (NCDs), this study focuses on those affecting physical health. The NCDs have been categorised based on their comorbid characteristics. The categories used in this study are as follows:

1. NCDs Category I: Hypertension, Diabetes or CVD.
2. NCDs Category II: Respiratory Diseases, Musculoskeletal Diseases, Digestive Issues, Kidney Issues, Cancer or Reproductive Health Issues.
3. Comorbidities: Presence of more than one NCD.
4. Communicable Diseases: COVID-19, Flu, Cold, Dengue or Fever.

METHODOLOGY

STUDY DESIGN:

A cross-sectional study was conducted involving 426 employees in sedentary occupations within the Delhi-NCR region. Utilising a combination of stratified and purposive sampling, data were collected from Delhi and Gurgaon based on workforce estimates [20] to mitigate selection bias. The stratified random sampling technique divided the regions into

distinct zones, with at least 30 samples collected from each stratum. Purposive sampling was implemented to ensure equitable representation across gender and age categories.

PARTICIPANTS:

The research targeted a sample size of 385 participants and successfully reached out to 432 employees. Ultimately, 426 completed the survey, resulting in a high response rate of 98.61%. The survey was conducted between November 2021 and April 2022 during the third wave of COVID-19. The sample size for this study was based on a rule of thumb [21] and an online sample size calculator, suggesting 370-400 responses for populations of 5,000 to 100,000 at a 95% confidence level with a $\pm 5\%$ margin of error. As there was no specific data for sedentary occupations, the study used the tertiary sector workforce in Delhi-NCR as a proxy.

The study targeted salaried individuals aged 18 to 64 in sedentary occupations in Delhi-NCR with at least one year of experience. Those diagnosed with, or self-reporting, any health issue at the time of the survey or within the preceding one month were included, irrespective of whether medical consultation or treatment had been sought. Individuals without any diagnosed or self-reported health issues within the past month were excluded from the study.

The responses were primarily collected through field interviews. However, due to the COVID-19 third wave, the study faced challenges in collecting data in person. The telephonic interview method was adopted only for those cases.

Before conducting field interviews, the study received approval from the 'Research Conduct and Ethics Committee' of CHRIST University, Bengaluru, Karnataka, India (CU: RCEC/00374/11/21 dated: 21 November 2021). Participants were informed about the study's nature and purpose, and informed consent was obtained. Participants were assured of their voluntary involvement, the right to withdraw at any time, and the confidentiality of their information, which was used only for research purposes.

QUESTIONNAIRE:

A questionnaire consisting of three sections and a total of 39 questions was prepared for the survey, focusing on a one-month recall period to minimise 'recall biasedness'. The first section collected socio-demographic data (Question 1-13; Question 29-32), the second addressed health issues (Question 14-28), and the third assessed productivity loss due to illness (Question 33-39).

The economic burden of disease was assessed, covering both direct costs (medical and non-medical expenses) and indirect costs related to productivity loss, following the framework proposed in previous literature [22]. Indirect costs were estimated using the human capital approach based on average earnings.

Both presenteeism and absenteeism were measured using the Health and Work Performance Questionnaire (HPQ) by WHO [23]. Before data collection, field experts evaluated the questionnaire for face and content validity.

STATISTICAL ANALYSIS:

The study's analysis was performed using IBM SPSS software for data evaluation and interpretation. To summarise the surveyed data, basic descriptive analysis tools were applied, and the results were presented as mean scores using tabular representations.

Using the Kolmogorov-Smirnov test and Kaiser-Meyer-Olkin (KMO) tests, the normality assumption and sample adequacy of the surveyed data were tested.

To estimate scores for presenteeism and absenteeism, the study followed the WHO's guidelines for content and scoring [24]. Additionally, it adopted an established methodology to calculate the annual cost of 'Lost Productive Time (LPT)' resulting from presenteeism and absenteeism [25]. The study also employed the General Linear Model (GLM) to analyse the relationship between the cost of LPT related to presenteeism and absenteeism across disease categories and socio-demographic variables. The following econometric model was used:

$$Y_i = f(Dis_i, Gen_i, Age_i, Edn_i, BMI_i, Inc_i, Work\_Exp_i, Mar\_Stat_i)$$

$$Y_i = \beta_1 + \beta_2 Dis_i + \beta_3 Gen_i + \beta_4 Age_i + \beta_5 Edn_i + \beta_6 BMI_i + \beta_7 Inc_i + \beta_8 Work\_Exp_i + \beta_9 Mar\_Stat_i + \varepsilon_i$$

where,

Y_i represents dependent variables from different models:

Model I: Cost of LPT due to Presenteeism

Model II: Cost of LPT due to Absenteeism

Dis_i = The disease category of i^{th} respondent. With the 'Communicable Disease' category as the reference category

Gen_i = Gender of the i^{th} respondent. With the 'Male' category as the reference category

Age_i = Age of the i^{th} respondent. With the '45 years and above' category as the reference category

Edu_i = Years of formal education of the i^{th} respondent. With the 'Post-Graduation and above' category as the reference category

BMI_i = Body Mass Index of the i^{th} respondent. With the 'Obesity Class II and above' category as the reference category

Inc_i = Income of the i^{th} respondent. With the 'Income quintile V' category as the reference category

$Work\_Exp_i$ = Years of work experience of the i^{th} respondent. With the 'Less than 5 years' category acting as the reference category

Mar_Stat_i = Marital status of the i^{th} respondent. With the 'Married' category as the reference category

β_1 to β_9 are the parameters of the estimates.

ε_i = Residual term.

RESULTS

Table 1 presents the socio-economic characteristics of the sample population. The mean age of the sample group is 36.30, with a majority (39.7%) aged between 25 and 34, with a slight male predominance (58.0%). The average Body Mass Index (BMI) was recorded at 24.90 ($\sigma = 3.95$), with 52.3% of participants classified as having normal weight. Most respondents were married (68.1%) and held an undergraduate degree (93.2%). The mean monthly Income was INR 60,962.91 (1,097.33 AUD), and the average work experience was approximately 12 years. Respondents were selected from nine zones in the Delhi-NCR region, contributing 7.7% to 13.8% each to the total sample.

Descriptive statistics on absenteeism and presenteeism among sedentary employees are highlighted in Table 2. A higher score of absenteeism represents a higher amount of lost productivity, whereas a higher score of presenteeism represents a lower amount of lost performance [25]. Absolute absenteeism showed a range where some employees worked up to 60 hours overtime while others missed up to 135 hours a month, resulting in an average absenteeism of 23.98 hours, approximately equivalent to one workday. The relative absenteeism rate averaged 0.11, indicating a low level of absenteeism in the sample. In absolute presenteeism, measured from 0 (complete lack of performance) to 100 (full performance), scores ranged from 40 to 100, with an average of 80.63%, reflecting generally high job performance.

TABLE 1: SOCIO-DEMOGRAPHIC PROFILE OF THE RESPONDENTS'

Variables	Frequency (n)	Percentage (%)
Gender		
Male	247	58.00
Female	179	42.00
Age		
Less than 25 years	51	12.00

Variables	Frequency (n)	Percentage (%)
25 years <35 years	169	39.70
35 years <45 years	122	28.60
45 years and above	84	19.70
Mean (S.D*; C.V#)	36.30 (10.00; 27.54)	
BMI		
Underweight (0-18.5)	11	2.60
Normal weight (18.5-24.9)	223	52.30
Pre-obesity (25-29.9)	149	35.00
Obesity class I (30-34.9)	36	8.50
Obesity class II and above	7	1.60
Mean (S.D*; C.V#)	24.90 (3.95; 15.86)	
Educational attainment		
High-School	29	6.80
Undergraduate	207	48.60
Post-graduate and above	190	44.60
Marital status		
Unmarried	136	31.90
Married	290	68.10
Income**		
Income Quintile I	85	19.95
Income Quintile II	85	19.95
Income Quintile III	85	19.95
Income Quintile IV	85	19.95
Income Quintile V	86	20.20
Mean (S.D*; C.V#)	60,962.91## (46,511.92##; 76.29)	
Years of work experience		
Less than 5 years	106	24.88
5 years – 11 years	106	24.88
11 years – 18 years	107	25.12
18 years and above	107	25.12
Mean (S.D*; C.V#)	11.78 (9.30; 78.94)	
Region		
North Delhi	59	13.80
South Delhi	55	12.90
Central Delhi	52	12.20
East Delhi	34	8.00
West Delhi	38	8.90
North Gurgaon	55	12.90
South Gurgaon	52	12.20
East Gurgaon	48	11.30
West Gurgaon	33	7.70

*S.D=Standard Deviation; #C.V=Coefficient of Variation; ##Measured in Indian Rupees

TABLE 2: DESCRIPTIVE STATISTICS ON PRODUCTIVITY MEASURES

Variables	Minimum	Maximum	Mean	Standard Deviation	Coefficient of Variation (%)
Absenteeism					
<i>Relative</i>	-0.33	0.52	0.11	0.14	127.27
<i>Absolute</i>	-60.00	135.00	23.98	30.48	78.67
Presenteeism					
<i>Relative</i>	0.60	1.80	1.02	0.21	20.58
<i>Absolute</i>	40.00	100.00	80.63	12.53	15.54
Productivity Loss	0.33	1.88	0.90	0.25	27.78

TABLE 3: MEAN SCORES OF ANNUAL LPT DUE TO PRESENTEEISM AND ABSENTEEISM

Disease Categories	LPT of Presenteeism			LPT of Absenteeism		
	<i>In Hours</i>	<i>In days</i>	<i>In Work Days</i>	<i>In Hours</i>	<i>In Days</i>	<i>In Work Days</i>
<i>NCDs Category I</i>	325.55	13.56	40.69	374.71	15.61	46.84
<i>NCDs Category II</i>	342.86	14.29	42.86	324.84	13.54	40.61
<i>Comorbidities</i>	342.97	14.29	42.87	381.35	15.89	47.67
CDS	234.36	9.77	29.30	315.11	13.13	39.39

TABLE 4: GLM RESULTS FOR ESTIMATION OF THE ANNUAL COST OF LPT DUE TO PRESENTEEISM (000'S)

Variables	β	Standard Error	Confidence Interval		Sig.
			Lower	Upper	
Intercept	148.50**	59.76	30.96	266.04	0.01
Diseases (#Ref. CDs)					
<i>NCDs Category I</i>	51.93***	4.76	30.46	73.39	0.00
<i>NCDs Category II</i>	20.29**	1.92	-0.49	41.07	0.04
<i>Comorbidities</i>	51.78***	4.33	28.23	75.32	0.00
Gender (#Ref. Male)	-3.07	8.02	-18.85	12.71	0.70
Years of education	4.96*	2.79	-0.53	10.45	0.07
Age (#Ref. 45 years and above)					
<i>Less than 25 years</i>	-0.43	27.12	-53.78	52.92	0.98
<i>25 years – 35 years</i>	2.90	23.39	-43.11	48.91	0.90
<i>35 years – 45 years</i>	-7.11	15.94	-38.46	24.23	0.65
Income (#Ref. Income Quintile V)					
<i>Income quintile I</i>	-239.56***	14.48	-268.03	-211.08	0.00
<i>Income quintile II</i>	-159.34***	13.21	-185.33	-133.36	0.00
<i>Income quintile III</i>	-123.07***	12.79	-148.22	-97.93	0.00
<i>Income quintile IV</i>	-86.10***	12.36	-110.41	-61.79	0.00
Years of work experience (#Ref. Less than 5 years)					
<i>5 years - 11 years</i>	7.03	13.96	-20.43	34.49	0.61
<i>11 years - 18 years</i>	15.49	22.77	-29.30	60.27	0.49
<i>18 years and above</i>	-1.33	25.93	-52.33	49.67	0.95
BMI	-0.43	1.04	-2.47	1.62	0.68
Insurance (#Ref. People having insurance)	-8.23	8.33	-24.61	8.16	0.32
Marital status (#Ref. Married)	18.34	12.80	-6.84	43.52	0.15
R-Square	0.589				
F-Statistic (df1, df2)	196.61*** (346,3)				

*Significant at 10% level. **Significant at 5% level. ***Significant at 1% level. Values are represented in INR (000's). Values can be converted to AUD by multiplying to 0.018 (avg. exchange rate in 2021)

TABLE 5: GLM RESULTS FOR ESTIMATION OF THE ANNUAL COST OF LPT DUE TO ABSENTEEISM (000'S)

Variables	β	Standard Error	Confidence Interval		Sig.
			Lower	Upper	
Intercept	314.82**	134.14	78.06	605.58	0.01
Diseases (#Ref. CDs)					
<i>NCDs Category I</i>	93.58*	59.07	-22.56	209.72	0.09
<i>NCDs Category II</i>	213.38***	67.44	80.77	345.98	0.00
<i>Comorbidities</i>	226.47***	71.52	85.85	367.10	0.00
Gender (#Ref. Male)	84.32	58.06	-29.84	198.49	0.14
Years of education	-15.68**	6.24	-27.96	-3.40	0.01
Age (#Ref. 45 years and above)					
<i>Less than 25 years</i>	9.00	59.57	-108.14	126.14	0.88
<i>25 years – 35 years</i>	14.40	50.24	-84.38	113.19	0.77
<i>35 years – 45 years</i>	-17.02	34.08	-84.04	49.99	0.61
Income (#Ref. Income Quintile V)					
<i>Income quintile I</i>	-55.18	53.01	-159.43	49.06	0.29
<i>Income quintile II</i>	-36.04	54.90	-143.99	71.91	0.51
<i>Income quintile III</i>	-25.48	53.21	-130.12	79.15	0.63
<i>Income quintile IV</i>	-19.08	52.59	-122.48	84.32	0.71
Years of work experience (#Ref. Less than 5 years)					
<i>5 years - 11 years</i>	25.90	32.54	-38.07	89.88	0.42
<i>11 years - 18 years</i>	22.43	48.46	-72.85	117.71	0.64
<i>18 years and above</i>	-2.79	56.66	-114.21	108.62	0.96
BMI	-2.05	2.38	-6.73	2.62	0.38
Insurance (#Ref. People having insurance)	26.01	19.42	-12.18	64.19	0.18
Marital status (#Ref. Married)	-4.76	29.81	-63.38	53.87	0.87
R-Square	0.213				
F-Statistic (df1, df2)	29.19*** (370, 6)				

*Significant at 10% level. **Significant at 5% level. ***Significant at 1% level. Values are represented in INR (000's). Values can be converted to AUD by multiplying to 0.018 (avg. exchange rate in 2021).

The data in Table 3 reflect the extent of productive time lost due to presenteeism and absenteeism. The absolute scores for both presenteeism and absenteeism were utilised to assess the total productive time lost. For employees diagnosed with 'NCDs Category I,' 'NCDs Category II,' and 'comorbidities,' the estimated range of workdays lost due to these determinants was between 40 and 48 days per year. While there is no significant difference in the productive time lost between presenteeism and absenteeism, the findings indicate that employees are more likely to miss work days due to absenteeism across all disease categories rather than working while unwell. This postulate that employees prefer to take time off when they are ill instead of attending work despite being sick.

Table 4 showcases the results of the GLM model examining the relationship between the annual average cost of LPT due to presenteeism with the categories of diseases and the confounding variables. All disease categories were statistically significant, with 'comorbidities' and 'NCDs Category I' leading to the highest productivity losses due to presenteeism, at INR 51.78 thousand (932.04 AUD) and INR 51.93 thousand (934.74 AUD), respectively.

Education and Income were identified as significant confounding variables influencing the cost of LPT due to presenteeism. An increase of one year in educational attainment corresponds to an increase in LPT costs of INR 4.96 thousand (89.28 AUD). This indicates that employees with higher education, who are also likely to have higher incomes, may experience greater productivity loss, possibly due to a reluctance to take sick leave while ill. The income-related sensitivity of productivity loss is evident; higher-income employees tend to favour presenteeism to protect their earnings. In contrast, lower-income employees reported considerably lower LPT costs, with 'Income Quintile I' and 'Income Quintile II' showing reductions of INR 236.56 thousand (4,258.08 AUD) and INR 159.34 thousand (2,868.12 AUD), respectively, compared to 'Income Quintile V'.

All disease categories emerged as significant predictors in the GLM model used to examine the annual cost of LPT due to absenteeism (Table 5). Employees with comorbidities experienced the highest productivity losses, with absenteeism costs exceeding those related to CDs by INR 226.47 thousand (4,076.46 AUD), followed by INR 213.38 thousand (3,840.84 AUD) for NCDs Category II and INR 93.58 thousand (1,684.44 AUD) for NCDs Category I. The findings indicate that individuals with any NCDs are more likely to take sick leave than their peers with CDs. Furthermore, a negative association was found between years of education and LPT costs, suggesting that higher educational attainment is associated with reduced productivity losses from absenteeism.

DISCUSSION

Current research has demonstrated that NCDs can result in considerable presenteeism and absenteeism, leading to a loss of between 40.61 and 47.67 work days. The co-occurrence of one or more NCDs led to 42.87 and 47.67 workdays lost due to presenteeism and absenteeism, respectively.

A similar observation regarding absenteeism was noted, as the seven NCDs examined in the study resulted in a loss of workdays ranging from 6.65 to 37.32 [26]. The variation in average lost days stemmed from differences in estimating productivity loss, with their study utilising prevalence-based secondary data compared to the incidence-based primary data of the current study. Notably, days lost increased from 6.62 to 16.26 with multiple NCDs. The study also revealed a 2.5-fold increase in the number of workdays lost due to functional limitations for individuals with comorbid conditions compared to those with one NCD.

Similarly, according to study by Found et al., individuals with multiple chronic diseases had a 36% higher presenteeism rate and 61% higher absenteeism rate compared to those with a single NCD [27]. However, this study diverges from current research by also considering mental health issues while examining NCDs.

The present study further revealed higher presenteeism costs for 'NCDs Category I' compared to 'NCDs Category II,' while absenteeism costs were greater for 'NCDs Category II'.

These results are in line with previous research that presents mixed evidence on productivity loss related to NCDs. An assessment of productivity losses due to absenteeism and presenteeism linked to chronic diseases was conducted among 1.3 million employees [28]. The findings indicated significant productivity losses for 'NCDs Category II', with asthma [INR 23,652 (425.74 AUD)], back pain [INR 17,766 (319.79 AUD)], and cancer [INR 86,454 (1,556.17 AUD)] exceeding those of 'NCDs Category I', which included CVD [INR 17,712 (318.82 AUD)] and diabetes [INR 17,496 (314.93 AUD)]. Notably, the productivity loss associated with arthritis [INR 9,882 (177.88 AUD)] was lower than that of 'NCDs Category I'.

These findings are in contrast with previous studies on productivity loss from absenteeism across seven NCDs [26, 27]. The study found that employees with arthritis, lung disease, and cancer experienced greater productivity losses than those with 'NCDs Category I'.

Similarly, previous research has shown that musculoskeletal and respiratory diseases, along with kidney and digestive disorders, impact absenteeism rates more significantly than cardiovascular diseases and diabetes [27]. However, only chronic respiratory diseases were observed to have a significantly higher effect on presenteeism rate than other NCDs.

Overall, 'NCDs Category II', such as MSD, respiratory diseases and cancer, lead to a high productivity loss in the form of absenteeism and presenteeism. Results further suggest that employees with MSD or arthritis experience higher absenteeism and reduced productivity due to pain and physical limitations affecting their job performance.

The present study's findings also indicate a positive correlation between educational attainment and presenteeism costs while concurrently demonstrating a negative correlation with absenteeism costs. This unexpected finding may result from the pandemic's remote work culture, which enabled more employees to work while unwell [29]. With most employees working from home irrespective of their formal education, the latter predicted a conflicting result regarding presenteeism. Despite this plausible explanation, studies conducted before the COVID-19 pandemic recorded supporting evidence. Study conducted by Found et al. among people diagnosed with chronic illnesses estimated an average presenteeism score of 1.8 days for individuals lacking formal education, in contrast to higher scores for individuals with formal education [27].

However, prior research assessing productivity loss in individuals with NCDs before the pandemic reported contrasting findings [30]. All education categories were observed to incur a lower presenteeism score than the education category of no education. In addition, the study provided corroborative evidence to suggest a negative correlation between absenteeism and educational attainment, implying that the likelihood of absenteeism decreases as years of education increase.

The current study highlights decreased absenteeism scores with increased years of educational attainment. However, it is imperative to note that the current study was conducted in a work-from-home culture and may significantly impact the results. Employees working from home were reluctant to take sick leave even when unwell, irrespective of their educational background. Nevertheless, employees in higher education categories had higher opportunity costs of taking sick leaves due to their well-paying jobs, leading to a plausible explanation.

Studies conducted before the COVID-19 pandemic provided similar observations [27, 31]. Employees without a university degree reported 0.12 times higher absenteeism than those with one [31]. These studies emphasised the importance that individuals with a university degree hold by considering them irreplaceable at work, resulting in a lower absenteeism rate. They further highlighted a positive correlation between health and education level, leading to a lower likelihood of them incurring physical or mental illness and lower absenteeism.

The study has also yielded other significant findings, indicating a robust and positive relationship between presenteeism and absenteeism costs across the income categories. However, it should be noted that the estimates of presenteeism and absenteeism costs are sensitive to Income, as the latter is utilised to derive the former estimates. This sensitivity may

have led to a positive association between the variables. However, the study fails to provide conclusive remarks due to the absence of interactive analysis between the variables.

Findings from previous research highlight that individuals in the wealthiest quintile (Q5) were 1.29 times more likely to experience presenteeism than those in the lowest quintile (Q1) [30]. The study also found some contradictory evidence regarding absenteeism, as individuals in Q5 were 0.92 times less likely to experience absenteeism than those in Q1. However, the results for absenteeism were not statistically significant to draw any conclusive comparisons with the present study.

In contrast to the current study's findings, earlier findings highlighted lower-income quintiles exhibiting higher mean presenteeism and absenteeism scores (28.2 and 3.1, respectively) compared to their high-income counterparts [31]. The study suggests that reduced flexibility in taking sick leave and increased job insecurity among low-income individuals may lead to these higher rates. However, a lack of detailed data on absenteeism and presenteeism costs across income categories hinders a thorough comparison with the main study.

The study failed to provide conclusive remarks on Gender, Age, Work Experience, Marital Status, Insurance and BMI due to statistical insignificance. Despite this limitation, this study's findings are important due to the increased significance in the discourse on understanding the economic burden of lifestyle diseases in multiple spheres.

LIMITATIONS:

The study was conducted during the third wave of the COVID-19 pandemic, which may have affected the findings. It specifically examines the NCDs related to physical health, excluding the productivity loss associated with mental health issues. Additionally, the results primarily rely on employee income information, meaning that the outcomes derived using the human capital approach could have limitations based on the quality and accuracy of the respondents' data.

CONCLUSION

This study highlights significant productivity losses attributable to NCDs, particularly among employees afflicted with multiple health conditions. The analysis found that higher levels of education and Income were correlated with increased costs associated with presenteeism, a phenomenon potentially influenced by the rise of remote work during the pandemic.

The findings further suggest that the shift to remote work may have lowered absenteeism, particularly among highly educated employees who face higher opportunity costs for missing work. Although the results are mostly consistent with previous studies, variations in productivity loss estimates among different disease categories and differences in methodologies emphasise the challenges involved in examining productivity loss. Additionally, the research did not identify definitive associations with variables such as gender, age, work experience, marital status, insurance coverage, and BMI. This suggests that more research can be undertaken to understand how socio-demographic variables and NCDs affect workplace productivity.

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TRUST IN HEALTH SERVICES DURING AND AFTER COVID-19: BELIEVING TO TRUST, KNOWING TO BELIEVE

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ABSTRACT

BACKGROUND:

This research aimed to measure the multidimensional trust in the health services and health perception of individuals with health literacy under the conditions of COVID-19.

METHODS:

This research was a relational, descriptive and cross-sectional study. A total of 1025 participants were reached in our study. Three different scales were used of the multidimensional trust scale in health services, health perception scale and a health literacy scale. SPSS 22.0 package program (regression, Cronbach alpha and t-test analyses), R 4.2.2 package program and Rstudio (correlation and distribution tests) were used for statistical analysis in the study.

RESULTS:

The effect of health perception on multidimensional trust in health services was significant ($B=.261\pm0.031$; $\beta=0.262$; $p=0.000<0.05$). Additionally, the effect of health literacy on multidimensional trust in health services was also significant ($B=0.072\pm0.026$; $\beta=0.083$; $p=0.007<0.05$). Finally, health literacy was found to have a significant effect on health perception ($B=0.192\pm0.020$; $\beta=0.272$; $p=0.000<0.05$).

CONCLUSION:

Especially during the pandemic period, health literacy affected health perception and trust in the health services. Health literacy was a partial mediator variable between health perception and multidimensional trust in health services.

KEYWORDS

COVID-19, health literacy, health perception, trust in healthcare

INTRODUCTION

The coronavirus (COVID-19) emerged in late 2019 as one of the deadliest and most severe viral outbreaks in history [1]. The World Health Organization (WHO) declared COVID-19 a pandemic in 2020 [2]. The fact that the situation turned into a pandemic prompted people to acquire and apply health information and change their behavior. Health communication educating about how to avoid catching and spreading the virus has become commonplace. Thus, COVID-19 revealed that low health literacy is a global public health problem [3].

According to a study, individuals with low health literacy are less likely to understand health problems and care management and have higher hospitalization/death rates. Healthcare costs associated with low health literacy are estimated at \$50 to \$73 billion annually. Therefore, improving the health literacy levels of patients has become one of the main goals of WHO [4]. Health literacy is a focus for healthcare providers and policy makers in many countries around the world. People's health perceptions have also changed. Health perception is an individual's self-evaluation and their general idea about health [5]. Due to the pandemic, people around the world better understood the value and importance of health; social distancing lifestyle and healthy living habits were adopted [6]. As the perception of health has changed, so has people's sense of trust in health services. Trust is one of the strongest emotions that keeps a society in unity and togetherness, especially in a crisis. Studies reported that the level of trust in healthcare positively affects both general health and mental health [7].

Trust in healthcare is the patient's consideration of benefit from a physician or health system [8]. The pandemic affected people's trust and service demands from hospitals, health services, and insurance companies [7]. As a result, trust is vital to effective functioning of health systems [9].

It is important to understand the interaction of health literacy, health perception and trust in health care. It is also useful to focus on health literacy, which is financed and accepted as a valuable issue by the European Union. This research aimed to measure the multidimensional trust in the health services and health perception of individuals with health literacy under the conditions of COVID-19.

In this study, trust in health services is conceptualised as a multidimensional construct encompassing trust in healthcare providers, healthcare institutions, and healthcare payers, reflecting individuals' confidence in the functioning, fairness, and reliability of the health system as a whole. Health perception refers to individuals' subjective evaluation of their health status, including perceived control, certainty, importance of health, and self-awareness. These dimensions are particularly salient during public health crises such as the COVID-19 pandemic, when heightened uncertainty, perceived risk, and information overload may reshape both trust in health systems and individuals' perceptions of their own health.

METHODS

AIM OF THE STUDY:

This research measured the impact of individual health literacy on multidimensional trust in the health services and health perception under the conditions of COVID-19.

RESEARCH DESIGN:

This research was a relational, descriptive and cross-sectional study.

RESEARCH HYPOTHESIS:

Based on the literature, the hypotheses of the research are listed as follows;

H₁: Health perception has a significant effect on multidimensional trust in health services.

H₂: Health literacy has a significant effect on multidimensional trust in health services.

H₃: Health literacy has a significant effect on health perception.

H₄: Health literacy plays a mediating role between health perception and multidimensional trust in health services.

RESEARCH QUESTIONS:

Based on these hypotheses, the research questions are listed as follows;

Q₁: Does the perception of health have a significant effect on the multidimensional trust in health services?

Q₂: Does health literacy have a significant effect on multidimensional trust in health services?

Q₃: Does health literacy have a significant impact on health perception?

Q₄: Does health literacy play a mediating role between health perception and multidimensional trust in health services?

POPULATION AND SAMPLE:

This study was conducted in Türkiye at a public university during the COVID-19 pandemic period, within a higher education setting that includes students, academic and administrative staff. There are 10,077 students, 1,039 academic staff and 381 administrative staff on campus. Participants were determined by the random sampling method. It is considered appropriate that the number of participants should be five or ten times the number of scale questions [10]. Considering the two factors mentioned above, the number of samples for this study was determined as 1000 because if more individuals are reached, the higher the reliability of the scales applied. Data were prepared for the R program and 45 participants were excluded before analysis. In total, 1025 data were studied.

DATA COLLECTION TOOLS:

In the study, first, a form containing information about the sociodemographic features of the participants, and then scales obtained from the relevant literature in accordance with the purpose of the research were used. These scales were the multidimensional trust scale in health services, health perception scale and a health literacy scale.

Health Literacy Scale (HLS-EU): The Health Literacy Survey – European Union (HLS-EU) Questionnaire was used in the study. The questionnaire developed by Sorensen et al. (2013) [11] with 47 items was later simplified by Toçi et al. (2013) [12] and its validity and reliability were tested. The simplified version of the Health Literacy Scale consists of four subscales and 25 items. The internal consistency coefficients for the scale were between 0.90 and 0.94 (Jerliu et al. 2013) [13]. Adaptation to Türkiye was performed by Aras and Bayık Temel (2017) [14].

Health Perception Scale (HPS): The Health Perception Scale was developed by Diamond et al. (2007) [15] The HPS consists of four subscales and 15 items. Cronbach alpha values were 0.82 for importance of health; 0.91 for self-awareness; 0.90 for center of control; and 0.91 for certainty. Adaptation to Turkish was performed by Kadioğlu and Yıldız (2012) [16].

Multidimensional Trust in Health Care Systems Scale (MTHCSS): The Multidimensional Trust in Health Care Systems Scale was developed by Egede and Ellis (2008) [17]. The MTHCSS consists of three subscales and 17 items. Cronbach alpha values for the subscales were 0.64 for trust in healthcare institutions; 0.74 for trust in healthcare payers; and 0.94 for trust in healthcare providers. Adaptation to Turkish was performed by Dinç, Korkmaz, and Karabulut (2013) [18].

Moreover, Cronbach's α internal consistency coefficient was found to be 0.84 for all scales in this study based on reliability calculations for the scales. Reliability coefficients for all scales were 0.89 for "health literacy", 0.72 for "health perception" and 0.78 for "multidimensional trust in health services". Reliability coefficients were found suitable for the study.

DATA COLLECTION:

The face-to-face survey method was used. Before interviews, training was given to the interviewers. Interviewers training: Four-hour training was given to 10 interviewers selected for data collection. They were trained in the subject, scope and questions of the research. The purpose of receiving training is to ensure that they understand the study and conduct better quality surveys.

DATA ANALYSIS:

The SPSS 22.0 package program, R 4.2.2 package program and Rstudio were used for statistical analysis in the study. Before analyzing the data, the data in SPSS were transferred to the R program and the tidyverse package was loaded. Variable names were arranged and analyses were obtained with R commander. The data were normally distributed. When data is normally distributed, the kurtosis and skewness values are between -1.5 and +1.5 [19]. The kurtosis and skewness values obtained from the analysis (skewness – between 0.93 and 0.94; kurtosis - between 0.90 and 0.23) were in the appropriate range and it was decided to use parametric tests. Demographic findings, descriptive values for the subscales, Cronbach alpha values, ANOVA, and t-test were calculated with the SPSS package program. The R package program was applied for correlation analysis, multiple regression analysis and ANOVA analysis.

RESULTS

SOCIODEMOGRAPHIC FINDINGS

The sociodemographic characteristics of the academics, administrative staff and students participating in the research are given in Table 1.

TABLE 1 DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS

Demographic Characteristics		Number (n)	Percent (%)
Gender	Female	733	71.5
	Male	292	28.5
Age	1-18	79	7.7
	19-25	842	82.1
	26-35	75	7.3
	36-45	23	2.2
	46 and over	6	0.6
Marital status	Married	55	5.4
	Single	970	94.6
Grade Level	Middle School	5	0.5
	High school	610	59.5
	University	366	35.7
	Master- Doctorate	44	4.3
Profession	Student	905	88.3
	Academic/ Administrative staff	120	11.7
Working time	0-5 years	915	89.3
	6-10 years	75	7.3
	11-15 years	16	1.6
	16-20 years	13	1.3
	21 years and over	6	0.6
Monthly Income	0-5500 tl	892	87
	5501 tl and over	133	13

Of respondents, 71.5% (n=733) were female and 94.6% (n=970) were single. Respondents were mostly between the ages of 19-25, comprising 82.1% (n=842). For education, 59.5% (n=610) of them were high school graduates. Looking at the distribution of occupations, 88.3% (n=905) were students and 11.7% (n=120) were academics/administrative staff. The highest duration of employment 89.3% (n=915) was 0–5 years. In terms of economic status, most participants had income of minimum wage or less 87% (n=892).

TABLE 2 DESCRIPTIVE VALUES FOR THE SUB-DIMENSIONS OF THE VARIABLES

Subdimensions	N	Minimum	Maximum	Mean	Std.deviation
Health literacy					
Access	1025	1.00	5.00	3.76	0.82
Understanding	1025	1.00	5.00	3.75	0.73
Appraisal	1025	1.00	5.00	3.70	0.72
Application	1025	1.00	5.00	3.71	0.81
Health perception					
center of control	1025	1.00	5.00	2.46	0.95
Certainty	1025	1.00	5.00	2.95	0.86
Importance of health	1025	1.00	5.00	3.36	1.04
Self-awareness	1025	1.00	5.00	3.23	0.97
Multidimensional trust					
Trust in Health Care Providers	1025	1.00	5.00	3.32	0.59
Trust in Health Care Payers	1025	1.00	5.00	3.17	0.76
Trust in Health Care Institutions	1025	1.00	5.00	3.21	0.80

Additionally, the values for subscales related to the variables were also examined in the study, as shown in Table 2. According to the table, the access to information subscale had highest mean score (3.76), and lowest mean score was for the control center (2.46) subscale. Additionally, standard deviation values varied between 0.76 – 1.04.

The correlations between the subscales are shown in Table 3. Values between 0.00-0.30 indicate a low level relationship, values between 0.30-0.70 indicate a medium level relationship and values between 0.70-1.00 indicate a high level of relationship [20]. There were significant and moderate relationships between all subscales of health literacy and all subscales of health perception. Additionally, there were moderate and significant relationships between the subscales of health literacy and the subscales of multidimensional trust in health services. Finally, significant and positive relationships were found between the subscales of health perception and the subscales of trust in health services. According to these results, there were positive and significant relationships between almost all subscales at the 95% confidence level ($p < 0.001$; $p < 0.05$).

TABLE 3 CORRELATIONS BETWEEN THE SUBSCALES OF HEALTH LITERACY, HEATH PERCEPTION AND MULTIDIMENSIONAL TRUST IN HEALTH SERVICES

Subscales	1	2	3	4	5	6	7	8	9	10	11
Access (1)	1	0.60**	0.56**	0.46**	-0.54**	-0.63**	0.55**	0.54**	0.42**	-	-
Understanding (2)	-	1	0.49**	-0.56**	-0.21**	0.34**	0.42**	0.33**	0.68**	-	-
Appraisal (3)	0.52**	0.56*	1	0.55**	-	-0.44**	0.36**	0.33**	0.31**	-	-
Application (4)	0.61**	0.59**		1	-0.55**	-0.78**	0.42**	0.33**	0.69**	-	-

center of control (5)	1	0.46**	-	-	0.70**
	0.67**	0.76**			
Certainty (6)	1	0.66*	0.57*	0.49*	*0.62**
	0.79**				
Importance of health (7)	1	0.50**	0.31**	0.58**	
	0.58**				
Self-awareness (8)	1	0.37**	0.32**		
	0.45**				
Trust in Health Care Providers (9)	1	0.41**			
	0.35**				
Trust in Health Care Payers (10)	1				
	0.43**				
Trust in Health Care Institutions (11)	1				

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed). **p<.01; * p<.05

The correlation values for the relationships subject to the hypothesis were examined. There was a positive, significant and low correlation ($r=0.55$; $p<0.001$) between health literacy and health perception. There were positive, significant and moderate correlations between health literacy and multidimensional trust in health services ($r=0.61$; $p<0.001$), and between health perception and multidimensional trust in health services ($r=0.38$; $p<0.001$). When these relationships are examined, the correlation coefficients were considered sufficient for hypothesis testing.

TABLE 4 MULTIPLE REGRESSION ANALYSIS RESULTS

Variables	B	Standart error	β	t	p	VIF
Multidimensional trust in health care	2.17	0.13	15.80	0.000		
Health perception	0.26	0.03	0.26	8.50	0.000	1.00
Health literacy	0.07	0.02	0.08	2.70	0.007	1.00
R=0.27 R ² =0.07 Adjusted R ² :0.07 F=39.75 Durbin Watson=1.68						
DF (2, 97) p-value: < 2.2e ⁻¹⁶						

Multiple linear regression analysis was applied to understand the relationship between health literacy, health perception and multidimensional trust in health services, and results are presented in Table 4. The effect of health perception on multidimensional trust in health services was significant ($B=0.261\pm0.031$; $\beta=0.262$; $p=0.000 <0.05$). H1 was accepted. Additionally, the effect of health literacy on multidimensional trust in health services was also significant ($B=0.072\pm0.026$; $\beta=0.083$; $p=0.007 <0.05$). H2 was accepted. Finally, health literacy had a significant impact on health perception ($B=0.192\pm0.020$; $\beta=0.272$; $p=0.000 <0.05$). H3 was also accepted.

According to the table, the contributions of health perception and health literacy to multidimensional trust in health services were significant (Adjusted R^2 : 0.073; $F=39.75$; $p<0.05$). The power of health perception and health literacy to explain multidimensional trust in health services was 7%. Although this value is low, it is significant as $p<0.05$. This indicates that health literacy is a partial mediator variable between health perception and multidimensional trust in health services. H_4 was accepted.

ANOVA and t-test were applied to understand whether there was a significant difference in multidimensional trust in health services, health perception and health literacy according to demographic characteristics. When the difference levels due to the participants' ages were examined, age did not make a significant difference to health literacy ($F=1.74$; $p>0.05$). There were notable differences in health perception ($F=5.73$; $p<0.05$) and multidimensional trust in health services ($F=3.27$; $p<0.05$). The Tukey test was used for health literacy and multidimensional trust in health services, and the Games-Howell test was used for health perception to understand the cause of the difference.

In cases where 'N' varies between groups with heterogeneous variances, the Games-Howell method is one of the most robust methods [21]. Participants in the 1-18 age range ($X=3.68$) had higher confidence in health services than individuals between the ages of 19-25 ($X=3.22$) and individuals between the ages of 26-35 ($X=3.22$). Additionally, the health perceptions of respondents aged 19-25 ($X=2.98$) were higher than individuals aged 26-35 ($X=3.14$).

In addition to this, health literacy was notably different according to gender ($t=2.94$; $p<0.05$). The health literacy of female participants ($X=3.77$) was higher than male participants ($X=3.65$). Health perception did not differ significantly based on gender ($t=0.10$; $p>0.05$). Additionally, multidimensional trust in health services did not differ significantly by gender ($t=-0.39$; $p>0.05$). Difference in terms of marital status were examined for the variables.

DISCUSSION

There is still a lack of information about the long-term effects of COVID-19, which may have consequences not only for individuals, but may also affect the functioning of the entire population [22].

When the pandemic emerged, some issues took priority in health. Health literacy globally became important for the prevention of communicable and noncommunicable diseases. Secondly, individual preparation gained importance as much as the preparation of the system [3]. During the pandemic, myths and misinformation greatly worried the public. People with higher health literacy are thought to have better perception of health information [23]. In a study by Yiğitalp, Değer, and Çifçi (2021) [24], 80.7% of the participants had a relatively low level of health literacy. As a result of the study, older people and those with low educational levels had higher health literacy scores. Additionally, there is a positive relationship between health literacy levels and health perception. Moreover, Fransen et al. (2015) [25] investigated the relationship between health perceptions of diabetes patients and health literacy. There was a notable relationship between health perceptions and low literacy.

In a study by Bayrak Kahraman et al. (2022) [26], the health perceptions of older participants were found to be moderate, while health literacy was low. This research showed that there is a relationship between health perception and health literacy in the elderly. Additionally, Say Şahin et al. (2018) [27] determined that the relationship between health perception subscales and health literacy subscales was significant. These results show that health literacy is a significant factor for health perception. Bayık Temel and Çimen (2017) [28] examined the relationship between health literacy and health perception in older individuals with chronic diseases and the factors affecting health literacy.

According to the results of the research, as the perceived health level increased, the literacy level of individuals also increased. Moreover, the implementation of health literacy at national and local levels can increase trust in doctors and the health system. A study by Tsai et al. (2018) [29] showed that health literacy is related to trust in health services. Dawson-

Rose et al. (2016) [30] revealed there was a relationship between health literacy and trust in health services in a study about the care of patients with HIV.

Differences in findings across studies may be partly explained by variations in sample characteristics, age distributions, socioeconomic contexts, and measurement approaches. Studies focusing on older or more socioeconomically diverse populations may report different patterns of health perception, health literacy, and trust compared to research conducted among younger and educated groups. Therefore, seemingly contradictory results in the literature may reflect contextual and demographic differences rather than true inconsistencies.

The findings of this study should also be interpreted within the context of the Turkish healthcare system. Türkiye has a predominantly publicly funded and centrally organised health system, which played a critical role during the COVID-19 pandemic through nationwide coordination, standardised health messaging, and extensive public health interventions [31]. Such structural characteristics may influence individuals' trust in health services, particularly among younger and educated populations who were highly exposed to pandemic-related information and digital health communication. Therefore, the observed relationships between health literacy, health perception, and trust in health services may partly reflect the institutional and cultural context in which healthcare is delivered in Türkiye.

This study has several limitations. The sample primarily consisted of young and student populations, which limits the generalisability of the findings to older age groups or individuals with different socioeconomic backgrounds. However, younger and educated populations represent a critical group in post-pandemic digital health environments, as they are highly exposed to health information, digital health services, and online communication channels. Understanding the dynamics of health literacy, health perception, and trust within this group provides valuable insight for designing targeted health communication strategies and interventions in future public health crises. Future studies could benefit from more diverse samples to further explore these relationships across different ages, education, and income groups.

PRACTICAL IMPLICATIONS

The findings of this study offer several practical implications for health service management and policy making in the post-pandemic period. First, health literacy should be considered a strategic component of public health preparedness. Strengthening individuals' ability to access, understand, evaluate, and apply health information may contribute not only to improved health perceptions but also to enhanced trust in health services during times of crisis.

Second, trust-building strategies in healthcare systems should extend beyond service delivery to include transparent communication, consistent messaging, and accessible digital health information, particularly for younger and educated populations who are highly engaged with online health content.

Finally, the results suggest that universities and similar institutions can play a key role in promoting health literacy and trust by serving as platforms for targeted health communication and education initiatives. Integrating health literacy-focused interventions into institutional health policies may enhance societal resilience and trust in health systems in the face of future public health emergencies.

CONCLUSION

The COVID-19 pandemic has changed many aspects of healthcare, including trust in health services, health perception, and health literacy. This study demonstrated significant relationships between health literacy, multidimensional trust in health services, and health perception among a predominantly young and educated population. The findings highlight that health literacy not only directly influences trust in health services but also partially mediates the relationship between health perception and trust.

From a health management perspective, these results underline the importance of incorporating health literacy into public health strategies, particularly during periods of uncertainty such as pandemics. Strengthening transparent

communication and improving access to reliable health information may contribute to building and sustaining trust in health systems. Fostering health literacy through institutional and policy-level initiatives may enhance societal preparedness and resilience in the face of future public health emergencies.

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DATA AVAILABILITY

The Research Ethics Board has approved the sharing of data based on predefined criteria. To submit a request to acquire this data, contact the author at arzu.kursun@giresun.edu.tr describing the reason(s) why you would like access to the data and how you intend to use them. If a request is approved by the author, the data will be made available to the requestors.

ETHICS APPROVAL

Before the research, ethics committee permission was obtained from Giresun University Social, Science and Engineering Sciences Research Ethics Committee with the decision numbered 17287 and dated 07/04/2021 and numbered 9/17. Verbal consent was obtained from the participants.

CONFLICT OF INTEREST STATEMENT

The author has no conflicts of interest to disclose.

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RE-INFECTION AND SIDE EFFECTS AFTER COVID-19 VACCINATION: A CROSS-SECTIONAL STUDY FROM IRAN

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ABSTRACT

BACKGROUND:

The effectiveness of vaccination as one of the management strategies of the COVID-19 pandemic should be investigated and its results should be considered as a lesson learned in facing future crises.

OBJECTIVES:

This study was conducted determining the rate of reinfection with COVID-19 after vaccination and the side effects of vaccination.

METHODS:

In this cross-sectional descriptive study, 351 employees who had undergone corona vaccination were examined by available a random sampling method. To collect data, a personal profile form and a researcher-made questionnaire were used.

RESULTS:

About 42% of the employees were infected before the injection of the vaccine, and the rate of COVID-19 after the injection of the first dose, the second dose and the booster dose was 16%, 19.1% and 14.8% respectively. 24% of the samples did not report any side effects after the vaccine injection, but other people reported the most common side effects as "fever and sweating" (42.5%), "weakness" (38.5%), "headache" (33.6%) and "injection site pain (32.8%)" reported.

CONCLUSIONS:

The main side effects reported were general symptoms and the body's response to the corona vaccine injection, which is the case for many other common disease vaccines. But the remarkable thing about the reported side effects is that the frequency of common side effects reported in the third dose has decreased compared to the first and second doses.

KEYWORDS

Vaccination, Re-infection, COVID-19, Side effects

INTRODUCTION

The COVID-19 pandemic, since its onset in December 2019, has created various challenges for the public and healthcare providers. Challenges such as significant mortality, lack of recognition of the disease and how to deal with it, lack of personal protective equipment etc [1-4].

Among all the damages caused by this pandemic, it can be said that the high death rate in different countries during the periods of this pandemic was the most important and severe of these damages [5, 6]. According to the latest reports, the death rate due to infection with COVID-19 in the world [7] and in Iran [8] has been 6,946,336 and 146,580, respectively, since the beginning of the pandemic until December 2023.

In order to control the COVID-19 pandemic, various strategies were implemented, such as complete quarantine of cities, social restrictions, physical distancing, use of personal protective equipment, etc [5, 9]. The most effective strategy to control this pandemic was the production of the COVID-19 vaccine and the national vaccination program [6, 10, 11]. Vaccination programs in some developed countries started and continued at a higher rate compared to developing and underdeveloped countries [10, 12]. The result of this vaccination program was a significant reduction in the rate of infection and death due to COVID-19. In Iran, the vaccination program officially started on February 9, 2021, with the priority for health care providers [13].

The vaccination program has faced challenges despite significant progress in controlling the COVID-19 pandemic [14]. One of these challenges is people's opposition to the COVID-19 vaccine injection. In some studies, some reasons for opposition to vaccination have been reported, such as fear of short-term and long-term side effects of the vaccine, ineffectiveness of the vaccine and re-infection of the COVID-19 disease, mistrust of the vaccine production process, and cultural and religious reasons [1, 15, 16]. In previous studies, the most common side effects were fever, injection site pain, fatigue, headache, nausea and vomiting, and joint pain [17-20].

In the review of the literature, most of the studies were conducted on the immunogenicity of different types of vaccines and also in the form of clinical trials with the aim of the effectiveness of the vaccines [11, 21]. Meanwhile, investigating the side effects of the vaccine as well as re-infection of the COVID-19 disease after the vaccine has been given less attention as one of the reasons for not accepting the COVID-19 vaccine [22]. On the other hand, since the crises similar to the COVID-19 pandemic may challenge the human society again in the future, it is important to examine the strengths and weaknesses of the determined strategies.

OBJECTIVES:

The main objectives of this study were to determine the rate of COVID-19 re-infection after coronavirus vaccination and to identify the type and frequency of vaccine-related side effects among the employees of the University of Social Welfare and Rehabilitation Sciences in Tehran, Iran. Accordingly, this study specifically addresses the following research questions: (1) What side effects are experienced after COVID-19 vaccination among university employees? (2) What is the rate of COVID-19 re-infection following different doses of vaccination?

METHODS

STUDY DESIGN AND PARTICIPANTS

This cross-sectional descriptive study was conducted from December 2021 to March 2022 in Tehran. The research population included all employees of the University of Social Welfare and Rehabilitation Sciences. This university was established as one of the universities affiliated with the Ministry of Health of Iran in 1992 in the northern region of Tehran, the capital of Iran. This university is known as the hub of rehabilitation sciences in the country and has 22 educational departments, eight research centers, two specialized hospitals, and affiliated medical centers.

All university employees in administrative, therapeutic, and educational environments who met the inclusion criteria completed the questionnaire. Inclusion criteria were injection of the first and second dose of one of the Sputnik V, AstraZeneca, Sinopharm, Bharat, and Barekat (vaccine produced in Iran) vaccines, not having an acute disease with symptoms similar to COVID-19 or influenza.

From the community of two thousand university employees, 351 people were selected using the ratio formula and considering $P=50\%$ as the sample size. Based on the list received from the university's vice-chancellor for treatment, the names of all individuals who had received the coronavirus vaccine were sampled using a table of random numbers and simple random sampling, yielding a 100% response rate.

DATA COLLECTION INSTRUMENTS

A researcher-made questionnaire was used to collect data. The designed questionnaire has three main components, including 1) demographic characteristics (questions such as age, gender, education etc), 2) questions related to complications after vaccine injection (both mild/common side effects; such as fever, headache, injection site pain, fatigue, nausea and less common/severe symptoms; such as limb paralysis, bleeding, loss of consciousness), and 3) questions related to re-infection with COVID-19 disease after vaccine injection (addressing history of infection after vaccination, timing, number of episodes, and severity). For the validity of the questionnaire, the content validity method was used. In this way, the designed questionnaire was given to 10 faculty members and experts in the field of health, and their opinions about the questions were collected. Next, the CVR and CVI indexes were also calculated ($CVI=0.82$, $CVR=0.88$). Experts' opinions were raised in the meeting of the research team members, and finally, the necessary corrections were made, and the final version of the questionnaire was determined for data collection. In order to verify the reliability of the designed questionnaire, the test-retest method and the correlation coefficient were used. Based on this, the questionnaire was distributed among 20 participants and completed by them. After 14 days, the questionnaire was given to the same people again. Finally, after calculating the Pearson correlation coefficient ($r=0.83$), the reliability of the designed tool was confirmed.

PROCEDURE

After obtaining the necessary permits, the researchers went to the research environment. After explaining the study's objectives and ensuring the confidentiality of participants' information, the questionnaires were distributed to the sample population. After completing the questionnaires, they were reviewed, and incomplete items were removed.

ETHICAL CONSIDERATIONS

The study was approved by the ethics committee affiliated with the University of Social Welfare and Rehabilitation Sciences on 09/03/2022 (approval number "IR.USWR.REC.1400.316"). The participants signed an informed consent form before their participation. They were assured of the confidentiality of their data.

DATA ANALYSIS

The collected data were analyzed with IBM's SPSS (version 23) software. To describe and categorize data from descriptive statistics (frequency distribution, mean, and standard deviation) and for the relationship between demographic variables and the rate of re-infection with COVID-19, chi-square and t-tests, and Pearson's correlation coefficient at a significant level of $p<0.05$ were used.

RESULTS

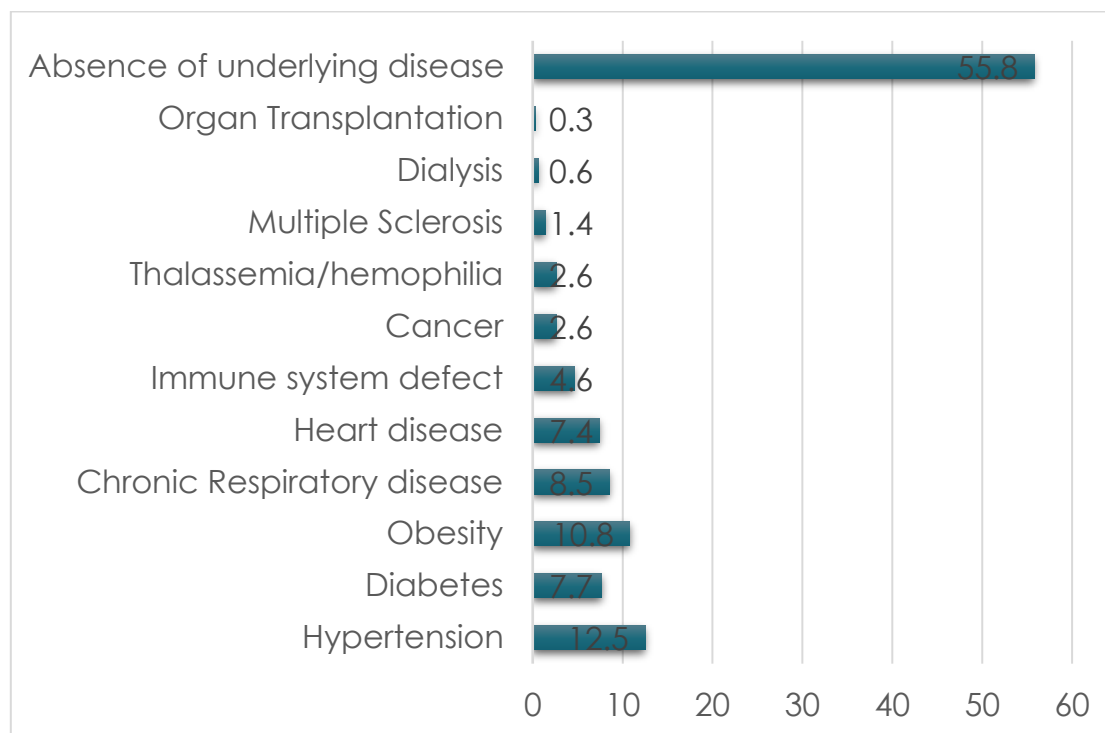
BACKGROUND CHARACTERISTIC

The data included 351 people, 43% of whom were men, with an average age of 39.9 ± 9.9 years. More than 70% were married, and the majority had a bachelor's degree. Approximately 64% of the participants were working at Razi Hospital, and more than 62% reported encountering a COVID-19 patient (Table 1). More than 55% of the participants did not have any underlying disease, and the most common underlying disease was hypertension. Obesity and chronic respiratory disease had the next highest prevalence rates (Figure 1). The relationship between each of these diseases and contracting COVID-19 after vaccination was not significant for any of them (p -value > 0.05).

TABLE 1: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

Variable	Label	N (%)
Gender	Female	200(57)
	Male	151(43)
Marriage status	Married	247(70.37%)
	Single	91(25.9)
	Divorced	5(1.4)
	Widow	2(0.6)
Education	Elementary	8(2.3)
	Diploma	55(15.7)
	Bachelor	147(41.9)
	Master	99(28.2)
	Doctorate	7(2)
	Ph.D.	33(9.4)
Place of activity	Campus of the university	58(16.5)
	Razi Hospital	226(64.4)
	Rofaydeh Hospital	31(8.8)
	Asma rehabilitation center	16(4.6)
	Nezam mafi clinic	20(5.7)
Exposure to the COVID-19 patient	Yes	220(62.7)
	No	128(36.5)
Name of Vaccine	Sputnik V	129(36.8)
	Oxford AstraZeneca	131(37.3)
	Sinopharm	71(20.2)
	Baharat	11(3.1)
	Barekat (Iranian vaccine)	9(2.6)

FIGURE 1: DISTRIBUTION OF UNDERLYING HEALTH CONDITION (PERCENTAGES %)



SIDE EFFECTS OF COVID-19 VACCINES

About 76% (CI: 71.3–80.4%) of the participants experienced side effects after receiving the first dose of the vaccine, and the most common side effects were fever and sweating, followed by weakness, headache, and pain at the injection site. After receiving the second and booster doses of the vaccine, nearly 75% (CI: 69.2–78.6%) and 77% (CI: 72.5–81.5%) of participants, respectively, reported vaccine side effects. Less than 1% of the samples, after receiving the second dose of the vaccine, experienced limb paralysis, and more than 42% reported fever and sweating as the most common complications experienced. As with the first and second doses, the most common side effects after receiving the booster dose were fever and sweating, and weakness and chills were the next most common. Limb paralysis, blurred vision and bleeding were the least reported side effects after receiving the booster dose. Figure 2 and Table 2 illustrate the distribution of side effects associated with COVID-19 vaccines.

FIGURE 2: DISTRIBUTION OF SIDE EFFECTS OF COVID-19 VACCINES (PERCENTAGE)

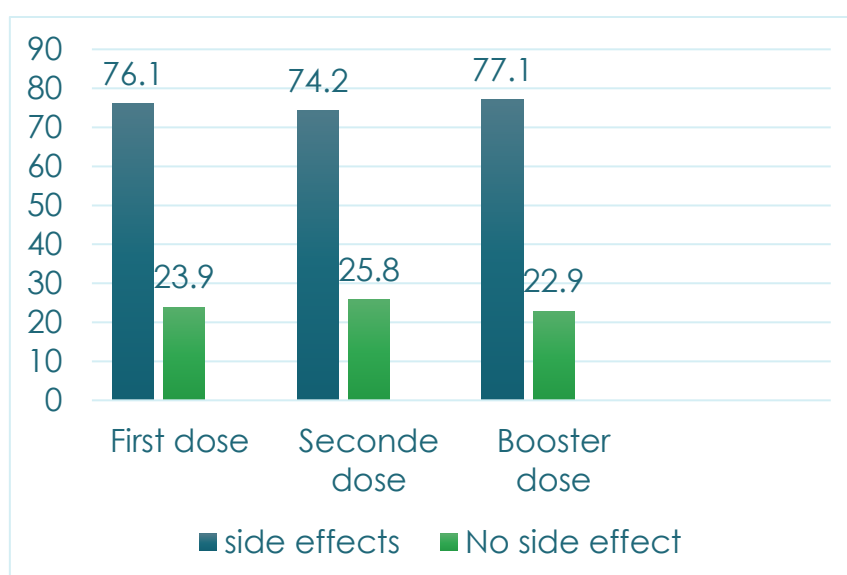


TABLE 2: DISTRIBUTION OF SIDE EFFECT OF COVID-19 VACCINES.

Side effect	N	First dose %(CI)	N	Second dose %(CI)	N	Third dose %(CI)
Fever and sweating	149	42.5 (37.2 - 47.8)	149	42.5 (37.2 - 47.8)	82	23.4 (19.0 - 28.1)
weakness	134	38.2 (33.1 - 43.5)	134	38.2 (33.1 - 43.5)	80	22.8 (18.5 - 27.5)
Headache	118	33.6 (28.7 - 38.8)	118	33.6 (28.7 - 38.8)	56	16.0 (12.3 - 20.2)
Injection site pain	115	32.8 (27.9 - 37.9)	83	23.6 (19.3 - 28.4)	55	15.7 (12.0 - 19.9)
Shivering	98	27.9 (23.3 - 32.9)	98	27.9 (23.3 - 32.9)	66	18.8 (14.9 - 23.3)
Body pain	62	17.7 (13.8 - 22.1)	62	17.7 (13.8 - 22.1)	24	6.8 (4.4 - 10.0)
Nausea	35	10.0 (7.0 - 13.6)	35	10.0 (7.0 - 13.6)	26	7.4 (4.9 - 10.7)
Body numbness	33	9.4 (6.6 - 12.9)	33	9.4 (6.6 - 12.9)	15	4.3 (2.4 - 7.0)
Chest pain	29	8.3 (5.6 - 11.7)	29	8.3 (5.6 - 11.7)	8	2.3 (1.0 - 4.4)
Shortness of breath	26	7.4 (4.9 - 10.7)	26	7.4 (4.9 - 10.7)	24	6.8 (4.4 - 10.0)
Skin lesions	17	4.8 (2.8 - 7.6)	17	4.8 (2.8 - 7.6)	10	2.8 (1.4 - 5.2)
Blurred vision	11	3.1 (1.6 - 5.5)	11	3.1 (1.6 - 5.5)	3	0.9 (0.2 - 2.5)
Diarrhea	10	2.8 (1.4 - 5.2)	10	2.8 (1.4 - 5.2)	5	1.4 (0.5 - 3.3)
Bleeding	6	1.7 (0.6 - 3.7)	6	1.7 (0.6 - 3.7)	4	1.1 (0.3 - 2.9)
loss of consciousness	4	1.1 (0.3 - 2.9)	4	1.1 (0.3 - 2.9)	0	0.0 (0.0 - 0.0)
Paralysis	3	0.9 (0.2 - 2.5)	3	0.9 (0.2 - 2.5)	2	0.6 (0.1 - 2.0)

Rare events (paralysis, bleeding, loss of consciousness) were self-reported and not clinically confirmed.

RE-INFECTION AFTER VACCINATION COVID-19

About 42% of the participants were infected with COVID-19 disease before the vaccine injection, and the statistics of COVID-19 infection after receiving the 1st, 2nd and 3rd doses were 16%, 19.1% and 14.8%, respectively (Table 3). Survival analysis was used to estimate the probability of the occurrence of COVID-19 in each of the time intervals obtained from the interval between the injection of the vaccine and the occurrence of COVID-19. Also, the probability of occurrence was calculated and reported separately for vaccines injected in doses up to the third dose. The probability of cumulative incidence of COVID-19 after the first dose of vaccine (independent of the type of vaccine) has been shown in the studied sample. Based on this, the probability of cumulative occurrence of COVID-19 in the first 10 days after the injection of the first, second and booster doses of the vaccine is equal to 38%, 18% and 15%, respectively. Figure 3-5 show the time of infection with COVID-19 (days) after injection of doses of vaccine.

TABLE3: FREQUENCY DISTRIBUTION OF COVID-19 INFECTION IN PARTICIPANTS

COVID-19 infection	Before injection of vaccine N (%)	After injection/first dose N (%)	After injection/second dose N (%)	After injection/booster dose N (%)
Yes	151(43)	56(16)	67(19.1)	52(14.8)
No	200(57)	294(84)	282(80.9)	299(85.2)

FIGURE 3: TIME OF INFECTION WITH COVID- 19 (DAYS)/FIRST DOSE

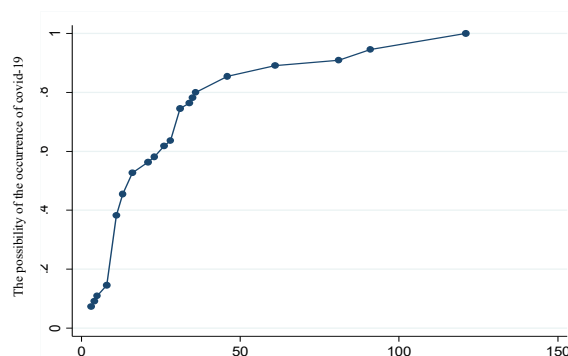


FIGURE 4: TIME OF INFECTION WITH COVID-19 (DAYS)/SECOND DOSE

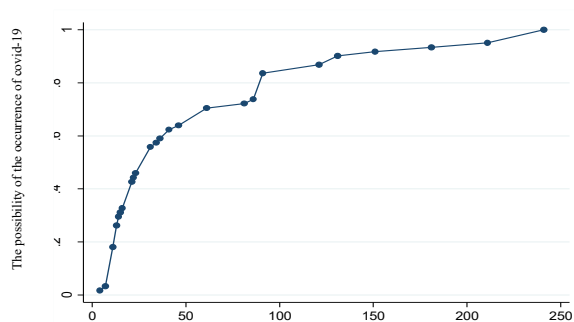
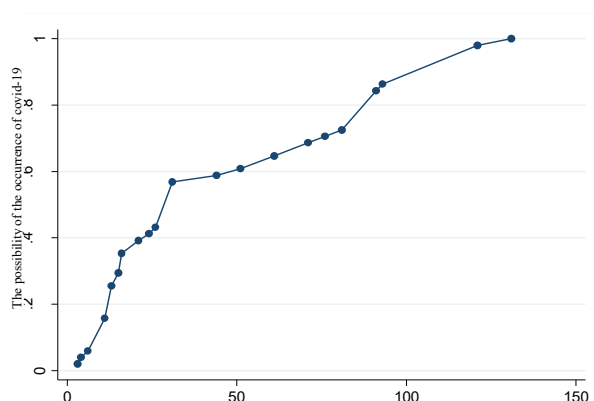


FIGURE 5: TIME OF INFECTION WITH COVID-19 (DAYS)/BOOSTER DOSE



DISCUSSION

This study was conducted with the aim of determining the rate of re-infection with COVID-19 after coronavirus vaccination and the side effects of vaccination among the employees of the University of Social Welfare and rehabilitation Sciences in 2022. In line with the general aim of the study, the findings showed that 42.7% of the samples had a history of COVID-19 disease before injecting the coronavirus vaccine. In the following, 16%, 19.1%, and 14.8% of the samples were infected with COVID-19 after the first dose, second dose, and third dose of the vaccine, respectively.

In addition, in the analysis carried out, the survival analysis of the probability of cumulative occurrence of COVID-19 after the first dose of vaccine (independent of the type of vaccine) in the studied sample showed that the probability of cumulative occurrence of COVID-19 in the first 10 days after the injection of the vaccine has it is important (38%). This finding shows that the first dose of the vaccine, regardless of its type, cannot have an acceptable immunity in preventing the infection of COVID-19. On the other hand, the cumulative probability of getting infected with COVID-19 after the second dose of the vaccine within 10 days after injecting the second dose of the vaccine, regardless of its type, should be significantly reduced (infection rate 18%). Also, this probability is within 10 days after the injection. The booster dose (the third dose) also decreases further (15%). In explaining the above findings, it can be stated that the completion of the COVID-19 vaccination, regardless of the type of vaccine, has been able to reduce the rate of infection or re-infection with COVID-19 in the population covered by the vaccination.

However, the cumulative probability of contracting COVID-19 within 10 days after the injection of different types of vaccines in the first dose is different from each other, so this probability is higher for the Sinopharm vaccine compared to other vaccines and lower for the AstraZeneca vaccine. On the other hand, the cumulative probability of getting infected with COVID-19 within 10 days after the injection of the second dose and booster vaccine is not much different among

different types of vaccine. Based on this, it is not possible to conclude which of the types of vaccines are more effective and immunogenic compared to other types of COVID-19 vaccines, but it can be concluded that completing the course of COVID-19 vaccination can significantly reduce the risk of contracting COVID-19. Babamahmoudi et al. (2021) have stated that in 90% of health service providers who injected both doses of the Sputnik vaccine, a high level of immunogenicity was observed in the immunometric tests of these people [13]. Menni et al. (2022) also reported that people have the highest level of immunogenicity in the prevention of COVID-19 within 5 months after the injection of the main doses of Pfizer, AstraZeneca, and Moderna vaccines [23].

The findings of the study showed that 24% of the samples did not report any side effect after the injection, but the other samples experienced various types of side effects following the injection of the vaccine. "Fever and sweating" was the most common side effect reported after the injection of the first, second, and booster doses. Also, the side effects of "weakness", "headache" and "injection site pain" were the most common side effects in the first dose of corona vaccine. In addition, "shivering", "headache", "weakness", "chilling" and "injection site pain" were the most common side effects reported in the second dose of the vaccine. Finally, in the third dose of corona vaccine, the side effects of "weakness", "shivering" and "injection site pain" were reported as the most common side effects. Compared to other studies that have investigated the side effects of coronavirus vaccines, similar results are seen. Babamahmoudi et al. (2021) reported the most common side effects after the injection of the coronavirus vaccine in the order of pain at the injection site, weakness, body pain, headache, and fever [13]. Aznab et al. (2023) also investigated the side effects of the coronavirus vaccine in cancer patients, and the most common side effects were fever, injection site pain, dizziness, body pain, and headache, respectively [24]. Yasmin et al. (2022) also reported in their study among young Pakistanis, that the most common side effects of various corona vaccines, including Sinovac, Sinopharm, and Moderna, were pain at the injection site, muscle weakness, headache, fever, and fatigue, respectively [25]. Duva et al. (2023) in determining the complications after the corona-vaccine injection in Ethiopia, reported the most common complications after the corona-vaccine injection in the order of fever, headache, fatigue and weakness, injection site pain, and nausea [18].

In explaining the findings from the analysis of the side effects reported after the vaccine doses, it seems that the main side effects reported were general symptoms and the body's response to the coronavirus injection, which is the case for many other common disease vaccines. But the remarkable thing about the reported side effects is that the frequency of common side effects reported in the third dose has decreased compared to the first and second doses.

In the implementation of any study, there are some limitations that should be considered. In this study, the main limitation was the self-completion of the questionnaire and self-reporting of side effects, which may introduce recall or reporting bias. Additionally, the study was conducted on a sample of 351 employees using available random sampling, which may limit the generalizability of the findings to the broader population. The sample size and specific characteristics of the participants might not fully represent all demographic or occupational groups, and therefore, the results should be interpreted with caution.

CONCLUSION

The results of this study, like those of other research conducted on the COVID-19 vaccine, indicate that the vaccine is safe and can reduce the risk of contracting COVID-19. Additionally, receiving both doses of the vaccine will induce immunity, and receiving only one dose alone will not reduce the risk of infection. Also, the most common side effects reported after injection were "fever and sweating", "body weakness", "headache", and "injection site pain".

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TELEMEDICINE IN ELDERLY CARE: TRENDS, CHALLENGES, AND FUTURE DIRECTIONS

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ABSTRACT

BACKGROUND:

Telemedicine is transforming elderly care by enhancing accessibility, optimizing chronic disease management, and increasing healthcare efficiency. However, significant disparities in research funding, infrastructure development, and policy execution continue to hinder its widespread and equitable adoption.

OBJECTIVE:

This study conducts a comprehensive bibliometric analysis of global research on telemedicine in elderly care, identifying key trends, research gaps, and future opportunities. Unlike previous studies, it systematically maps global research collaborations, thematic research clusters, and persistent barriers to equitable telemedicine adoption, offering insights for decision-makers.

METHODS:

A scoping review and bibliometric analysis were conducted using Scopus, analyzing 862 peer-reviewed articles. Co-occurrence mapping, Betweenness Centrality, and Freeman Degree analyses were used to identify dominant research themes and emerging trends.

RESULTS:

Findings reveal a threefold increase in telemedicine research post-2014, peaking during COVID-19. Anglo-Saxon countries dominate research output, with significant regional disparities. Thematic clustering identified four core areas: 1) Healthcare access and demographics; 2) Institutional integration and nursing homes; 3) COVID-19's impact on telemedicine; 4) Gender disparities in elderly care research. Despite rapid advancements, critical challenges remain, including digital literacy gaps, financial constraints, and policy fragmentation.

CONCLUSIONS:

Telemedicine is a game-changer for elderly care, but without targeted policy reforms and infrastructure investments, its potential remains underutilized. This study provides data-driven insights for governments, healthcare providers, and nursing homes to bridge these gaps and ensure a more equitable future for digital healthcare.

KEYWORDS

telemedicine, elderly care, digital health, bibliometric analysis, healthcare access, remote monitoring, chronic disease management, geriatric healthcare.

INTRODUCTION

Healthcare systems worldwide are undergoing rapid digital transformation, with telemedicine emerging as a critical solution for addressing the complex and evolving healthcare needs of aging populations. The COVID-19 pandemic significantly accelerated this transition, aligning with broader trends in artificial intelligence, cloud computing, and 5G connectivity, key drivers of enhanced healthcare efficiency and accessibility [1]. Egypt's national telemedicine program exemplifies these advancements [2].

As digital innovations continue to evolve, telemedicine provides tailored solutions for elderly patients, mitigating mobility constraints and improving chronic disease management through remote monitoring and personalized care [3-5]. It delivers medical services remotely, synchronously, or asynchronously, supported by Information and Communication Technology (ICT) [6]. The widespread adoption of virtual healthcare platforms by clinics, hospitals, and governments has enhanced service delivery and efficiency, yet challenges remain in ensuring equitable access to these services across different regions [7].

Despite its rapid expansion, telemedicine adoption remains uneven. North America and Europe lead research output in this field, whereas many low- and middle-income countries face significant barriers, including infrastructure limitations and digital literacy gaps [8, 9]. This imbalance not only affects accessibility but also influences the implementation and effectiveness of telemedicine services.

In developed countries, where the elderly population is increasing alongside cases of chronic, low-urgency diseases [10], telemedicine has demonstrated its potential to reduce healthcare costs [8, 11]. However, further research is needed to enhance quality care for aging populations through e-health systems. While remote elderly care models integrate health monitoring devices linked to tablets and smartphones [6, 12, 13], their adoption remains limited due to economic constraints, privacy concerns, and varying levels of digital literacy among elderly patients.

The cost of acquiring necessary equipment and ensuring secure communication between medical staff and patients presents another challenge, as IT security measures such as encryption, compliance, and software updates contribute to rising expenses [31]. Additionally, intangible costs such as staff training and patient education remain critical for successful telemedicine adoption [14-17]. Without strategic investment in infrastructure and education, disparities in telemedicine access are likely to persist.

As the elderly population grows, investments in technology-driven healthcare solutions are expected to rise, driven by demand and advancements in wearable health monitoring devices [18]. While telemedicine research has made significant progress, certain gaps remain underexplored. One such area is gender disparities in telemedicine adoption among elderly patients. While differences in healthcare access and outcomes based on gender have been extensively studied, their specific impact on telemedicine usage in elderly populations remains unclear [19].

Understanding these nuances is essential for ensuring that digital healthcare solutions address the needs of all elderly individuals, regardless of demographic differences. A comprehensive understanding of global telemedicine research is necessary to guide future developments and address these gaps. Expanding literature underscores the importance of quantitative methods to track and synthesize findings in this field.

Bibliometric analysis offers an objective and repeatable approach to examining research output, collaboration networks, and the impact of healthcare policies [20]. Additionally, it provides valuable insights for researchers, healthcare administrators, and policymakers seeking to optimize telemedicine adoption [21, 22].

This study explores the evolving role of telemedicine in elderly care, focusing on its potential to enhance healthcare processes, improve resource management, and increase accessibility for aging populations. By synthesizing insights from existing studies, it provides a data-driven perspective on the development of telemedicine and its future directions.

Beyond its academic implications, bibliometric analysis helps uncover the social, political, and economic factors influencing telemedicine's growth and adoption [23]. In elderly care, telemedicine has been shown to improve service delivery and patient management, particularly in long-term care settings [24, 25].

This paper is structured as follows: Section 2 provides a comprehensive literature review, summarizing key studies on telemedicine in elderly care, highlighting existing challenges, and identifying gaps in research. Section 3 presents the data and methodology used for the analysis. Section 4 outlines the results, detailing the main trends, thematic clusters, and centrality measures identified through bibliometric analysis. Section 5 discusses the findings and their implications, while Section 6 offers practical recommendations for policymakers, healthcare providers, and researchers. Finally, Section 7 presents limitations and recommendations for future research.

THEORETICAL BACKGROUND

Telemedicine has evolved significantly over the past two decades, driven by technological advancements and the need for more efficient healthcare models. In the early 2000s, telecommunication technologies were introduced into patient care; however, adoption was restricted by infrastructure limitations [10]. With the rise of digital health platforms, telemedicine has expanded its role in managing chronic diseases, particularly among elderly populations [5]. The COVID-19 pandemic further accelerated this trend, prompting healthcare systems worldwide to adopt remote monitoring and virtual consultations as standard practices [15, 26, 27]. Despite these advancements, the long-term sustainability of telemedicine in elderly care remains a subject of ongoing research.

Several studies highlight the benefits of telemedicine in elderly care, particularly in improving accessibility and resource efficiency. Remote monitoring systems allow physicians to track patient health in real-time, reducing hospital visits and improving early detection of complications [12, 13, 28]. Cost-effectiveness is another key advantage, as telemedicine reduces the need for in-person consultations and optimizes healthcare resource allocation [8]. Additionally, studies indicate high levels of patient satisfaction, with elderly patients expressing comfort in using digital platforms for routine check-ups [4, 29]. However, the effectiveness of telemedicine varies based on technological infrastructure, digital literacy, and regional healthcare policies, factors that continue to create disparities in access [9].

While telemedicine presents numerous benefits, several challenges hinder its widespread adoption in elderly care. One significant barrier is the digital divide, particularly among low-income elderly populations who may lack the necessary technological literacy to navigate telemedicine platforms [30]. Additionally, data security concerns remain a critical issue, as telemedicine relies on digital health records that require strict encryption and compliance measures [31]. Financial constraints further limit implementation, especially in resource-limited settings where healthcare providers struggle to invest in telemedicine infrastructure [7]. Studies also highlight ethical concerns regarding the depersonalization of care, as remote consultations may lack the emotional connection found in traditional face-to-face interactions [16]. The economic sustainability of telemedicine remains uncertain, with researchers debating whether it can replace conventional healthcare models or should serve as a complementary service [32].

Despite the growing body of literature on telemedicine, certain research gaps persist. Most studies focus on the technological and financial aspects of telemedicine, while gender disparities in telemedicine adoption among elderly populations remain largely unexplored [19]. Additionally, while several bibliometric analyses have examined general trends in telemedicine research, few have specifically analyzed its evolution in elderly care [20].

Given the rapid expansion of digital healthcare, a comprehensive bibliometric analysis is needed to map global research trends, identify thematic gaps, and inform future research directions. This study aims to fill these gaps by systematically analyzing 862 peer-reviewed articles to provide a data-driven perspective on the role of telemedicine in elderly care.

MATERIALS AND METHODS

This study employs a scoping review and bibliometric analysis to systematically assess the evolution of research on telemedicine in elderly care. Given the breadth of the topic and the need to synthesize diverse sources, the study follows the PRISMA extension for scoping reviews [33]. This approach allows for a structured yet flexible methodology, ensuring comprehensive coverage while identifying key themes and gaps in existing research. A two-phase approach was adopted, beginning with a scoping review, followed by a bibliometric analysis, as conducted in prior studies [23, 34].

DATA COLLECTION AND SEARCH STRATEGY

The dataset for this study was retrieved from Scopus, one of the most comprehensive databases for peer-reviewed literature. The search query included a combination of relevant terms: ("telemedicine" OR "digital health" OR "e-health") AND ("elderly care" OR "long-term care" OR "geriatric care" OR "nursing homes" OR "skilled nursing facilities" OR "homes for the aged" OR "geriatric nursing"). The search was conducted on March 13, 2024, ensuring the inclusion of the most recent studies relevant to the field.

While other databases, such as Web of Science (WoS), were considered, Scopus was ultimately chosen due to its greater citation tracking coverage, robust keyword indexing, and extensive inclusion of digital health research. Unlike WoS, Scopus provides higher citation coverage and a more structured classification system, ensuring the accuracy of bibliometric indicators such as citation frequency, co-occurrence mapping, and network analysis. Other studies also support the use of Scopus as a single-source database to avoid inconsistencies and biases introduced by multi-database integration [35-37].

ELIGIBILITY CRITERIA

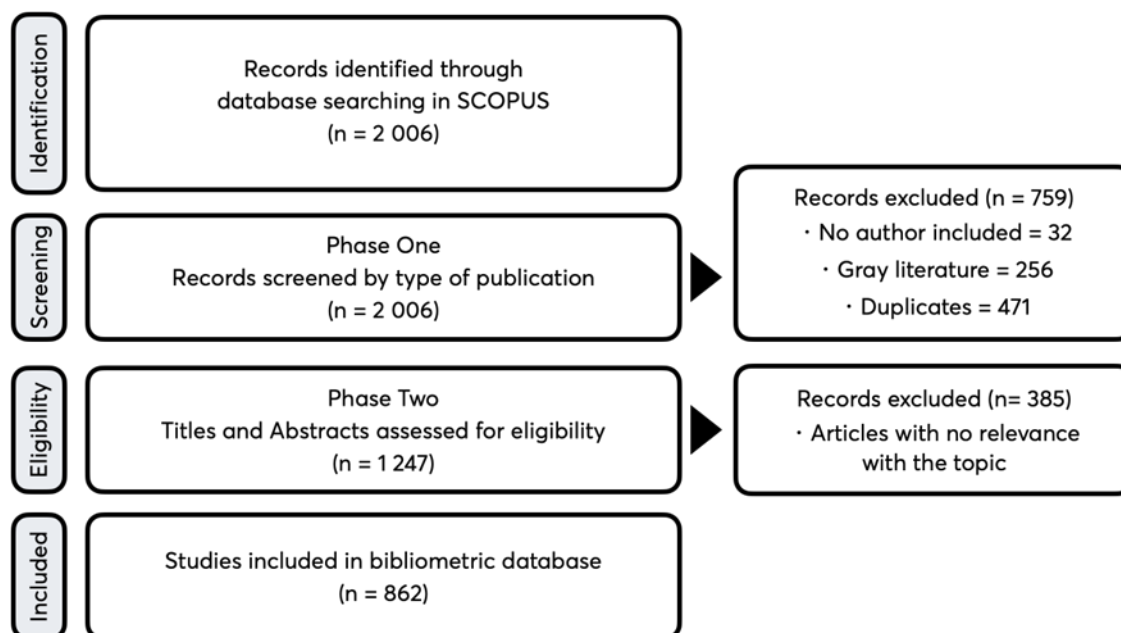
To ensure methodological consistency and relevance, specific inclusion and exclusion criteria were applied in selecting the articles. The study included peer-reviewed journal articles, reviews, and conference papers, as these provide validated and high-quality contributions to the field. Only articles published in English were considered, as English serves as the primary language for global research in digital health [38]. Studies that explicitly discussed telemedicine in elderly care were prioritized.

Grey literature (e.g., books, book chapters, reports, and conference abstracts) was excluded because peer-review and editorial practices are heterogeneous and the bibliographic metadata required for reproducible bibliometric mapping (e.g., abstracts, author keywords, affiliations, and reference lists) are often incomplete or not comparable across these sources.

In contrast, grey literature, such as books, book chapters, and conference abstracts, was excluded, as these sources lack standardized peer review, which is essential for maintaining methodological rigor. Additionally, non-English publications were excluded to avoid translation inconsistencies and to ensure uniform interpretation of keyword-based analyses. Studies that lacked an available abstract or author information were also removed from consideration. After manually reviewing article relevance, a total of 862 scientific articles were selected for bibliometric analysis.

Figure 1 illustrates the article selection process following PRISMA guidelines, detailing the number of studies retrieved, screened, and included in the analysis.

FIGURE 1 PRISMA FLOW DIAGRAM



BIBLIOMETRIC ANALYSIS AND STATISTICAL METHODS

The bibliometric analysis was conducted in three phases to examine research trends, keyword co-occurrence, and centrality measures.

The first phase involved a descriptive statistical analysis, which extracted data from Scopus, including publication trends, journal distribution, and research output by country. These statistical methods were aligned to ensure consistency [25]. The dataset was normalized and analyzed using Excel, which was used for data visualization and trend analysis. The second phase focused on keyword co-occurrence analysis to detect emerging themes and research clusters. The 100 most frequent keywords were identified and analyzed using Python's AI module, which processed abstracts from all 862 articles. To ensure data uniformity, all text from abstracts was converted to lowercase [30]. The co-occurrence matrix was then processed using VOSviewer, which generated visual network maps that highlight relationships between research topics.

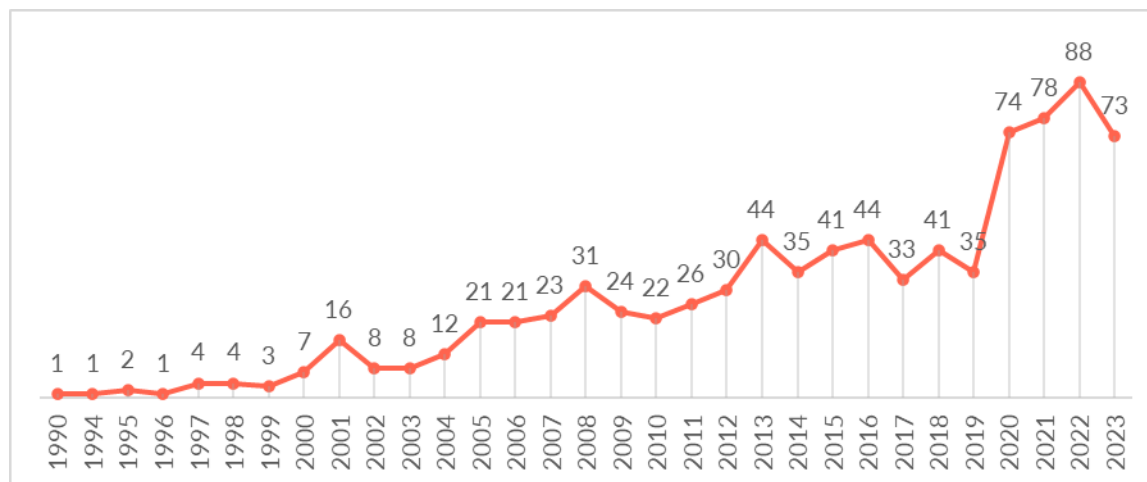
The third phase involved centrality measures, including Freeman Degree and Betweenness Centrality, to evaluate keyword significance. Freeman Degree was used to identify highly connected keywords, which reflect dominant research topics [39]. Betweenness Centrality was applied to determine bridge keywords, which link different research domains and indicate interdisciplinary trends [40]. The combined use of co-occurrence analysis and centrality measures allowed for a comprehensive understanding of thematic clusters and key areas driving telemedicine research.

RESULTS

TRENDS IN TELEMEDICINE AND ELDERLY CARE RESEARCH

The bibliometric analysis reveals a steady increase in telemedicine research focused on elderly care over the past two decades. As shown in Figure 2, research output has grown significantly since 2000, with a sharp increase after 2014, likely driven by advancements in digital health technologies. The most substantial spike in publications occurred between 2019 and 2022, corresponding to the COVID-19 pandemic, which accelerated the adoption of remote healthcare solutions. The increase in research highlights the growing interest in telemedicine as an alternative to in-person elderly care and its potential to improve healthcare accessibility.

FIGURE 2 ANNUAL PUBLICATIONS TREND (1990-2023)



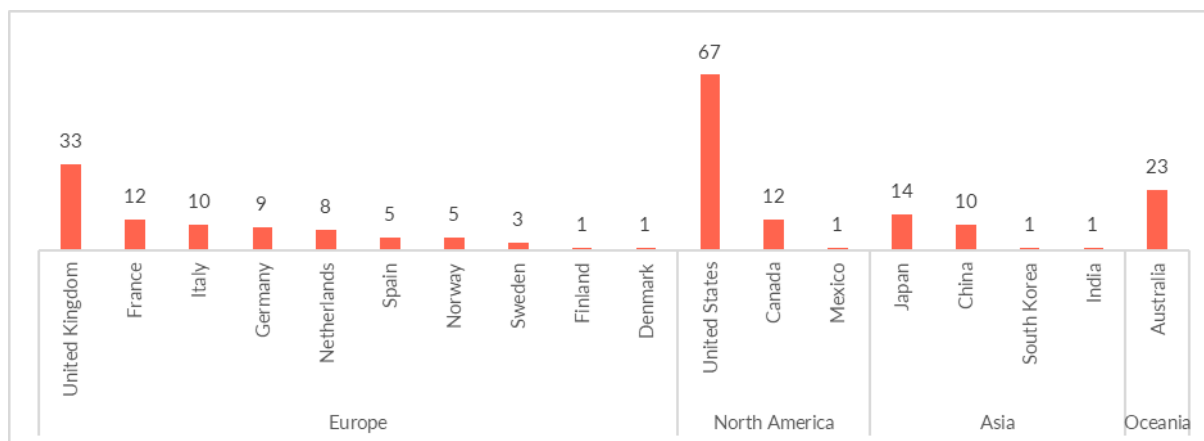
Note: Based on this research dataset

GEOGRAPHIC DISTRIBUTION OF RESEARCH OUTPUT

A geographical analysis of research mentions in abstracts identifies key regions leading telemedicine research. As shown in Figure 3, North America dominates, with the United States accounting for 67 mentions, reinforcing its leadership in digital health innovation. In Europe, the United Kingdom (33 mentions), France [12], and Italy [10] emerge as major contributors, reflecting the region's strong focus on technological healthcare solutions. Asia has also seen notable contributions, particularly from Japan (14 mentions) and China (10 mentions), while Australia (23 mentions) leads in Oceania.

These findings suggest that high-income countries continue to shape global research on telemedicine, while low- and middle-income countries remain underrepresented. This geographic disparity indicates a need for increased international collaboration to ensure that telemedicine solutions address global challenges, rather than being concentrated in wealthier regions. The geographic concentration of research in high-income countries suggests a lack of telemedicine studies from developing regions, which may impact the global scalability of digital health solutions.

FIGURE 3 GEOGRAPHICAL DISTRIBUTION OF THE STUDIES BY COUNTRY AND CONTINENTS



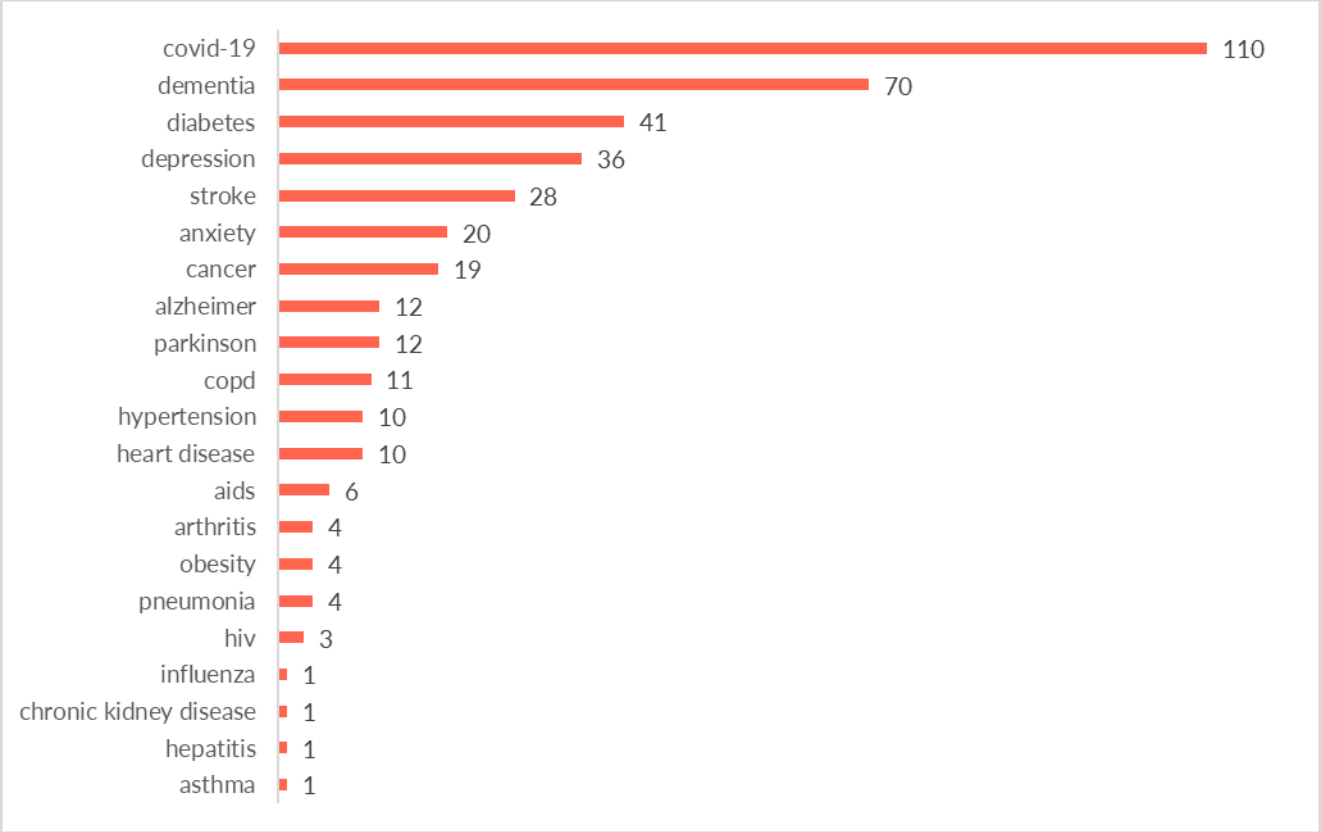
Note: Based on this research dataset

RESEARCH FOCUS: DISEASES AND HEALTHCARE CHALLENGES

Analysis of disease mentions in abstracts reveals that dementia and diabetes are the most frequently studied conditions in telemedicine-related elderly care, as shown in Figure 4. These findings align with broader trends in chronic disease management, reinforcing the role of telemedicine in monitoring long-term health conditions among the elderly. The research focus on dementia suggests a strong interest in cognitive health interventions, while diabetes research highlights the importance of remote monitoring technologies for chronic disease management. The high frequency of dementia

and diabetes studies indicates a growing emphasis on telemedicine's role in chronic disease management, particularly for elderly patients requiring long-term monitoring.

FIGURE 4 MOST FREQUENTLY IDENTIFIED DISEASES IN ABSTRACTS



Note: Based on this research dataset

THEMATIC CLUSTERS IN TELEMEDICINE RESEARCH

Keyword co-occurrence analysis identified four major thematic clusters, visualized in Figure 5, which highlight distinct research trends in telemedicine and elderly care. Together, these clusters illustrate how telemedicine research has evolved from broad accessibility concerns to more targeted areas, such as institutional care, pandemic-driven adoption, and demographic-specific disparities.

Cluster 1- Healthcare Access and Demographics: This cluster includes keywords such as "elderly care," "healthcare access," and "quality of life," reflecting the role of telemedicine in improving medical accessibility for aging populations.

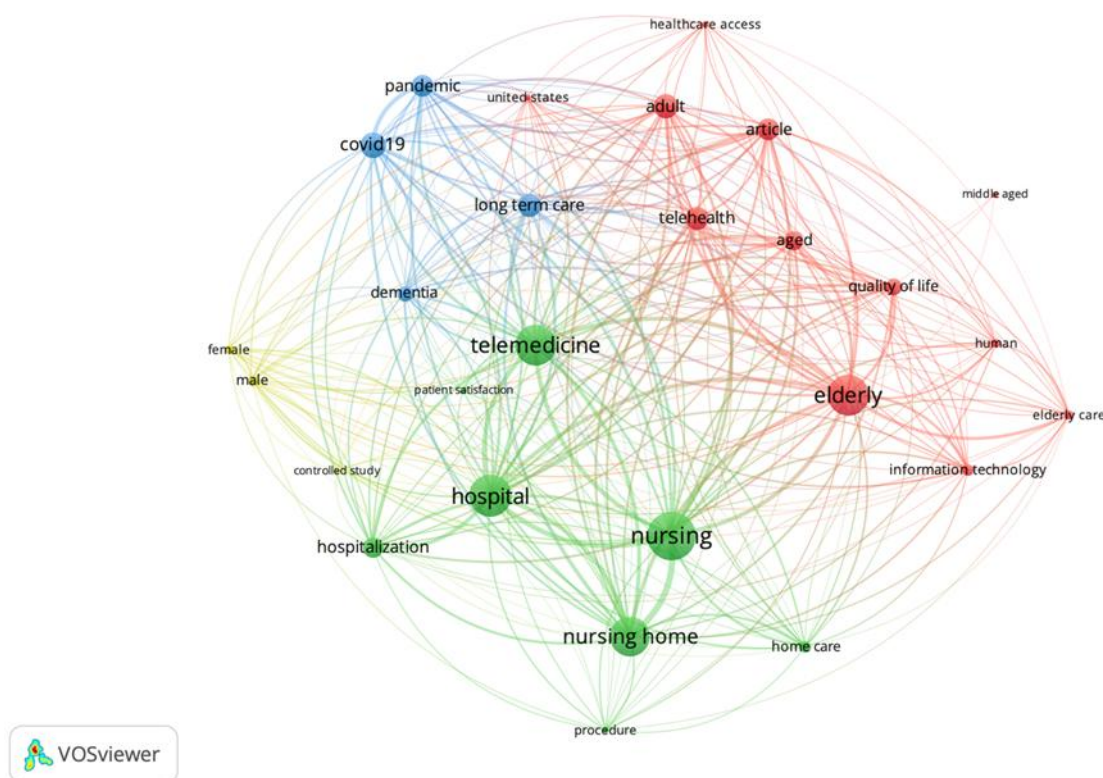
Cluster 2- Institutional Integration and Nursing Homes: This group focuses on hospitals, home care, patient satisfaction, and nursing home integration, showing telemedicine's growing role in long-term care facilities.

Cluster 3- COVID-19's Impact on Telemedicine: This cluster highlights pandemic-related terms, including "COVID-19," "long-term care," and "telemedicine," confirming that the pandemic significantly influenced telemedicine adoption.

Cluster 4- Gender Disparities and Controlled Studies: A smaller but significant cluster focuses on "controlled study," "female," and "male," indicating an emerging research interest in gender-based differences in telemedicine adoption.

These clusters collectively indicate that telemedicine research is evolving beyond general accessibility concerns to focus on specialized areas such as institutional care, pandemic-driven adoption, and demographic-specific disparities. This highlights the growing need for interdisciplinary collaboration to optimize digital health strategies for elderly populations.

FIGURE 5 TOP 40 KEYWORDS CO-OCCURRENCE NETWORK VISUALIZATION



CENTRALITY MEASURES: IDENTIFYING KEY RESEARCH TOPICS

To assess keyword significance and influence, we calculated Freeman Degree and Betweenness Centrality for the top terms in the dataset.

Freeman Degree measures how frequently a keyword appears in the dataset. The most connected terms were "telemedicine," "quality of life," and "monitoring," highlighting their central role in elderly care research.

Betweenness Centrality identifies keywords that serve as "bridges" between different research themes. The highest-scoring terms included "long-term care," "healthcare delivery," and "controlled study," suggesting that these topics link multiple aspects of telemedicine research.

These findings suggest that telemedicine research is expanding into new areas, such as institutional care models and demographic-specific studies, which may shape future innovations in elderly care technology.

CONCLUSION

Bibliometric analyses effectively explore large volumes of research documents [41]. This study combines classical statistical approaches [3, 30]. Combined with newer methods like centrality and link strength analyses [23]. While statistical analyses provide a broad overview, including publication trends and country contributions, co-occurrence analyses identify themes and relationships, offering insights into trends and practical implications [21]. Combining these methods enables a comprehensive understanding of research progress and future directions.

The results underscore the growing role of telemedicine in elderly care, particularly since the COVID-19 pandemic, as reflected in the surge of academic publications. Telemedicine enhances access to quality healthcare for elderly patients with chronic illnesses while optimizing resources, especially in settings with geographic, physical, or logistical barriers [3, 4].

A key challenge lies in the technological gap between regions. Research is concentrated in English-speaking countries like the United States, the United Kingdom, and Australia, highlighting disparities in access to telemedicine technologies [8]. Developing regions face barriers such as high costs, insufficient training, and limited infrastructure [9], widening the gap between accessible and inaccessible populations.

Gender differences in remote healthcare remain underexplored. While studies emphasize the importance of addressing biological and social differences in healthcare reception, telemedicine research has yet to adequately consider this aspect [17]. Addressing this gap is critical for adapting telemedicine to diverse demographic needs. Future studies should focus on identifying gender-based differences in telemedicine adoption and patient outcomes, ensuring that digital healthcare solutions are inclusive and equitable for all elderly populations.

In conclusion, for telemedicine to fulfill its transformative potential in elderly care, sustained investments, inclusive policies, and interdisciplinary collaboration will be essential. By ensuring equitable access, fostering technological innovation, and adapting to evolving healthcare needs, digital healthcare solutions can become a cornerstone of global aging strategies.

PRACTICAL IMPLICATIONS

Practical implications were analyzed from the perspective of different stakeholders, including healthcare providers, nursing homes, government and policymakers, and for patients and care recipients.

PRACTICAL IMPLICATIONS FOR HEALTHCARE PROVIDERS

For healthcare providers, this study highlights the growing trend of delivering medical services through remote technologies. With continuous advancements in digital tools, integrating telemedicine into healthcare systems is becoming increasingly essential for improving patients' quality of life. Regardless of whether providers operate in the public or private sector, offering remote therapies and home-based medical care through these technologies can enhance service quality by complementing traditional treatments with innovative approaches.

Estimating the initial costs of telemedicine implementation is challenging. However, in addition to financial investments, staff training and patient education are crucial for effective adoption. Other industries, including banking and insurance, have adapted to digital models to remain competitive, underscoring the necessity for healthcare providers to embrace these changes.

The surge in telemedicine publications since 2000 reflects a growing market for health-monitoring devices and digital healthcare platforms. As healthcare providers integrate telemedicine, nursing homes also face unique challenges in ensuring accessibility and quality of care. However, financial constraints and logistical barriers must be addressed to maximize telemedicine's potential.

PRACTICAL IMPLICATIONS FOR NURSING HOMES

For nursing homes, implementing telemedicine presents additional challenges, particularly due to the disparities between public and private facilities. Both sectors must recognize the benefits of these services and secure public and regulatory support to prevent underfunded institutions from lagging behind. This support is especially vital in the early stages of implementation, when additional incentives may be required to establish the necessary infrastructure.

Elderly care centers should be regarded as models for managing telemedicine services effectively. Their deep understanding of patient demographics, treatment plans, and the cultural and intergenerational nuances of elderly populations provides valuable insights for successful implementation. No other institutions possess this level of firsthand expertise, making their involvement crucial in designing effective digital healthcare solutions.

Access to quality healthcare is a fundamental priority, and telemedicine presents an opportunity to address some of the core challenges in elderly care, particularly in managing chronic illnesses and providing bedside assessments for

bedridden patients. However, it is essential to develop strategies that integrate telemedicine without diminishing the human aspect of medical care. Maintaining patient satisfaction and adherence to treatments requires a balanced approach that combines digital efficiency with compassionate, personalized attention. Center administrators and healthcare professionals must collaborate to ensure that telemedicine initiatives align with broader healthcare priorities, fostering synergy between different stakeholders for enhanced patient care.

PRACTICAL IMPLICATIONS FOR GOVERNMENTS AND POLICYMAKERS

From a policy perspective, governments play a pivotal role in facilitating telemedicine adoption. Countries with higher GDPs, particularly in North America, Europe, and Asia, have made significant strides in this area. Less economically developed nations can benefit from these advancements by leveraging existing models and technological frameworks. International collaboration among researchers and policymakers has also proven effective in knowledge exchange and best practices, highlighting the importance of cross-border cooperation in healthcare innovation.

While high-income countries have prioritized telemedicine for elderly care due to aging populations, its benefits extend globally, particularly in regions with limited healthcare access. Telemedicine can be instrumental in improving healthcare accessibility in rural areas, reducing the need for patient travel, and easing logistical burdens on public agencies. Governments, in collaboration with medical research institutions and universities, can advance telemedicine applications. Tailoring these services to specific diseases, cultural contexts, and gender considerations will enhance both equity and personalization in digital healthcare.

PRACTICAL IMPLICATIONS FOR PATIENTS AND CARE RECIPIENTS

For patients and care recipients, the findings of this study suggest that telemedicine can be successfully implemented across diverse healthcare contexts without compromising service quality. However, for older adults accustomed to traditional in-person care, transitioning to digital healthcare models may feel disruptive. Therefore, integrating telemedicine should involve careful consideration of patients' perspectives, concerns, and needs.

The findings on digital literacy disparities suggest that patients familiar with technology may adapt more easily to telemedicine, whereas those with limited experience may require additional support. A well-planned transition strategy, incorporating patient education and gradual adoption, can help mitigate these concerns. Ultimately, telemedicine aims to enhance healthcare accessibility and equity, not only across socioeconomic groups within a country but also across nations and regions where elderly populations are among the most vulnerable demographic groups.

By addressing these challenges and implementing telemedicine thoughtfully, healthcare systems can improve service delivery, reduce disparities, and ensure that elderly patients receive high-quality, accessible, and efficient care.

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

While centrality measures like Freeman Degree and Betweenness Centrality identify key concepts and bridge terms, they do not fully capture the evolving nature of telemedicine in diverse healthcare settings. A longitudinal analysis tracking changes in keyword relevance and connections over time could better reflect how telemedicine concepts adapt to technological advancements and policy shifts. This would provide forward-looking insights into emerging trends and changing research priorities.

Future studies could explore telemedicine trends in elderly care after its peak during the 2020 pandemic, assessing whether interest continues to grow or declines. Additionally, qualitative research and case studies of successful telemedicine programs could offer valuable insights into best practices for overcoming institutional resistance and ensuring sustainability.

Despite increasing research output, gaps persist in gender disparities in telemedicine adoption among elderly populations. Further research should focus on how demographic factors influence patient engagement with telemedicine services, particularly in underserved populations. Addressing these gaps can enhance the effectiveness and inclusivity of digital healthcare strategies.

Policymakers and researchers should also prioritize evaluating the cost-effectiveness of telemedicine across different healthcare models, particularly in low-resource settings. Understanding the economic impact and sustainability of telemedicine programs will be crucial for their long-term integration into elderly care services.

ETHICS STATEMENT:

This study analysed publicly available, previously published literature and did not involve human participants, identifiable personal data, or animals. Therefore, ethics committee approval and informed consent were not required. The conduct of this review complied with relevant institutional and national guidance for studies based solely on secondary data.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS:

During the preparation of this work the author(s) used ChatGPT in order to check English grammar. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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APPENDIX 1. TOP 100 KEYWORDS

CHART EXAMPLES

1. aged	35. procedures	68. pandemic
2. telemedicine	36. systematic review	69. physiologic
3. human	37. technology	70. stroke
4. female	38. united states	71. teleconsultation
5. humans	39. methodology	72. chronic obstructive lung disease
6. male	40. robotics	73. cost effectiveness analysis
7. article	41. aging	74. economics
8. elderly care	42. independent living	75. daily life activity
9. priority journal	43. heart failure	76. hospitals
10. middle aged	44. videoconferencing	77. hospital admission
11. 80 and over	45. clinical trial	78. health care quality
12. patient satisfaction	46. follow up	79. patient education
13. controlled study	47. health care	80. pilot projects
14. home care	48. nursing homes	81. questionnaire
15. review	49. outcome assessment	82. social isolation
16. chronic disease	50. depression	83. clinical effectiveness
17. adult	51. delivery of health care	84. cost benefit analysis
18. quality of life	52. health service	85. falling
19. telehealth	53. internet	86. feasibility studies
20. home care services	54. frail elderly	87. medical informatics
21. major clinical study	55. long-term care	88. medical technology
22. treatment outcome	56. organization management	89. patient compliance
23. health services for the a	57. patient monitoring	90. Parkinson disease
24. monitoring	58. telephone	91. mortality
25. health care delivery	59. cost-benefit analysis	92. nursing
26. geriatric care	60. health care cost	93. social support
27. long term care	61. health care access	94. time factors
28. hospitalization	62. feasibility study	95. ambulatory
29. nursing home	63. mobile phone	96. activities of daily living
30. randomized controlled t	64. prevalence	97. coronavirus disease 2019
31. dementia	65. very elderly	98. devices
32. telecommunication	66. caregiver	99. controlled clinical trial
33. diabetes mellitus	67. geriatrics	100.confidentiality

ASSESSING HOSPITAL SERVICE QUALITY: A SYSTEMATIC REVIEW USING PRISMA AND SERVQUAL TO EXPLORE PATIENT SATISFACTION AND LOYALTY

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ABSTRACT

PURPOSE:

This paper aims to develop a conceptual framework that focuses on the original dimensions of Service Quality (SERVQUAL). Patient satisfaction has been taken as a mediating variable to measure customer loyalty in the context of hospital service quality. It is important to note that SERVQUAL measures service quality rather than satisfaction, but SERVQUAL is a satisfaction measure and loyalty is considered an outcome rather than an experience or perception. This framework illustrates the interplay between hospital service quality, patient satisfaction, and loyalty as perceived by patients.

METHODOLOGY:

This study employed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) framework to conduct a systematic literature review (SLR) on hospital service quality (SQ) encompassing its dimensions, patient satisfaction, and loyalty. Deeper analysis was conducted using content analysis methods. SERVQUAL's primary sources, including Google Scholar, Scopus, Web of Science (WoS), among others, were utilized to identify relevant documents.

FINDINGS:

The Reliability, Assurance, Tangibility, Empathy and Responsiveness (RATER) dimensions have been identified in this study as the main criteria patients use to evaluate the standard of care received in hospitals. It suggests that patient satisfaction, loyalty, and service quality are positively correlated.

PRACTICAL IMPLICATIONS:

Hospital marketing managers will have a better understanding of how healthcare service quality dimensions impact patient satisfaction and loyalty, both directly and indirectly. They can also employ the recommended tools to gather feedback on their performance in terms of service quality metrics, enabling them to compare their performance over different periods.

ORIGINALITY:

SERVQUAL is a frequently utilized paradigm for evaluating service quality from the perspective of patients. However, its application to the intricate nature of healthcare services is limited. A few other techniques can also be applied like SERVPERF, Fuzzy Analytic Hierarchy, and Technical and Functional quality model, etc.

KEYWORDS

hospital service quality, patient satisfaction, loyalty, SERVQUAL, PRISMA, SLR, content- analysis

INTRODUCTION

The Indian economy increasingly relies on the service sector [1,2]. Healthcare providers, regulators, and payers are putting more emphasis on quality improvement initiatives to enhance service effectiveness, patient safety, patient outcomes, and resource allocation efficiency [3].

Meeting the demands, desires, and expectations of consumers remains a persistent challenge for healthcare providers and experts, as non-fulfillment may result in reduced patient satisfaction [4]. Over the years, the Indian government has significantly increased public expenditure on healthcare (Economic Survey, 2022-23; NHA Report, 2022), with healthcare emerging as one of the largest sectors in terms of revenue and employment [52]. The introduction of the Ayushman Bharat Digital program (NHA Report, 2022) by the Prime Minister in September 2021 aims to link hospitals across the country with digital health solutions, reflecting the rapid adoption of digital technologies such as telemedicine and increased emphasis on public-private partnerships in the past two decades.

Quality in healthcare services refers to the degree to which services meet required standards, are fit for purpose, and are perceived as excellent by service users [5]. Customer satisfaction and loyalty are strongly influenced by service quality, and the link between service quality and loyalty is mediated by customer satisfaction [6].

Assessing quality standards has become essential for effective resource management and operational enhancement in the healthcare industry [7]. The quality of services provided by healthcare organisations is crucial for achieving patient satisfaction, loyalty, and trust [8], as the unique services offered by hospital employees affect patients' intentions to use or refer to the facility, ultimately increasing positive behavioural intentions [9].

However, there is no widely recognized conceptualization of perceived service quality in healthcare, posing challenges in gauging healthcare service quality due to its intangible, heterogeneous, and simultaneous nature [10]. The Service Quality (SERVQUAL) model is commonly used to assess how patients perceive hospital quality [11], and Parasuraman, Zeithaml, and Berry's (1985) methodology for measuring service quality in healthcare is extensively utilized [12].

Both existing research and organizational practices in healthcare support the notion of enhancing hospital quality and patient safety through quality assessment systems [13]. Patients' satisfaction levels are significantly influenced by how well their healthcare services are perceived and delivered [14], and exceeding patients' and their relatives' expectations can foster loyalty [15].

This paper is structured to provide a systematic and theory-driven understanding of hospital service quality and its implications for patient satisfaction and loyalty. Following the introduction, the study outlines a rigorous methodology grounded in the PRISMA framework to identify, screen, and analyse relevant literature on hospital service quality using SERVQUAL dimensions. The results and discussion section synthesizes empirical and conceptual insights to explain how service quality dimensions influence patient satisfaction and loyalty, culminating in the development of a conceptual framework. The paper concludes by highlighting key theoretical contributions, managerial implications, limitations, and directions for future research. By consolidating fragmented evidence across diverse healthcare contexts, this review offers a comprehensive reference for researchers, healthcare administrators, and policymakers seeking to assess, compare, and improve hospital service quality in a structured, evidence-based manner.

METHODOLOGY

The methodology employed in conducting this literature review adopts a narrative approach and draws on studies from the medical field that utilize systematic literature reviews (SLRs) and meta-analyses [23]. Given the ongoing evolution of management research, there is a continuous process of refining research agendas and focus areas. Systematic reviews serve as valuable tools for understanding the development of research on a particular topic. The objective of this study is to gather pertinent information to delineate the dimensions of hospital service quality based on existing literature, employing the PRISMA statement, flow diagram, and checklist. This study adopts a systematic literature review (SLR) design following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure transparency, methodological rigor, and replicability. PRISMA was selected due to its structured and widely recognised framework for identifying, screening, appraising, and synthesising evidence, particularly in healthcare and interdisciplinary service quality research.

The methodology employed in the current literature review capitalizes on the comprehensive details and adaptability of the PRISMA model, particularly tailored for management studies [16]. A revised PRISMA2020 statement has been issued [17], with ongoing developments currently in progress. Despite the widespread use of the PRISMA Statement and other reporting criteria, errors in their application are common in articles [18], with many systematic reviews (SRs) still being inadequately conducted and reported [19]. The PRISMA Statement and its extensions represent a minimal set of evidence-based recommendations primarily aimed at enhancing the accurate reporting of SRs. While the PRISMA declaration is primarily tailored for guiding the reporting of systematic reviews with meta-analyses of interventions [20], its precise requirements can be readily adopted by various review types [18]. Systematic reviews have garnered considerable attention due to their multifaceted utility, contributing to their widespread adoption [21]. Certain funding organizations are increasingly advocating for the use of systematic reviews as an evidence-based justification for proposed randomized trials [21,22]. In the identification phase, 456 articles were initially retrieved from various databases (i.e., Scopus, Emerald, Elsevier, Web of Science, Wiley, Sage, Taylor & Frances, Inder Science and Google Scholar) using the specified keywords.

After review, 235 articles were excluded due to duplication or non-English language. The titles, abstracts, objectives, keywords, and quality of the remaining 125 articles were assessed, and those not aligned with the central theme were discarded. Full texts of 96 potentially relevant papers were then reviewed. At this stage, 46 papers were excluded for reasons such as insufficient depth on service perspectives, not aligned with study objective, non-empirical studies, poor methodological quality or lack of focus on the five SERVQUAL dimensions, the relationship between service quality, patient satisfaction, loyalty, or the mediating role of patient satisfaction. Ultimately, 50 papers met the inclusion criteria represent in Table 2 and were selected for final analysis.

FIGURE1: PRISMA FLOWCHART FOR THIS STUDY

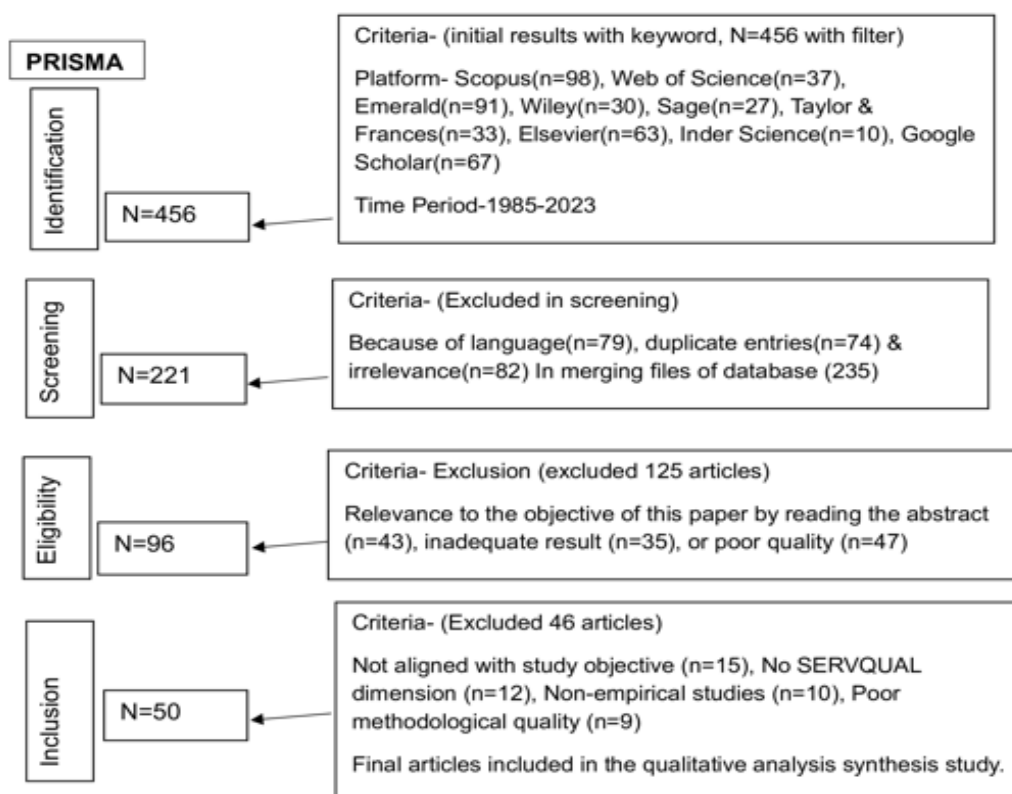


Table 1 shows the search strategy employed includes terms such as 'Service,' 'quality,' 'Healthcare,' 'Service quality in healthcare,' 'Healthcare Service quality,' 'Service quality in hospital,' 'Healthcare service quality framework,' and 'Hospital service quality framework.'

SEARCH STRATEGY AND STUDY IDENTIFICATION

A comprehensive search was conducted across major academic databases, including Scopus, Web of Science, Emerald, Elsevier, Wiley, Sage, Taylor & Francis, InderScience, and Google Scholar. The search strategy employed Boolean operators to combine keywords related to hospital service quality, SERVQUAL dimensions, patient satisfaction, loyalty, and systematic reviews. Only peer-reviewed journal articles published in English were considered to ensure academic quality and consistency. The initial search yielded 456 records, which were exported to a reference management system for further processing.

SCREENING AND ELIGIBILITY CRITERIA

Duplicate records and non-English publications were removed during the screening stage. Titles and abstracts of the remaining studies were independently reviewed to assess thematic relevance. Full-text articles were then evaluated against predefined inclusion and exclusion criteria.

Inclusion criteria:

- Peer-reviewed empirical or conceptual studies
- Explicit focus on hospital service quality
- Application of SERVQUAL or comparable service quality frameworks
- Examination of patient satisfaction and/or loyalty
- Full-text availability

Exclusion criteria:

- Non-peer-reviewed sources (e.g., editorials, conference abstracts)

- Studies not related to healthcare or hospital settings
- Articles having different language, duplicate entries and irrelevance
- Articles lacking conceptual or methodological clarity
- Studies not addressing service quality dimensions or patient outcomes

Following this process, 50 studies were retained for final synthesis.

QUALITY APPRAISAL OF INCLUDED STUDIES

To address methodological robustness and respond to PRISMA quality requirements, all included studies were subjected to a formal quality appraisal process. Consistent with prior PRISMA-based healthcare reviews [53, 54], a structured quality assessment checklist adapted from established SLR practices in healthcare and management research was employed.

Each study was evaluated across the following criteria:

1. Clarity of research objectives
2. Appropriateness of research design and methodology
3. Transparency in data collection and analysis
4. Clear operationalisation of service quality dimensions
5. Validity and reliability of measurement instruments
6. Relevance to hospital service quality, patient satisfaction, and loyalty
7. Consistency between findings and conclusions

Each criterion was scored on a three-point scale:

- 0 = Not addressed
- 1 = Partially addressed
- 2 = Fully addressed

Studies achieving moderate to high cumulative quality scores were retained for synthesis. No study was excluded solely on quality grounds; however, quality scores were used to weight interpretation during content analysis, ensuring that findings from methodologically robust studies informed the core conclusions.

DATA EXTRACTION AND ANALYTICAL APPROACH

Following quality appraisal, a structured data extraction protocol was applied. Extracted information included:

- Study objectives
- Methodological approach
- Service quality dimensions examined
- Measurement instruments used
- Key findings related to patient satisfaction and loyalty

A **content analysis technique** was employed to synthesise recurring themes, methodological patterns, and conceptual linkages across studies. SERVQUAL's five RATER dimensions served as the primary analytical framework, enabling systematic comparison and aggregation of findings across diverse healthcare contexts. The methodological patterns and empirical relationships identified through this process informed the results and discussion section, culminating in the development of a conceptual framework linking hospital service quality, patient satisfaction, and loyalty.

METHODOLOGICAL RIGOR AND TRANSPARENCY

By integrating PRISMA-based study selection, explicit quality appraisal, and structured content analysis, this methodology ensures a transparent, reproducible, and theory-driven synthesis of hospital service quality literature. This approach strengthens the credibility of the review and aligns the study with best practices adopted in high-quality healthcare systematic reviews.

ANALYTICAL APPROACH AND SYNTHESIS

Following study selection, content analysis was employed to systematically extract and categorize key themes related to service quality dimensions, patient satisfaction, and loyalty outcomes. The SERVQUAL framework served as the primary analytical lens, enabling comparative assessment of how the five RATER dimensions are operationalized and evaluated across healthcare settings. Patterns, convergences, and methodological trends identified in the literature informed the synthesis presented in the results and discussion section.

In addition to descriptive synthesis, the methodological insights derived from reviewed studies—such as measurement approaches, conceptual models, and mediating mechanisms—were critically examined to support theory development. This methodological grounding directly informed the construction of the conceptual framework, which integrates service quality, patient satisfaction, and loyalty relationships.

By combining PRISMA guided study selection with structured content analysis, this methodology ensures both methodological robustness and conceptual depth, enabling the study to generate reliable insights for assessing hospital service quality and guiding future empirical research.

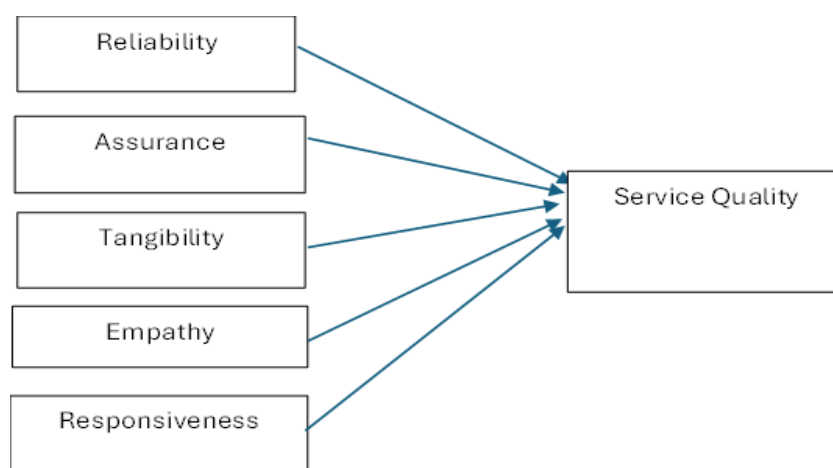
RESULT & DISCUSSION

SERVICE QUALITY AND SERVQUAL

As per various scholars [30,31], service quality is intricate, multifaceted, vague, intangible, abstract, and challenging to grasp. Nonetheless, certain renowned academics have attempted to define it; for example, some studies define service quality as a gap between consumers' expectations and perceptions [5,6,7,8,9,10,11]. A strong correlation exists between quality and services, which can be evaluated using various factors [32].

The literature on service quality (SQ) suggests a division into two distinct dimensions: technical quality and functional quality [33]. Technical quality pertains to fundamental care attributes such as infrastructure and treatments offered, while functional quality relates to secondary care attributes like the amiability of service providers and the punctuality of service delivery. Additionally, Gronroos, n.d. identified the "image" of the service provider as a third component in service evaluation [31], serving as a filter for consumers' quality perceptions. The SERVQUAL instrument developed by Parasuraman et al., 1985; Zeithaml et al., 1988 is the most cited framework in service marketing literature [5,11]. According to Parasuraman et al., 1985 as shown in figure 2, perceived service quality resembles a general assessment akin to attitude, suggesting that discrepancies or gaps between consumers' expectations and performance across quality dimensions indicate service quality [11]. The "Gaps Model" delineates five areas in the service delivery process where customer needs may remain unfulfilled, developed following enhancements to their original model.

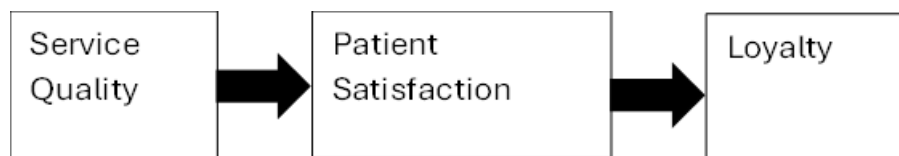
FIGURE 2: RATER CONSTRUCT AS A SERVICE QUALITY FRAMEWORK (ADAPTED FROM PARASURAMAN,1988 [11])



CONCEPTUAL FRAMEWORK

Figure 3 presents the conceptual framework illustrating the relationship between service quality, patient satisfaction, and patient loyalty. The framework proposes that service quality dimensions directly influence patient satisfaction by shaping patients' perceptions of healthcare services. In turn, satisfied patients are more likely to develop loyalty, reflected in repeat visits, positive word-of-mouth, and continued preference for the healthcare provider. Additionally, the model suggests that service quality may also have a direct effect on patient loyalty, highlighting the central mediating role of patient satisfaction in strengthening long-term patient - hospital relationships.

FIGURE 3: CONCEPTUAL FRAMEWORK FOR THIS STUDY



PATIENT SATISFACTION

Customer satisfaction has garnered significant attention in marketing and services literature [35,36]. Patient satisfaction, defined as a consumer's post-purchase mental state, reflecting their attitude toward a product or service after its use [37]. According to Parasuraman et al., 1985; Zeithaml et al., 1988, satisfaction entails comparing consumers', users', or patients' perceptions with their expectations and performance of the service providers [5,11]. It represents a cognitive assessment of patients' attitudes toward services that emotionally impact them [38,39]. As per the definition proposed by Javed et. al., "patient satisfaction is the consequence of perceived service quality and is a function of observed performance of healthcare service and patient expectations [40]."

In the literature, customer satisfaction and service quality have often been regarded as two sides of the same coin. Oliver, 1977 postulated that satisfaction is a function of the disconfirmation of performance from expectation. Customers can only evaluate an object after comprehending it, unlike satisfaction assessments; expectations of service quality are not influenced by interactions with the service environment or providers [41]. Researchers' opinions on service satisfaction and quality vary. Considering that satisfaction and service quality both represent attitudes, several researchers [42] have attempted to operationalize satisfaction similarly to service quality. However, some researchers argue that they are distinct, and some say they are wholistic [43].

PATIENT LOYALTY

Patient loyalty refers to the decision of a consumer to continue using a service or product after its initial use. Various factors such as price, quality, brand image, satisfaction, service, and reliability can influence loyalty. Service quality indirectly affects patient loyalty through satisfaction [44], as well as patient enjoyment [45]. The degree of customer satisfaction plays a significant role in determining customer loyalty. Satisfied customers are more inclined to remain loyal to a product or service [46,47,48]. Empirical evidence provided by Zeithaml et al., 1988 supports a positive correlation between service quality and loyalty [5]. Patient satisfaction was examined as a mediating factor between customer loyalty and service quality [49]. In service organizations, the pathway "service quality, customer satisfaction, loyalty" was found to be significant [50].

Healthcare service providers must deliver high-quality services to consumers [24], as it improves the patient -focussed care of the healthcare sector. Oliver (1977) [41] proposed that satisfaction depends on how performance compares with expectations. Customers can assess services only after experiencing them and always expect improvements, even when services are excellent. While satisfaction can be influenced by values and prices, service quality is not linked to costs [51]. Service quality is evaluated based on the service itself, whereas satisfaction can be shaped by factors like mood. Unlike satisfaction, perceptions of service quality remain unaffected by the service environment or interactions [41]. Researchers debate whether service quality and satisfaction are distinct or overlapping concepts. Some researchers (Sureshchandar

et al., 2002) argue that satisfaction can be measured similarly to service quality [42], while others (Cronin & Taylor, 1994) maintain they are separate constructs [43, 25]. The present study uses this dilemma as a base and extended SERVQUAL model using two mediating variables. Previous studies have consistently demonstrated that consumers' positive perceptions of service quality correlate with better outcomes for hospitals [26]. Consequently, to meet consumer expectations [27] and mitigate unfavourable treatment results [28], healthcare service providers are increasingly prioritizing service quality [29].

This study explores the relationship between Perceived Service Quality, Patient Satisfaction, and Loyalty in the healthcare industry, we propose an innovative integration. Our primary objective is to examine the connections between service quality, satisfaction with service, and loyalty intention. Our findings suggest that, despite a comprehensive examination of the literature, research on the relationship between patient satisfaction and loyalty in the healthcare industry is still at an early stage of development. We expand the scope of our study beyond conventional Perceived Service Quality and Patient Satisfaction frameworks to explore loyalty.

CONCLUSION

This study provides a comprehensive literature assessment covering various topics related to healthcare quality and associated variables, such as service quality, patient satisfaction, and loyalty. The literature review encompasses definitions of health, healthcare quality, studies on the Indian healthcare system, service quality (SQ), the inception and utilization of SERVQUAL, and the correlation between SQ and patient satisfaction, among other categories. Additionally, the literature review explores research linking SQ and patient satisfaction for healthcare organizations. Identified gaps in the literature serve as focal points for current research efforts.

To evaluate service quality from the perspectives of both patients and attendants, a conceptual study framework is proposed. Hospitals embarking on the path to overall quality management must prioritize their patients, as "quality" is defined by meeting consumer needs. Understanding patient needs constitutes the initial step for hospitals in this endeavour. Hospitals can utilize the "voice of the customer" to construct a "house of quality" from an organizational standpoint to fulfil their patient's needs, as highlighted in the literature review. Satisfied patients' word-of-mouth marketing efforts influence their family and friends to patronize specific hospital services. Many patients rely on their attendants to access healthcare services, these recommendations are crucial in shaping patients' purchasing decisions. Service quality, encompassing both experience and outcomes, can contribute to loyalty, though loyalty is influenced by multiple factors beyond quality. Satisfied patients are more likely to remain loyal and may even be willing to pay a premium for better services. A root analysis of Service Quality, Patient Satisfaction, and Loyalty Intentions can shed light on this aspect.

In today's business landscape, understanding client preferences is paramount for organizations to better address their needs. The current study aids practitioners in understanding patient preferences by quantifying service quality characteristics. Hospitals can utilize this tool to collect patient information for informed decision-making. For example, hospitals performing poorly on various dimensions can scrutinize their systems to identify reasons for patient dissatisfaction. Categorizing clients can assist hospitals in positioning themselves for the future. Furthermore, hospitals can compare their services with those of competitors by gauging how patients perceive the quality of their services. By analyzing the origins of satisfaction and discontent in both scenarios, hospitals can identify potential areas for improvement.

LIMITATIONS AND FUTURE RESEARCH DIRECTION

This conceptual paper discussion is subject to several constraints.

Firstly, an extensive literature review on hospital service quality underscores the inadequacy of the SERVQUAL and modified SERVQUAL instruments' dimensions in capturing the comprehensive perspective of perceived service quality within a healthcare setting. Thus, many researchers have opted for non-SERVQUAL or alternative methods to comprehend and measure hospital service quality, ensuring all relevant areas are addressed.

Secondly, the use of only a few readily accessible databases for document screening may have limited the scope of search results. Although some new topics emerged from content analysis, further themes could surface depending on the research's contextual nuances.

Thirdly, the proposed conceptual framework is open to quantitative testing and validation across diverse healthcare contexts, including public hospitals, private hospitals, and specialized facilities. It can be applied in various geographic contexts, such as developing or Asian countries, and adapted to demographic variables like income levels, education levels, age, and gender.

Furthermore, data collection can encompass different patient groups, including inpatients, outpatients, emergency patients, and individuals with specific diseases or illnesses, using validated items. Additionally, by incorporating various theories such as the expectancy-disconfirmation theory, the two-factor theory of emotion, and the gap model, this model can be expanded to include moderators, mediators, or other dependent variables. Moreover, it holds applicability in a wide array of service research settings, spanning education, hospitality, public transportation, public services, and even correctional facilities.

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APPENDIX

Table 1 shows search strategy employed includes terms such as 'Service,' 'quality,' 'Healthcare,' 'Service quality in healthcare,' 'Healthcare Service quality,' 'Service quality in hospital,' 'Healthcare service quality framework,' and 'Hospital service quality framework.'

TABLE 1. BOOLEAN SEARCH TECHNIQUE

Boolean operator	Measurement instrument	AND Population	AND Tool
•	Service Quality	'Hospital*' OR	'Instrument*' OR
•	Patient perspective	• Department	• Model*
•	SERVQUAL study	• Care	• Tool*
•	GAP Model	• Ward	• Program*
		• provider	• Questionnaire*
			• Survey*
			• Measure*
			• Assess*
			• Factor*
			• Compare*
			• Method*
			• Develop*

Table 2 represents the list of 50 papers that met the inclusion criteria and were finalized for the analysis. This table includes the author name, year of publication, journal name, funding is received or not by the author, aim of the study, methods for analysis, country, setting, and population.

TABLE 2. STUDY CHARACTERISTICS AND DESCRIPTION (SOURCE: AUTHORS' COMPILATION)

Study		General characteristics			Description		
Author & Year	Journal	Funding	Aim	Methods	Country/Region	Setting	Population
1. (Jabnoun and Chaker, 2003)	Managing service quality	No Funding	compares the level of service provided by private and public hospital	Questionnaire	UAE	Hospital	Inpatient in general hospital
2. (Ali et al., 2023b)	International Journal of Quality & Reliability Management	No Funding	To create a conceptual framework that includes the original SERVQUAL dimensions and incorporates additional dimensions	SLR, content analysis, bibliometric analysis	Pakistan	Hospital	Government hospital patients
3. (Darzi et al., 2023)	LBS Journal of Management & Research	No Funding	Synthesize the literature on service quality that is currently available and investigate the knowledge gaps regarding the various service quality indicators and patient satisfaction.	SLR	India	Hospital	Private hospital, public hospital, and general hospital patients
4. (Sadiq Sohail, 2003a)	Managing service quality	No Funding	Measured perceived value of service concerning patient perspective	Survey, questionnaire	Malaysia	Hospital	Private hospital patients
5. (Padma et al., 2009)	Benchmarking: An International Journal	No Funding	to establish the parameters of Indian hospitals' service quality	Literature review	India	Hospital	General hospital patients and their attendants
6. (Amin and Nasharuddin, 2013)	Clinical Governance: An International Journal	No Funding	To better understand how patient satisfaction and behavior intention are impacted by hospital service quality	Questionnaire, convenience sampling technique	Malaysia	Hospital	Private hospital, public hospital inpatient
7. (Endeshaw, 2021)	Journal of Health Research	No Funding	Review the quality-measurement methods that exist and are used in healthcare	Literature review	Developing and Western countries	Hospital	General hospital patients
8. (Van Heerden, 2010)	Journal of Health Research	No Funding	Measure customer expectations and perceptions as well as the gaps between these two variables to	Questionnaire, Survey	South Africa	Hospital	Private hospital patients

			identify the realistically important areas where management should concentrate their efforts to improve the quality of the service system.				
9. (De Jager, Du Plooy and Femi Ayadi, 2010)	African Journal of Business Management	No Funding	To understand the responsiveness determinant of SQ which will lead to satisfaction and improvement in healthcare quality in developing countries.	The survey, questionnaire, Likert scale	South Africa	Hospital	Public hospital in-patient and out-patient
10. (D'cunha and Suresh, 2015)	International Journal of Health Science and Research	No Funding	To measure the satisfaction level of the patients with the help of various dimensions of service quality	Structured questionnaire	India	Hospital	Teaching hospital medical ward patients
11. (Nwobodo-Anyadiiegwu, Ibrahimu and Mbohwa, 2018)	Journal of Industrial and Intelligent Information	No Funding	To study the overall service quality and explore the concern of patient satisfaction at the clinic	Survey, quantitative and qualitative both approach	South Africa	Clinic	University clinic patients
12. (Essiam, 2023)	European Journal of Business and Management	No Funding	to assess patient satisfaction with healthcare service and quality measures	Survey, convenience sampling technique	Ghana	Hospital	Public university hospital's out-patient
13. (Yeilada and Direktör, 2010)	African Journal of Business Management	No Funding	Three objectives are tested in this paper: the SERVQUAL instrument's dimensionality in the Northern Cyprus healthcare sector; the service quality offered in Northern Cyprus's public and private hospitals; and the service quality dimensions that are significant for patient satisfaction.	Questionnaire, systematic sampling	Northern Cyprus	Hospital	Private and Public hospital patients
14. (Al-Neyadi, Abdallah and Malik, 2018b)	International Journal of Healthcare Management	No Funding	This study examines the factors influencing patient satisfaction in private and public hospitals in the UAE using SERVQUAL's five service quality dimensions as a basis for evaluating the quality of healthcare services.	Modified questionnaire, quantitative approach	UAE	Hospital, Nursing, Physician care	Private and Public hospital patients

15. (THE APPLICABILITY OF SERVQUAL IN DIFFERENT HEALTH CARE ENVIRONMENTS INTRODUCTION, n.d., 1997)	Journal of Services Marketing	No Funding	study that examines the usability of a modified SERVQUAL instrument as a means of assessing service quality	Modified and reduced questionnaire, random sampling	Australia	Medical care, Healthcare	Medical centres health providers
16. SM Mthanti (2015)	North-West University	No Funding	To explore the existing literature on perceived service quality, customer satisfaction influences consumption behaviors and patterns.	Literature review, empirical study	South Africa	Healthcare	General hospital patients
17. (Irfan and Farooq, 2012)	Middle-East Journal of Scientific Research	No Funding	to investigate the level of patient care provided by public hospitals	Modified SERVQUAL questionnaire	Pakistan	Hospital	Public hospital patients
18. (Int <i>et al.</i> , 2015)	Int. J. Behavioural and Healthcare Research	No Funding	To conduct an in-depth and methodical literature search on healthcare quality, SQ, the creation and use of SERVQUAL, and the relationship between SQ and patient satisfaction	SLR, literature review	India	Healthcare, Hospital, Medical care, Nursing	General hospital patients
19. (Chalikias <i>et al.</i> , 2016)	Int. J. Electronic Marketing and Retailing	No Funding	to evaluate and quantify client loyalty and satisfaction for a service termed "Nursing at home"	Questionnaire	Greece	Nursing	Hellenic Red Cross Nursing at home patients
20. (Sadiq and Adil, 2021)	<u>International Journal of Productivity and Quality Management</u>	No Funding	Examining consumer perceptions of service quality and how they relate to the satisfaction and retention of customers in Malaysia and India, are two very distinct cultural, historical, and traditional contexts.	Structured questionnaire	India & Malaysia	Banks	General bank customers and administrative staff
21. (Jonkisz, Karniej and Krasowska, 2021)	<u>International Journal of Environmental Research and Public Health</u>	No Funding	to investigate how the SQ technique is used to identify the factors affecting how patients evaluate the quality of services	Literature review, a bibliographic query, and desktop data analysis	Saudi Arabia	Hospital, Medical specialist, internal medicine, clinic	General hospital inpatients
22. (Rezaei <i>et al.</i> , 2018)	Medical Journal of the Islamic Republic of Iran	No Funding	Aare To examine service quality in Iranian hospitals by conducting a thorough literature review and meta-analysis.	Literature review, meta-analysis	Iran	Hospital	General hospital inpatients

23. (Shafiq <i>et al.</i> , 2017)	The Journal of Health Care Organization, Provision, and Financing	Higher Education Commission, Pakistan and University of the Punjab, Lahore	In this work, a service quality measurement scale was created by adapting the SERVQUAL instrument concerning the patient's perspective.	Questionnaire, simple random sampling technique	Asian countries	Hospital	Asian countries' hospital inpatient and outpatient
24. (Agarwal <i>et al.</i> , 2022)	International Journal of Marketing and Business Communication	No Funding	to conduct an in-depth review of the literature on the numerous facets of healthcare service quality, patient satisfaction, and loyalty	SLR, secondary data, citation analysis, logical reasoning	Indonesia, Saudi Arabia, Turkey	Healthcare, hospital	General hospital patients
25. (Ali <i>et al.</i> , 2021)	Journal of Contemporary Issues in Business and Government	No Funding	to research the trends and patterns found in the literature on healthcare service quality	SLR, Bibliometric analysis	US	Healthcare, Hospital	General hospital patients
26. (Upadhyai <i>et al.</i> , 2019)	Journal of Health Management	No Funding	To comprehend what constitutes healthcare service quality, the underlying characteristics of healthcare service quality, and how it is measured, it is necessary to investigate and synthesize the body of published knowledge currently available.	Literature review	India	Healthcare, Hospital, Medical, and non-medical services	General hospital patients
27. (Li <i>et al.</i> , 2015)	Asian Pacific Journal of Tropical Biomedicine	No Funding	To ascertain how patients in hospitals in nine Chinese cities feel about the level of service and to suggest some ways to make it better	Survey, SERVQUAL scale, qualitative approach	China	Hospital	Nine City Hospital patients
28. (KhanMohammadi, Talaie and Azizi, 2023)	Healthcare Analytics	No Funding	to evaluate the effectiveness of hospital services using the fuzzy Best-Worst Method (BWM), an effective, trustworthy, and simple-to-use quality evaluation technique.	Case study, SERVQUAL scale	Iran	Hospital	General hospital inpatients
29. (Ali <i>et al.</i> , 2022)	<u>The TQM Journal</u>	No Funding	to review the literature on healthcare service quality to identify and analyze the models	Literature review	Malaysia	Hospital	General hospital inpatients

			and dimensions of healthcare service quality and to present ideas for future study				
30. (Liu <i>et al.</i> , 2023)	BMC Health Services Research	No Funding	to develop and evaluate a research model to quantify patients' worth across all outpatient encounters	Literature review, expert panel discussion	China	Hospital	Public hospital inpatient and outpatient
31. (Zarirah Nizam, 2023)	International Journal of Membrane Science and Technology	No Funding	to forecast the link between service quality, recommendation, and private university choice	Questionnaire by using Google form	Indonesia	Universities	Private university students
32. (Rios-Caro <i>et al.</i> , 2023)	HUMAN Review	No Funding	The quality of the teledentistry service and the degree to which patients who received this type of care were satisfied were being studied during COVID-19.	Survey, Questionnaire, descriptive correlational and cross-sectional design, SERVQUAL model	Peruvian central jungle	Teledentistry service, Home care services	customers
33. (Farrokhi <i>et al.</i> , 2023)	BMC Health Services Research	No Funding	To aggregate the findings of similar studies to spot trends and discrepancies in Iran's outpatient care quality.	SLR, Meta-analysis	Iran	Hospital	General hospital outpatients and inpatients
34. (Amjeriya & Kumar Malviya, 2019)	International Journal of Engineering Research & Technology	No Funding	to identify the key service quality factors that influence patient satisfaction in the healthcare industry	Survey, Questionnaire, statistical method	Ujjain in India	Hospital	General hospital patients
35. (Nair <i>et al.</i> , 2023)	BMC Health Services Research	No Funding	explains how the Manyata-supported facilities' quality changed in comparison to the NABH standards of care	NABH checklist, SLR, Thematic analysis	India (Maharashtra, Uttar Pradesh, Jharkhand)	Hospital	Review of hospital policies and protocols
36. (Kandu, Jain and Ghosal, 2023)	INDIAN JOURNAL OF SCIENCE AND TECHNOLOGY	No Funding	to aggregate current data, identify knowledge gaps, and provide wise counsel to academics, decision-makers, and healthcare professionals to evaluate the service quality of hospitals in Nepal	SLR, Meta-analysis, Random Effect- model	Nepal	Hospital	Public hospital patients

			by systematic evaluation of the literature and meta-analysis				
37. (Joseph, 2019)	International Journal of Scientific Research and Engineering Development	No Funding	In the current work, which analyses the quality of healthcare connected to Indian studies and evaluates the definition of service quality and the creation of SERVQUAL, a thorough examination of the literature has been conducted.	SLR	India	Hospital	General hospitals
38. (Jones <i>et al.</i> , 2008)	J Clin Psychol Med Settings	No Funding	Investigated how young adults' healthcare behavior correlated with indicators of childhood healthcare exposure, healthcare attitudes, and optimism.	Survey	US	University	College students
39. (Chang and Chang, 2013)	Journal of Dental Sciences	No Funding	to suggest a conceptual framework for determining the primary motivators and offering suggestions for improving dental care service quality	Kano-model-based questionnaire, Donabedian's structure-process-outcome mode	Taiwan	Hospital	Studied hospital patients
40. (Senić and Marinković, 2013)	International Journal of Consumer Studies	No Funding	Students' satisfaction with the standard of care offered by student polyclinics was also examined in the study	Survey	Serbia	University	State-run university students
41. (Ampaw <i>et al.</i> , 2020)	Kybernetes	No Funding	to present actual data on patient satisfaction, which is a predecessor to the quality of healthcare services, and ongoing service use	Questionnaire	Ghana	Hospital	Selected hospitals patient
42. (Chang, Chen and Lan, 2013)	BMC Health Services Research	No Funding	This study tried to fill the research gap on the relationship between service quality, patient trust, and satisfaction from the possibility of interpersonal-based medical service encounters	Questionnaire survey	Taiwan	Medical centres	Seven medical centers' outpatient
43. (Sembiring & Nurwahyuni, 2023)	JOURNAL OF INDONESIAN HEALTH POLICY	No Funding	To identify the factors that influence executive patient loyalty at the COVID-19 pandemic era Siloam	Questionnaire, observational research design	Indonesia	Private hospital	Siloam Hospitals TB Simatupang outpatient

	AND ADMINISTRATION		Hospitals TB Simatupang outpatient installation.				
44. (Wu, 2011a)	Siloam Hospitals TB Simatupang outpatient	No Funding	to investigate the connections between hospital brand image, service excellence, patient loyalty, and satisfaction	Survey	Taiwan	Hospital	Large private hospital patient
45. (Hemadeh <i>et al.</i> , 2019)	International Journal Health Planning Management	World Bank	intended to evaluate patients' happiness with certain healthcare services offered by PHCCs and to discover the elements that influence patients' overall satisfaction	Survey through phone calls	Lebanon	Primary Healthcare Centres (PHCs)	Patients of selected Primary healthcare centers
46. (Vimla and Taneja, 2021)	Health Services Management Research	No Funding	to comprehensively examine and synthesize existing data, as well as to suggest a conceptual model of hospital brand image and its effect on patient loyalty via PSQ and PS	SLR, Meta-analysis	India	Hospital	General hospitals patient
47. (Vogus and McClelland, 2016)	Human Resource Management Review	No Funding	To meet the service problems of complexity, intangibility, and co-production, as well as the distinctive temporal dynamics of care delivery and its measurement through time, we examine sets of practices and processes used in healthcare. A more thorough integration of processes from management research on customer satisfaction and service quality into health services research can be advantageous. Current developments in healthcare can serve as natural experiments for the development of new insights.	Literature review	US	Healthcare	Patients of the healthcare centers
48. (M. Shashank., n.d.,2023)	Journal for Re-Attach Therapy and Developmental Diversities	No Funding	Can hospital image and service quality affect patients' satisfaction and loyalty	Questionnaire	India	Hospital	HSNJKT patients

49. (Prasad & Verma, 2022)	Int. J. Management Practice	No Funding	Provides future researchers with a thorough analysis of the service quality models that are available in the existing literature and an integrated perspective on service quality.	PRISMA review framework, Thematic analysis, and content analysis	India	Hospital	Different models can be applied in measuring the hospital service quality
50. (Pauli, Martin and Greiling, 2023)	International Review on Public and Nonprofit Marketing	University of Applied Sciences Upper Austria	Review of the available literature on WOM in healthcare	SLR	Austria	Hospital, Healthcare	General hospitals patient

Source: Author Framed

SYSTEMATIC REVIEW OF HEALTHCARE SERVICES IN PATIENTS WITH CARDIOVASCULAR PROBLEMS

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ABSTRACT

INTRODUCTION:

Cardiovascular disease is a type of disease that affects the blood vessels and heart. The global movement from infectious diseases to chronic diseases is a global problem that will result in a decline in the life quality and a rise in the need for services such as rehabilitation services. This research aimed to evaluate healthcare services, defined as the provision, management, and delivery of medical, rehabilitative, and supportive interventions designed to maintain or improve patients' health and quality of life, in patients with cardiovascular disease. This research aimed to evaluate healthcare services, defined as the provision, management, and delivery of medical, rehabilitative, and supportive interventions designed to maintain or improve patients' health and quality of life, in patients with cardiovascular disease.

METHODS:

40 published articles between 1990 and 2025 were evaluated with key words including "Nursing Services", "Healthcare Services", and "Cardiovascular Problems" in MEDLINE (PubMed and Ovid), Web of Science, and Scopus databases.

RESULTS:

The frequency of availability of complete medications and equipment related to cardiac patients in ambulances was 81% (ES: 81%, 95% CI: -1.05, 2.66). The patient's family in the field of rehabilitation and post-discharge care, along with the follow-up implementation of educational programs, increases the patient's quality of life and subsequently the quality of care by 91% (ES: 91%, 95% CI, 87%-95%).

CONCLUSION:

Family-centered education, community awareness, and optimized use of health information systems significantly improve quality of care and life for patients with cardiovascular disease. Family-centered education, community awareness, and optimized use of health information systems significantly improve quality of care and life for patients with cardiovascular disease.

KEYWORDS

cardiovascular diseases, quality of life, delivery of health care

INTRODUCTION

Coronary artery disease (CAD) is a type of heart disease in which the arteries in the heart become blocked and are unable to supply enough oxygen-rich blood to the heart and its muscles. Coronary artery disease is the most common heart disease. According to the World Health Organization, cardiovascular diseases, including CAD, are responsible for an estimated 17.9 million deaths annually, representing 32% of all global deaths [1]. Coronary artery disease is often caused by a buildup of plaque in the walls of blood vessels leading to the heart and can lead to heart failure or even a heart attack. In 2019, Li and colleagues investigated the effect of respiratory motion on end-diastolic, systolic, and ejection fraction volumes and respiratory gating correction on them. To examine the ejection fraction and volumes, they divided the respiratory motion cycle into two parts: inspiration and expiration and concluded that expiratory breathing increases the right ventricular ejection fraction and decreases the left ventricular ejection fraction but has no effect on the right ventricular end-systolic volume [2].

Studies have shown that effective management of healthcare services in cardiovascular patients plays an important role in preventing complications, improving quality of life, and reducing the financial burden on healthcare systems [3]. According to the findings of various studies, providing regular health services, continuous monitoring of patients' condition, and using modern diagnostic and therapeutic methods can reduce the complications of cardiovascular diseases. With coordination between medical teams and careful follow-up of patients, the effectiveness of treatment increases and, as a result, it will affect patient satisfaction [4].

Health services for this group of patients include a wide range of measures, from primary prevention and early screening to emergency care, drug and interventional treatments, cardiac rehabilitation, and long-term follow-up. The quality of these services, the extent to which patients access them, and the extent to which care is consistent with clinical guidelines can play a decisive role in improving clinical outcomes, reducing mortality, and enhancing patients' quality of life [3]. However, evidence suggests that widespread inequalities in service delivery persist; This is particularly true in low- and middle-income countries, where access to medicines and secondary care is more limited. Economic, social, and geographical differences also affect patients' access to effective care [6]. Evaluation of health services for cardiovascular patients requires attention to continuity of care, patient adherence to treatment, and the use of multidisciplinary approaches. A systematic review can provide a clear understanding of existing gaps and offer opportunities to improve the quality of care for cardiovascular patients [7,8].

Given the importance of providing optimal health services, a systematic literature review is a method that can provide a clear picture of the current status of healthcare service management in cardiovascular patients and identify strengths and weaknesses in this field [5]. In this context, "management of healthcare services" refers to the planning, implementation, and evaluation of strategies and interventions aimed at improving the accessibility, quality, and effectiveness of care for cardiovascular patients. Accordingly, the present study aimed to systematically evaluate the organization and delivery of healthcare services for patients with cardiovascular problems, identify gaps in service provision, and highlight areas for improvement.

MATERIAL AND METHOD

INFORMATION SOURCES AND SEARCH STRATEGY:

In the current systematic review and meta-analysis study, 40 articles published between 1990 and 2025 were reviewed using key words such as nursing services, healthcare services, and cardiovascular problems in international databases such as MEDLINE (PubMed and Ovid), Web of Science, and Scopus. The keywords were standardised in Mesh and used for searches. In addition, the reference lists of the selected publications were examined for relevant research.

Mesh key words: (("Nursing Services"[Mesh] OR "Nursing Service, Hospital"[Mesh]) AND ("Delivery of Health Care"[Mesh] OR "Health Services Research"[Mesh] OR "Community Health Services"[Mesh])) AND ("Cardiovascular Nursing"[Mesh] OR

"Cardiovascular Infections"[Mesh] OR "Models, Cardiovascular"[Mesh] OR "Cardiovascular Diseases"[Mesh] OR "Heart Disease Risk Factors"[Mesh] OR "Cardiology"[Mesh]).

INCLUSION AND EXCLUSION CRITERIA

Studies that addressed the provision or management of healthcare services in patients with cardiovascular disease, that had sufficient data to assess the effectiveness or quality of healthcare services, that had full text access, and that were published in English were included. Letters to the editor, abstracts, conference papers, case reports, articles with incomplete data, and retracted articles were excluded from the selection.

DATA COLLECTION

The search technique was as follows: initially, a list of titles and abstracts for all papers found in the databases under evaluation was created. This work was completed separately by two experts. Then, items with duplicate titles were deleted. Next, the abstracts of the papers were evaluated to discover eligible studies, and all of the found studies were saved in Clarivate's EndNote X8 program. To ensure methodological rigor and minimize potential bias, a quality assessment of all selected studies was conducted. Recognized appraisal tools appropriate to each study design were applied, including the Cochrane Risk of Bias tool for randomized or interventional studies, the Newcastle-Ottawa Scale for observational studies, and the AMSTAR 2 tool for systematic reviews. Each study was independently evaluated by two reviewers, and any discrepancies were resolved through discussion. The assessment focused on key domains such as study design, sample size, participant selection, measurement of outcomes, and completeness of data reporting.

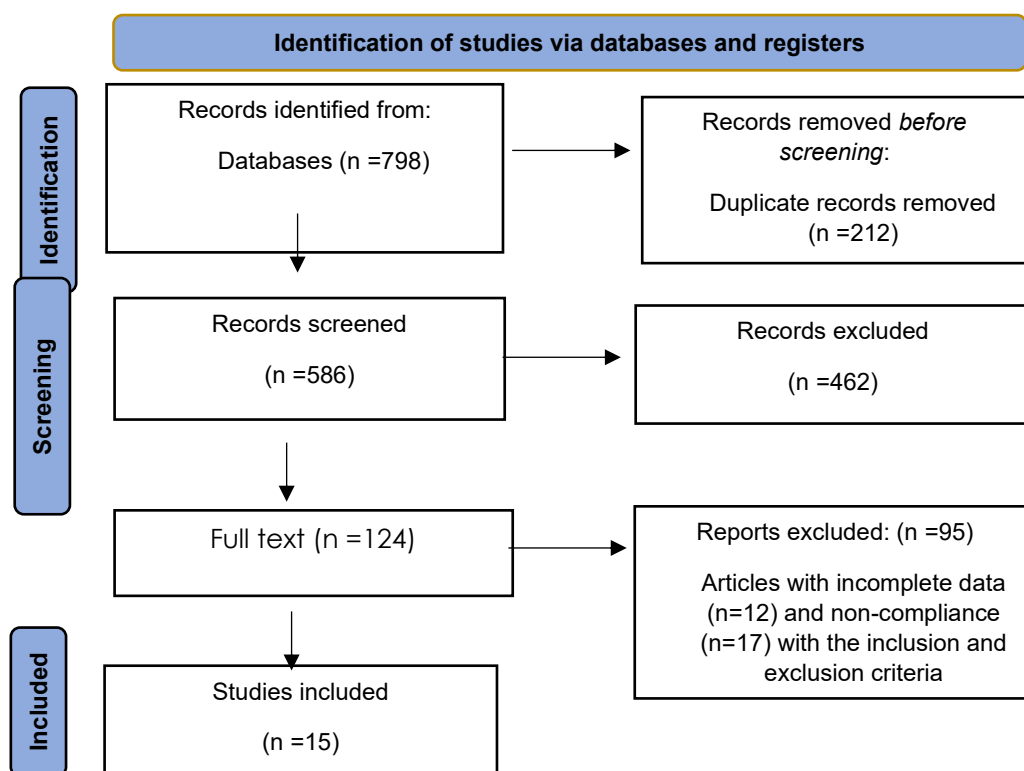
DATA ANALYSIS

Statistical analyses were performed using StataCorp LLC's Stata. v17 software. Fixed-effect models were used, the I^2 index was calculated to measure heterogeneity of studies, and forest plots were drawn to display the frequency of each study.

RESULT

The software then executed the next processes. In this article management of healthcare services in patients with cardiovascular problems with 798 published articles between 1990 and 2025 were evaluated with key words including "Nursing Services", "Healthcare Services", and "Cardiovascular Problems" in Scopus, Google scholar and PubMed databases was investigated. The preliminary search yielded 798 articles; during the first phase, 212 items were removed owing to duplicate data based on article titles. In the second phase, the abstracts of 586 publications were reviewed to remove studies that did not match the inclusion criteria ($n = 462$). After reviewing the entire texts of 124 papers, 109 were excluded in the third phase due to missing data or noncompliance with the inclusion and exclusion criteria. Finally, the current analysis contained 15 papers (Figure 1).

FIGURE 1. FLOW PRISMA 2020 OF INCLUDED SUBJECTS



STUDY CHARACTERISTICS

A total of 15 studies were included in this systematic review. The characteristics of the selected studies are summarized in Table 1.

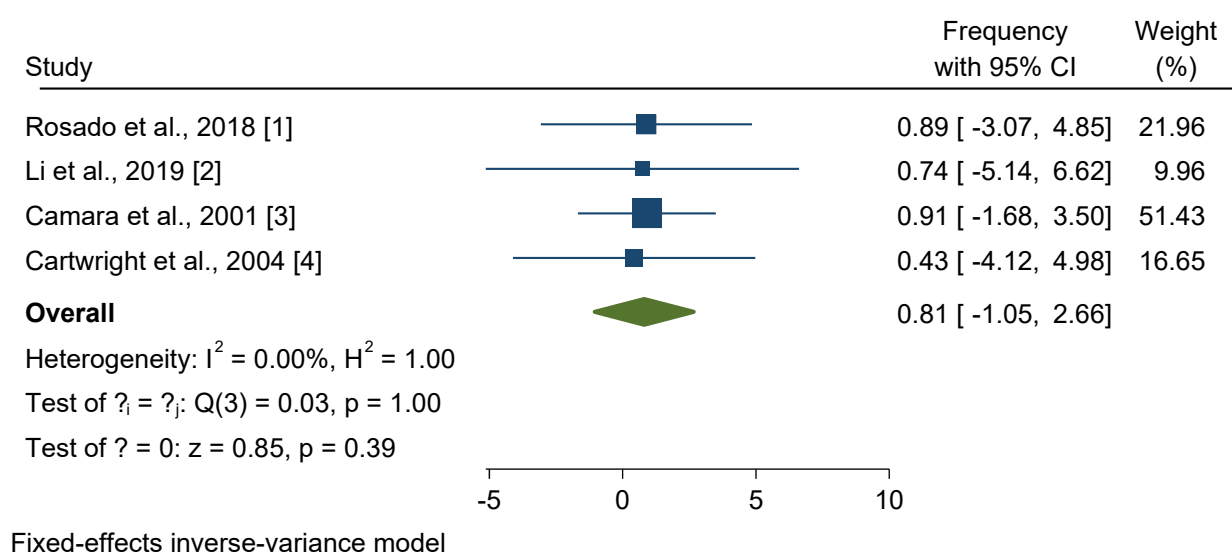
TABLE 1. CHARACTERISTICS OF THE SELECTED STUDIES FOR THIS RESEARCH

Author (Year)	Country / Population	Study Design	Sample Size	Population Characteristics	Healthcare Service / Intervention	Main Findings / Outcomes
Rosado V et al., 2018 [1]	Neonatal population	Systematic review	Not specified	Neonates with central venous catheters	Evaluation of risk factors for catheter-related infections	Identified key risk factors for infections in neonatal population
Li R et al., 2019 [2]	China	Observational	Not specified	Critically ill newborns	Use of peripherally inserted central catheters (PICC)	Reported outcomes and practical experience in NICU
Camara D, 2001 [3]	USA	Review / Clinical practice	Not specified	Neonates in NICU	Minimizing risks with PICC	Strategies to reduce catheter-associated risks
Cartwright D, 2004 [4]	Not specified	Observational	2186 catheters	Neonates	Central venous lines	Analyzed complications and outcomes related to catheter use

Chathas MK et al., 1990 [5]	USA	Observational	Not specified	Neonates in NICU	Percutaneous central venous catheterization	Experience over three years in NICU with outcome data
Colacchio K et al., 2012 [6]	USA	Observational	Not specified	Neonates in NICU	Central and non-central venous catheters	Reported complications associated with catheter types
Abeer AY, Asmaa MNK, 2025 [7]	Not specified	Review / Experimental	Not specified	N/A	Schiff base vitamin B derivatives & metal complexes	Biological and medical applications reviewed
Aras rt al.,, 2025 [9]	Not specified	Experimental	Not specified	N/A	Comarine azo chalcones derivatives	Cancer inhibition activity assessed
Arian B et al., 2025 [10]	Not specified	Review	N/A	N/A	Quantum dots in biomedical engineering	General review of applications in medical technology
Arika et al., 2025 [11]	Not specified	Experimental	Not specified	N/A	Phytoestrogen compounds from Vigna unguiculata	LC-MS/MS analysis of compounds
Dionisius et al., 2025 [12]	Not specified	Experimental	Not specified	N/A	Aquaporin-4 plasma expression	Effect of NaCl and Mannitol on tumor craniotomy outcomes
Jilani et al., 2021 [14]	Global	Review	N/A	Cardiovascular patients	Social determinants of health	Impact on cardiovascular outcomes and healthcare equity
Wenger et al., 2022 [15]	USA	Advisory / Review	N/A	Women with cardiovascular disease	Access and delivery of healthcare	Recommendations to improve equitable care
Javed et al., 2022 [16]	USA	Review	N/A	Racial/ethnic groups	Social determinants of health	Identified disparities in cardiovascular outcomes
Lockhart et al., 2021 [17]	Not specified	Review	N/A	Cardiovascular patients	General cardiovascular disease management	Overview of cardiovascular system diseases and management

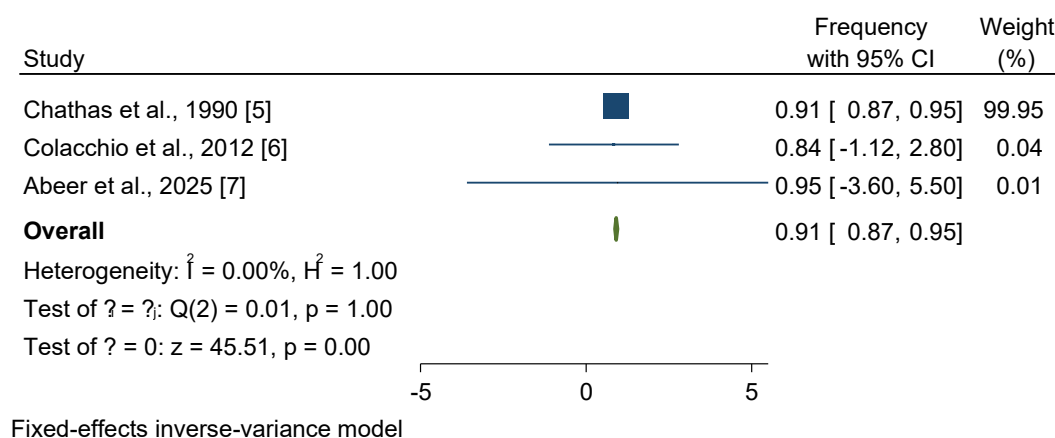
The frequency of availability of complete medications and equipment related to cardiac patients in ambulances was 81% (ES: 81%, 95% CI: -1.05, 2.66) (Figure 2). According to included studies, the availability of drugs and complete equipment related to heart patients is very vital for the referring ambulance. A heart attack is a sudden and unexpected complication that happens to a person, and its symptoms start in a few minutes.

FIGURE 2. FOREST PLOT ON THE AVAILABILITY OF DRUGS AND COMPLETE EQUIPMENT RELATED TO HEART PATIENTS



A person/patient's family in the field of rehabilitation and post-discharge care, along with the follow-up implementation of educational programs, increases the patient's quality of life and subsequently the quality of care by 91% (ES: 91%, 95% CI, 87%-95%). Accordingly, the implementation of the family-centered education model makes a statistically significant difference in the quality of life of patients after coronary artery bypass surgery and is associated with an increase in the quality of life of patients ($P < 0.01$) (Figure 3).

FIGURE 3. FOREST PLOT SHOWING THE EFFECT OF FAMILY-CENTERED EDUCATION ON PATIENTS' QUALITY OF LIFE

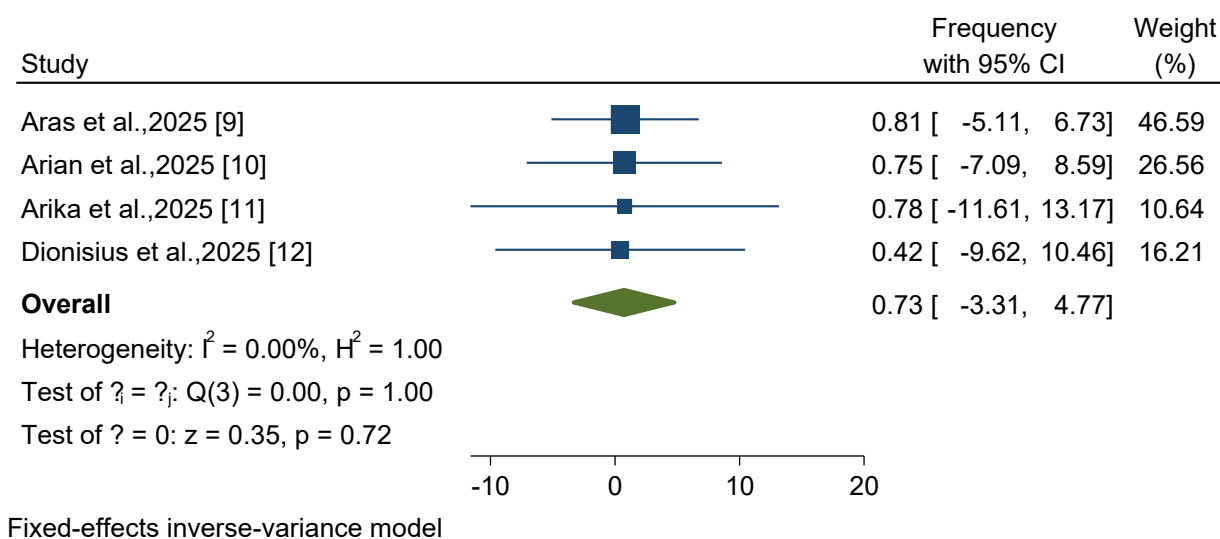


Anxiety and fear of playing the patient's role in the society causes depression, isolation and decrease in the patient's performance [8]. The presence of family members who have high understanding and tolerance to receive the necessary information about the treatment methods and the patient's recovery process is of great help in the recovery process of the patients for emotional support. Receiving social support from the family has a significant impact on recovery and the course of the disease. Informal support, as well as the impression and efficacy of family and friends as sources of support, can help patients recover faster. The supportive umbrella of family and friends, as well as significant persons in the patients' lives, can assist the person in dealing with and adjusting to the patient's problems and repercussions.

THE MAIN PARTS OF HOSPITAL INFORMATION SYSTEMS (HIS)

The division of HIS into two general categories (patient care system and management information system) is conceptual. The information system that supports administrative, human resources, and facility activities is conventionally classified as a management information system, which has an effectiveness of 73% (Figure 4).

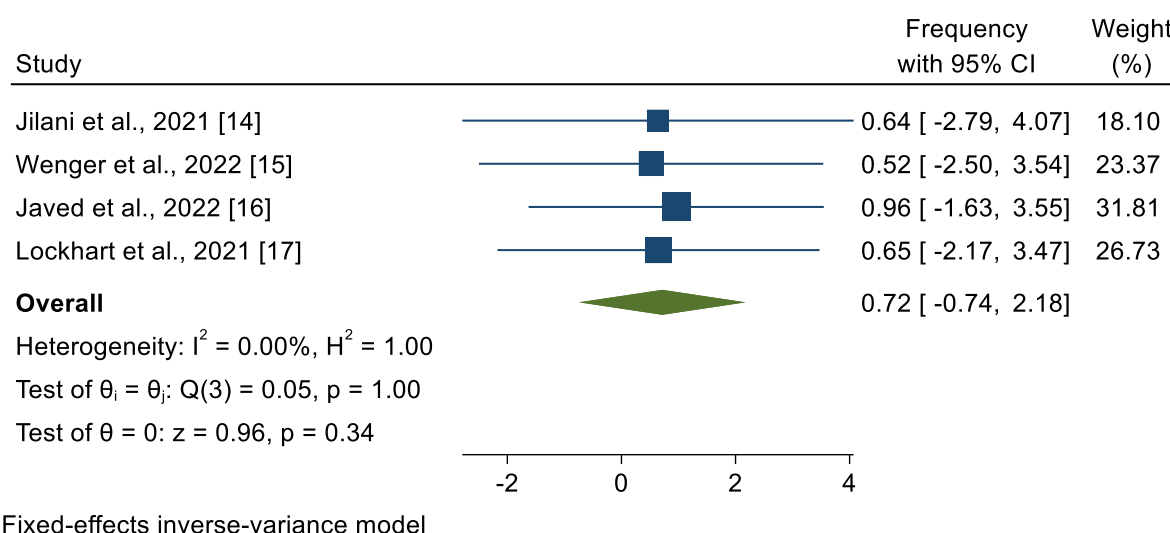
FIGURE 4. FOREST PLOT SHOWED EFFECTIVENESS OF HIS



PARTICIPATION IN OTHER HEALTH INFORMATION SYSTEMS

The hospital information system should be able to share patient information with other healthcare institutions to provide continuity of care through health information exchange or data warehouses or other tools [13]. Providing information for health promotion, disease prevention, and early detection efforts, as well as for planning, resource allocation, and epidemiology at various university, regional, or national levels, health databases contribute up to 72% (ES: 0.72; 95% CI) (Figure 5).

FIGURE 5. FOREST PLOT SHOWED LEVEL OF PARTICIPATION IN OTHER HEALTH INFORMATION SYSTEMS



DISCUSSION

The expectations and demands of patients, their caregivers and health professionals have increased over the past decade. Andryanto et al. (2025) reported that public awareness of health service provision increased following the release of key documents, such as the Patients' Charter and the Citizens' Charter (1993), both of which were made publicly accessible [18]. On the one hand, these charters increased the expectations of patients and their caregivers by providing more information about consumer rights [19]. On the other hand, the responsibility of the patients in using these rights was paid too much attention, which increased the demand for services and care in the busy organizations of that day [20]. Between 1990 and 2005, we saw a great emphasis on increasing the participation of patients and the community in planning, providing services and evaluating the quality of care provided to patients [21].

In the present study, the availability of complete medications and equipment for cardiac patients in ambulances was 81%. Family involvement in rehabilitation and post-discharge care, together with educational follow-up programs, improved patients' quality of life and care quality by 91%. Management information systems supporting administrative, human resources, and facility activities showed 73% effectiveness. Additionally, health databases, used for health promotion, disease prevention, early detection, planning, and resource allocation, contributed up to 72%.

The present findings are consistent with a study conducted in low-income countries, where access to emergency services, complete equipment, and medication is far below global standards [18]. A study reported that families play a significant role in improving patients' quality of life after discharge [19], and similar results were observed in the present study. Also, in most studies, the effectiveness and efficiency of management information systems and health databases were much higher than in the present study, and the reason for this is that the present meta-analysis used studies from all parts of the world [21,22]. One of the strengths of the present study compared to other studies was its simultaneous consideration of different dimensions of health services.

Despite its contributions, this meta-analysis has several limitations. First, the included studies showed substantial heterogeneity in design, populations, and healthcare settings, which may have influenced the pooled estimates. Second, most of the available evidence was observational in nature, limiting causal interpretation of the associations identified. Third, data from low- and middle-income countries were underrepresented in some domains, particularly regarding health information systems and structured family-centered programs. Future studies should employ longitudinal and interventional designs to clarify causal pathways and evaluate the long-term impact of integrated healthcare service models on cardiovascular outcomes. Additionally, context-specific research is needed to determine how these service components can be optimally adapted across different health systems and resource settings.

CONCLUSION

According to the present meta-analysis, fully equipping ambulances during patient transport, family-centred education, and general community awareness by health service systems would be significantly effective in reducing cardiovascular problems. It is suggested that health care systems carry out family-centred education and general community awareness to care for cardiovascular patients, and that fully equipping ambulances during patient transport would reduce mortality.

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BRIDGING THE GAP: TELEMEDICINE AND TB TREATMENT ADHERENCE IN INDIA

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ABSTRACT

OBJECTIVE:

This article examines the progress made in utilizing telemedicine for the treatment of tuberculosis (TB), particularly in enhancing patient adherence to treatment regimens. In a case study, the review evaluates the Ni-Kshay platform for health professionals and patients in India, identifying pain points contributing to treatment defaults. It aligns these findings with the country's National TB Elimination Program (NTEP) and offers recommendations to enhance telemedicine's role in TB treatment adherence.

METHODS:

The Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) framework was used to identify articles from two databases: Web of Science, and PubMed. The literature search included terms such as Telemedicine, eHealth, mHEALTH, Digital Health, Mobile Health, Video DOT, along with Tuberculosis and TB. Articles published between January 2021 and June 2024 were selected for the review.

RESULTS:

Out of 948 initially retrieved articles, 94 were reviewed and a final 69 articles included in this review. Except one, all reported positive outcomes from telemedicine. Video DOT and video calls showed superior results among various technologies. Instant messaging apps and smart pillboxes are rising. Mobile app solutions are promising. Telemedicine serves as a complementary tool to in-person clinical supervision, enhancing rather than replacing traditional face-to-face oversight. Integrating successful external interventions by studying local utility and limitations is critical.

CONCLUSION:

The utilization of telemedicine in TB treatment is increasing, highlighting the necessity for documenting best practices and establishing standardized protocols. However, the success of any technology-driven solution hinges on its alignment with user needs and contextual realities. In developing countries, it is crucial to deliberately and pragmatically integrate these solutions to effectively address challenges such as unequal access, high costs, social stigma, comorbidity prevalence, and delivery inefficiencies.

KEYWORDS

Tuberculosis (TB); Medication adherence; Telemedicine; Systematic review; Digital health; SDG goal 3.3

INTRODUCTION

Tuberculosis (TB) remains a major global health challenge, with approximately 10.6 million cases reported in 2022. Southeast Asia (46%), Africa (23%), and the Western Pacific (18%) account for the highest case burdens, where access to continuous, quality healthcare is often limited [1]. TB has consistently been the leading cause of death from a single infectious agent, excluding the recent COVID-19 pandemic [1].

To combat this, the World Health Organization (WHO) introduced the Directly Observed Treatment Short Course (DOTS) program in 1994, standardizing TB treatment across nations. The regimen typically lasts 6–9 months for uncomplicated cases, extending further for multidrug-resistant TB (MDR-TB) [2]. This prolonged treatment period is crucial for complete bacterial eradication and the prevention of drug-resistant strains [3].

Strict adherence to TB medication is critical for effective treatment outcomes. WHO and other organizations have implemented various strategies to support DOTS, including the integration of digital health technologies [4]. However, the absence of standardized tools and protocols hampers the widespread adoption of these technologies [5].

Telemedicine, the use of telecommunications and digital technologies to provide remote medical care, has shown significant potential in TB management. It offers several advantages, such as improved access to healthcare, enhanced patient monitoring, and reduced costs [6,7]. By complementing existing healthcare systems, telemedicine proves especially beneficial for patients requiring long-term treatment, including those with chronic infectious diseases like TB.

Successful implementation of telemedicine for managing TB, hepatitis B and C, and HIV has been documented in several settings [8]. Other telemedicine interventions, including mobile applications, messaging services, and digital adherence technologies (DATs), are also increasingly utilized in TB treatment [9, 10, 11, 12, 13]. However, comprehensive reviews on telemedicine's impact on TB management remain limited [5, 8, 14].

In 2015, WHO launched the "End TB Strategy," targeting an 80% reduction in TB incidence and a 90% decrease in TB deaths by 2030 [1]. India, which carries a significant TB burden, has responded with the National TB Elimination Programme (NTEP), leveraging digital technologies like *Ni-Kshay*, an online platform that aids patient care, monitoring, and management. NTEP offers free diagnosis and treatment and incentivizes private sector participation, which now accounts for 30% of TB case notifications. In 2022, India recorded 2.42 million TB cases, with extensive testing and enhanced treatment efforts, significantly reducing case numbers. *Ni-Kshay* has played a critical role in these improvements.

Nevertheless, patient adherence to TB treatment remains a challenge, with default cases observed in both public and private healthcare sectors [15]. Telemedicine offers a potential solution, as studies indicate that telemedicine-assisted supervision improves medication adherence and reduces default rates compared to traditional, in-person supervision [16, 17].

This article explores recent advancements in TB treatment and evaluates the potential for further integration of telemedicine interventions within the *Ni-Kshay* framework [4, 5]. It aims to achieve this through a comprehensive literature review, assessing global telemedicine interventions for TB and identifying those yet to be implemented in India's NTEP. Furthermore, this article examines the reasons for treatment defaults in India, aligning these with existing NTEP strategies and highlighting untested telemedicine interventions. The paper concludes by recommending enhancements to *Ni-Kshay* to improve medication adherence and TB management in India.

RESEARCH METHODOLOGY

This study systematically reviews telemedicine-based interventions for TB treatment using the PRISMA guidelines [18], with modifications (scoping review and broader set of keywords) to align with the Ni-Kshay framework. This study conducts a PRISMA-informed scoping review with a systematic search and expanded keywords to synthesise evidence on telemedicine-based TB interventions aligned with the Ni-kshay framework. The review covers studies from January 2021 to June 2024, focusing on recent advancements in Telemedicine. Literature searches were conducted on *PubMed* and *Web of Science*. In this study we applied the following definition of Telemedicine, "Any intervention utilizing telecommunication, internet, or information technology for enhancing medication adherence". Both authors conducted the review manually, without bibliographical software. It was agreed between the authors that papers listed under *PubMed* and *Web of Science* databases would be deemed of sufficient quality for the review if they meet the inclusion criteria. Disagreements were resolved through discussion, with adjudication by the first author where consensus could not be reached.

INCLUSION-EXCLUSION CRITERIA

Using the above definition of telemedicine, the final shortlist for the review was created based on specific inclusion and exclusion criteria. Each article had to meet two inclusion criteria with at least one sub-criterion from the second set. Articles were excluded if they met any exclusion criteria.

Inclusion criteria

1. The article discusses a telemedicine-based intervention method for TB medication adherence.
2. At least one of the following was identified:
 - (a) The article studies the implementation of a telemedicine intervention.
 - (b) The article studies a previously implemented telemedicine intervention with a new set of participants in a new geographical setting.
 - (c) The article studies a previously implemented telemedicine intervention to improve or alter the intervention process.

Exclusion criteria

1. The article discusses telemedicine intervention but not for TB treatment.
2. The article uses a telemedicine intervention usually used in TB treatment but for studying its treatment of non-TB diseases.
3. The article references telemedicine intervention for TB treatment but the focus of the article is not on studying its implementation or medication adherence.
4. The article reference telemedicine interventions but its objective is to study in-person TB treatment.

SEARCH PROCESS

Initially a set of keywords were identified for the search process using TB reports by WHO [1] and the Government of India [19], as well telemedicine research [7,14,6]. The identified keywords were used in the following search strings for their respective databases:

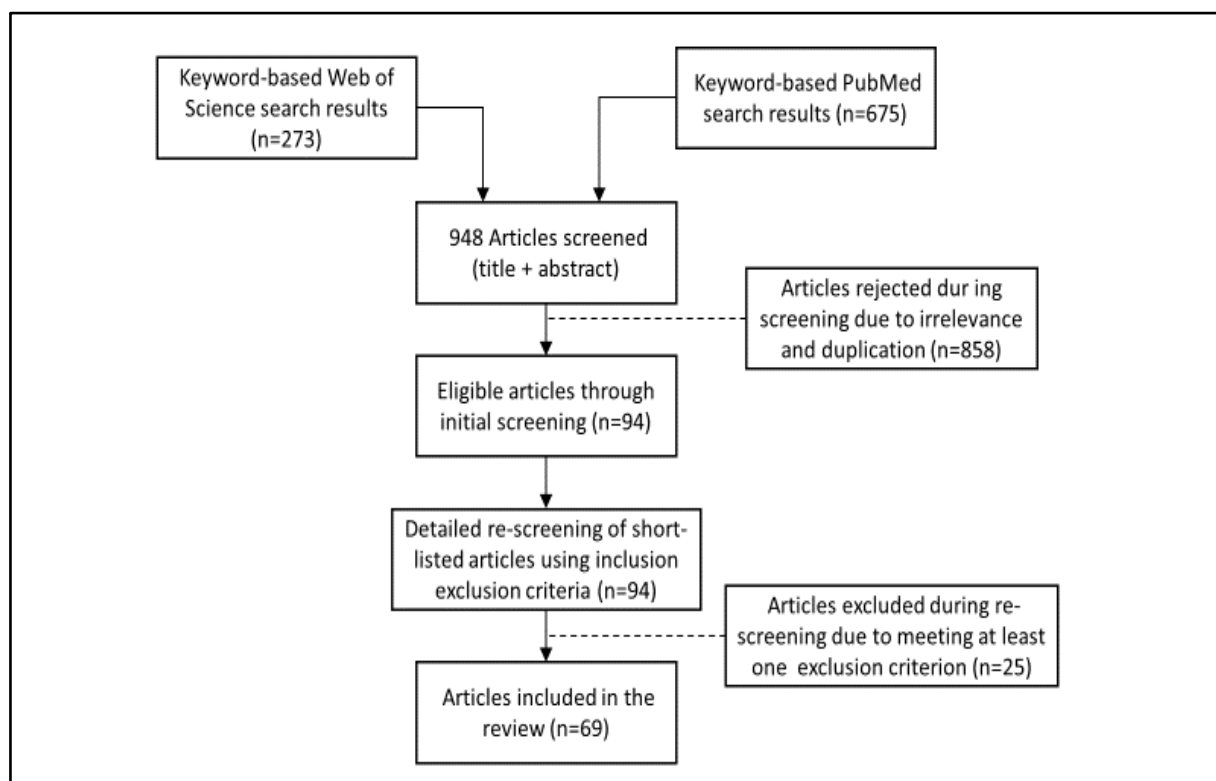
PubMed search string: (((((((Telehealth) OR (Telemedicine)) OR (EHEALTH)) OR (MHEALTH)) OR (Digital Health)) OR (Mobile Health)) OR (VDOT)) OR (Video DOT)) OR (EDOT)) AND ((Tuberculosis) OR (TB))

Web of Science search string: (Telehealth" OR Telemedicine" OR Tele-health" OR Tele-medicine" OR EHEALTH" OR E-Health" OR MHEALTH" OR Digital Health" OR Mobile Health" OR VDOT" OR Video DOT" OR E-DOT" OR EDOT") AND (Tuberculosis" OR TB")

The *PubMed* and *Web of Science* searches yielded 675 and 273 results, respectively. After reviewing the titles and abstracts of these 948 articles, 94 papers were short-listed. The manuscripts of these 94 papers were rigorously examined based on inclusion-exclusion criteria. Subsequently, 69 research articles, focusing on the implementation of telemedicine-based TB interventions between January 2021 and June 2024, were selected for the review. Each of the 25 articles

excluded during the rescreening fell under at least one of the exclusion criteria. The flow of information for the entire search process is illustrated in Figure 1.

FIGURE 1: FLOW OF INFORMATION FOR THE PRISMA SEARCH PROCESS



RISK OF BIAS ASSESSMENT

The Joanna Briggs Institute (JBI) Critical Appraisal Tools suite was utilized for a risk of bias assessment on the final shortlist [96]. The included articles were first grouped according to their primary study design, following which the appropriate JBI Critical Appraisal checklist(s) were assigned to each group.

Each article was then assessed with the appropriate JBI Critical Appraisal checklist. Subsequently, the articles were analyzed based on their checklist performance and their ability to infer adherence effectiveness of the intervention being studied. These assessments were used to derive a risk of bias categorization at the study design level. Groups (based on study design) were categorized into low, moderate and high risk of bias depending on the overall risk profile of the articles within that group. Categorizing risk of bias at the study design level allowed for comparison of methodological rigor across designs.

The assessment results have been outlined in Table 1. Randomized controlled trials demonstrated lower risk of bias, while quasi-experimental, cross-sectional, qualitative, and textual evidence sources tended to show moderate to high risk, reflecting methodological and inferential limitations.

TABLE 1: RISK OF BIAS BY STUDY DESIGN USING JBI CRITICAL APPRAISAL TOOLS

Study Design	JBI Checklist Used	Studies	Risk of Bias	Notes
Randomized Controlled Trials (including cluster, stepped-wedge, superiority, non-inferiority, pilot RCTs)	JBI Checklist for Randomized Controlled Trials	Majella et al. [55]; Byonanebye et al. [57]; Sahile et al. [58]; Gashu et al. [59]; Kibu et al. [26]; Iribarren et al. [63]; Manyazewal et al. [64]; Burzynski et al. [14]; Kumwihar et al. [67]; Boutilier et al. [27]; Liu et al. [12]; Wei et al. [48]; Cattamanchi et al. [11]; Bao et al. [28]	Low	Randomisation and structured follow-up support internal validity. Completed trials reporting outcomes demonstrate low risk.
Randomized Controlled Trials (cluster and stepped-wedge protocol studies) with no outcome data	JBI Checklist for Randomized Controlled Trials	Sekandi et al. [54]; Tadesse et al. [24]; Iribarren et al. [56]; Ross et al. [32]; Velen et al. [66]; Cheng et al. [79]; Jerene et al. [25]; Foster et al. [46]	Not Applicable	Protocol-only papers with planned but not yet reported outcomes. Risk of bias cannot be formally judged.
Cohort & Longitudinal Studies	JBI Checklist for Cohort Studies	Udwadia et al. [10]; Perry et al. [35]; Lippincott et al. [37]; Bachina et al. [44]; Li et al. [38]; Rodrigues et al. [43]; Wu et al. [69]; Wang et al. [70]; Zhou et al. [81]	Moderate	Good follow-up and real-world adherence measurement, but non-random allocation limits internal validity.
Quasi-Experimental / Pre-Post Studies	JBI Checklist for Quasi-Experimental Studies	Santra et al. [22]; Wijayanti et al. [68]; Saha et al. [16]; Chen et al. [21]	Moderate to High	Useful real-world evidence but absence of randomization increases selection bias. Chen et al. [21] showed reduced outcomes, suggesting implementation uncertainty.
Analytical Cross-Sectional / Comparative Cross-Sectional / Survey Studies	JBI Checklist for Analytical Cross-Sectional Studies	Zhang et al. [17]; Walle et al. [77]; Levine et al. [72]; Kiwanuka et al. [78]; Selvaraju et al. [30]; Htet et al. [74]; Katende et al. [62]; Rahayu et al. [61]	Moderate to High	Good descriptive value, but many rely on self-reported measures. Surveys are exploratory in nature with small samples; outcome causation cannot be inferred.
Qualitative / CFIR / Exploratory / Perception Studies	JBI Checklist for Qualitative Research	Sekandi et al. [40]; Thomas et al. [52]; Mukora et al. [33]; Tumuhimbise et al. [75]; Sekandi et al. [76]; Shah et al. [80]; Milligan et al. [51]; El Joueidi et al. [47]	High	Appropriate for exploring context and experiences; however, do not measure adherence or treatment outcomes.
Mixed-Methods Studies	JBI Checklist for Qualitative Research + Appropriate JBI Quantitative Checklist	Szkwarko et al. [45]; Kim et al. [53]; Maro et al. [34]; Musiimenta et al. [13]; Milligan et al. [51]	Moderate	Comprehensive insight; but, quantitative components often lack randomization, and qualitative rigor is good but not universal.

Pilot / Feasibility / Implementation Studies	Appropriate JBI Quantitative Checklist matched to study design (eg. RCT, Quasi-experimental, Cohort)	Donahue et al. [23]; Marx et al. [29]; Casalme et al. [41]; Katende et al. [62]; Tello-Cajiao et al. [71]	Moderate	Exploratory in nature with small samples; focus is on implementation of the intervention.
Usability / Acceptability / Developmental Studies	JBI Checklist for Qualitative Research and/or JBI Checklist for Analytical Cross-Sectional Studies	Rahayu et al. [61]; Htet et al. [9]; Kumwichar et al. [42]; Abas et al. [36]	Moderate to High	Focus is on the design and testing of the intervention.
Textual Evidence (Narrative, Expert Opinion, Policy / Consensus)	JBI Critical Appraisal Checklists for Textual Evidence (Narrative or Expert Opinion or Policy / Consensus)	Robbiati et al. [39]; Park et al. [50]; Calnan et al. [60]; Yang et al. [65]	Moderate to High	Descriptive nature with focus on providing insights about implementation and not empirical evaluation of interventions.

TABLE 2: CATEGORIZATION OF THE LITERATURE

Author	Type of study	Telemedicine based intervention	Participants	Geography of study	Effectiveness*	Within NTEP / Ni-Kshay	Notes
Santra et al. [22]	Quasi- experimental study	SMS; voice calls	TB patients	Delhi (India)	85.5% - 96.4% (A)	Yes	The intervention duration was 90 days comprising once-daily text message in local language Hindi and once a week real-time two-way 10 minutes voice call.
Sekandi et al. [40]	Exploratory qualitative study	Mobile 'sureAdhere' application	TB patients, nurses, health workers, family member of patient	Kampala (Uganda)	N.A.	Yes	The respondents had no real-life experience using <i>sureAdhere</i> . Still, they identified some critical issues such as cost of internet, the smartphone, and privacy or confidentiality concerns.
Park et al. [50]	Integrated patient management project	Smart pillbox; medication monitoring system	TB patients	Morocco	N.A. - 90% (only end- line %)	No	The smart pillbox sends medication updates of patients to the system. The medication monitoring system operates similarly to the health worker interface of the <i>Ni-Kshay</i> platform.

Szkwarko et al. [45]	Mixed methods study	Mobile application	TB patients, health workers, community volunteers	Kenya	10.7% - 16.2% (A)	Yes	The mobile application is used for presumptive TB screening. A tablet device provided to health workers for the same.
Milligan et al. [51]	Mixed methods thematic analysis	Mobile application	TB patients, health workers	Buenos Aires (Argentina)	N.A.	Yes	The mobile application tracks treatment progress, provides disease tailored information, allows interactive communication between patients and health workers, and is linked with a direct adherence drug metabolite test.
El Joueidi et al. [47]	Consolidated Framework for implementation research (CFIR)	Digital platform and mobile application 'WeTel'	TB patients, health workers, nurses, WeTel manager	Kenya, Rwanda and Canada	N.A.	Yes	WeTel allows patients to communicate with health workers via short message service (SMS), voice and video call.
Thomas et al. [52]	Qualitative study	Smart pillbox	TB patients	Chennai and Mumbai (India)	N.A.	No	Probable missed doses would result in automated SMS text messaging notifications prompting health workers to intervene with patients.
Kim et al. [53]	Mixed methods study	Chatbot	TB patients, TB treatment experts	Seoul (South Korea)	N.A.	No	The chatbot was built on an open-source platform and operates within an instant messenger app called Kakao Talk.
Perry et al. [35]	Observational study	Mobile 'emocha' application	TB patients	California (USA)	53.9% vs. 68.4% (B)	Yes	Patients were daily sent two text message reminders in the absence of submitted videos and were prompted to document side effects prior to submissions.
Donahue et al. [23]	Pilot study	Software 'Adobe Connect'	TB patients	Maryland (USA)	N.A. - 100% (only end-line %)	Yes	The software was used to conduct VDOT for TB patients.
Sekandi et al. [54]	Randomized controlled trial	Digital platform and mobile application	TB patients	Kampala (Uganda)	N.A. (protocol)	No	Weekly internet subscription, text message reminders, and incentives for those who adhere to VDOT treatment are part of the intervention.
Majella et al. [55]	Randomized controlled trial	Voice calls	TB patients	Puducherry (India)	13.0% vs. 4.7% (C, measured loss to follow-up)	Yes	The intervention was used to remind patients to register for anti-TB treatment after referral, in order to reduce pre-treatment loss to follow up.
Iribarren et al. [56]	Randomized controlled trial	Web platform and mobile application	TB patients	Buenos Aires (Argentina)	N.A. (protocol)	Yes	A health worker and a direct adherence test strip is assigned to each patient. The application functions similar to Ni-Kshay.
Cattamanchi et al. [11]	Stepped-wedge cluster-randomized trial	Medication label '99DOTS'	TB patients	Kampala (Uganda)	70.5% vs. 86.6% (C, per protocol)	Yes	Patients need to call health workers and provide the label code for each medication so that their adherence can be tracked.

Tadesse et al. [24]	Cluster randomized trial	Web platform 'ASCENT'; smart pillbox; medication label	TB patients	Oromia and Addis Ababa (Ethiopia)	N.A. (protocol)	No	Smart pillbox and medication label were used as interventions for different participant groups and their adherence was measured using ASCENT.
Byonanebye et al. [57]	Randomised control trial	Interactive voice response technology	TB patients	Kampala (Uganda)	N.A. (protocol)	Yes	-
Sahile et al. [58]	Randomised control trial	SMS; voice calls	TB patients	Addis Ababa (Ethiopia)	N.A. (protocol)	Yes	-
Gashu et al. [59]	Randomised control trial	Voice calls	TB patients	Gondar (Ethiopia)	66.4% vs. 79% (C)	Yes	The intervention involved weekly pill refilling and daily medication reminders through phone calls.
Udwadia et al. [10]	Cohort study	Digital tools 'Skype' and 'Zoom'; instant messenger 'WhatsApp'	TB patients	Mumbai (India)	27% vs. 68% (B, preference by patients)	Yes	Telemedicine involved providing online consultations to participants.
Lippincott et al. [37]	Retrospective cohort study	Mobile 'emocha' application	TB patients	Maryland (USA)	59% vs. 86% (B)	Yes	Patients use <i>emocha</i> application through Smartphone / tablet and the TB clinic uses a web-based dashboard to conduct VDOT.
Bao et al. [28]	Randomized control trial	Instant 'WeChat' messenger	TB patients	Harbin (China)	N.A. (measured for self-management)	No	Pharmacists provide health education to TB patients through WeChat.
Marx et al. [29]	Pilot study	Instant messenger 'WhatsApp'	TB patients	Cape Town (South Africa)	N.A. (measured response to reminders)	No	WhatsApp based reminders were sent prior to appointment scheduled 2-3 days after the diagnostic visit.
Robbiati et al. [39]	Situation analysis	Digital platform	Health workers and health facility	Luanda (Angola)	N.A.	Yes	The digital platform is used for electronic medical records and functions similarly to the health worker's interface of the <i>Ni-Kshay</i> platform.
Calnan et al. [60]	Government project	Helpline number/call centre	TB patients	Philippines	N.A.	Yes	Intervention is similar to TB helpline <i>Ni-Kshay Sampark</i>
Bachina et al. [44]	Observational cohort study	Mobile 'emocha' application	TB patients	Minneapolis, Minnesota (USA)	54.5% vs. 81% (B)	Yes	The study implemented VDOT 7 where Patients were instructed to submit videos documenting ingestion of medications.
Casalme et al. [41]	Feasibility and acceptability study	Web platform and mobile application 'sureAdhere'	TB patients, health workers	Cavite (Philippines)	78% vs. 82% (B)	Yes	Patients had to record videos of them ingesting TB medication as part of the VDOT intervention.
Rahayu et al. [61]	Usability study	Mobile 'SIKRIBO' application	Health workers	Semarang (Indonesia)	N.A. (measured system usability)	Yes	The SIKRIBO application was developed using design science research methodology.
Htet et al. [9]	Usability study	Mobile application 'TB-screen'	TB patients	Mandalay City (Myanmar)	N.A. (measured system usability)	No	The application screens TB risk propensity of participants.

Li et al. [38]	Prospective cohort study	Mobile application 'TB Assistant'; web system and mobile application 'TB Doctor'	TB patients	Tianjin (China)	51.84% - 84.84% (A)	Yes	TB Assistant is the patient side and TB Doctor is the doctor side of the system. Doctors can view medication feedback, respond to questions, communicate with patients and send messages. The framework is similar to Ni-Kshay.
Kibu et al. [26]	Randomized control trial	SMS	TB patients	Buea and Kumba districts (Cameroon)	41.7% - 61.2% (A)	No	Both single way and double way communication through SMS were assessed as interventions individually as well as combined.
Katende et al. [62]	Pilot study	Mobile application	TB patients, health workers	Kampala (Uganda)	66% - 85% (measured adherence port)	No	Voice text mobile application was developed using design science research methodology.
Iribarren et al. [63]	Pilot randomized control trial	Mobile application	TB patients	Buenos Aires (Argentina)	81% vs. 95% (C)	Yes	Patients can interact with health workers assigned to them through the application. Additionally, a urine drug metabolite test is provided as part of the intervention.
Manyazewal et al. [64]	Randomized control trial	Smart pillbox	TB patients	Addis Ababa (Ethiopia)	N.A. - 79% (measured average adherence)	No	-
Burzynski et al. [14]	Randomized non-inferiority trial	Digital tool 'Skype'; mobile application 'sureAdhere'	TB patients	New York City (USA)	87.2% vs. 89.8% (C)	Yes	Patients can either record their videos (sureAdhere) or do live video conferencing (Skype) from their preferred locations for VDOT.
Yang et al. [65]	Project study	Smart pillbox; medication monitoring system	TB patients	Sale (Morocco)	N.A. (measured cost effectiveness using Markov model)	No	The web-based medication monitoring system sends medication reminders to patients. Smart pillboxes only monitor opening of the pillboxes electronically and not ingestion.
Manyazewal et al. [31]	Randomized control trial	Smart pillbox 'evriMED500'	TB patients	Addis Ababa (Ethiopia)	98.97% vs. 99.01% (C, measured geometric mean)	No	-
Selvaraju et al. [30]	Survey study	Instant messenger 'WhatsApp'	Health workers, TB patients	Tamil Nadu (India)	45% - 0% (A, measured loss to follow up)	Yes	WhatsApp was used by health workers to communicate among themselves. The intervention was concerned with improving communication between health workers.
Velen et al. [66]	Randomized control trial	Mobile application	TB patients	Vietnam	N.A. (protocol)	Yes	The mobile application functions similar to the Ni-Kshay application.
Kumwihar et al. [67]	Cluster Randomized control trial	Mobile application 'LINE'	TB patients, health workers	Songkhla province (Thailand)	N.A. (protocol)	Yes	The specific VDOT system 'TH VOT' was used as the intervention.

Kumwiche et al. [42]	Usability study	Mobile application 'LINE'	TB patients, health workers	Songkhla province (Thailand)	N.A.	Yes	The specific VDOT system 'TH VOT' was used as the intervention.
Boutilier et al. [27]	Randomized control trial	SMS	TB patients	Nairobi (Kenya)	N.A.	No	Patients can use the unstructured supplementary services data (USSD) interface to access educational information about TB and information on their adherence performance compared with other (anonymised) patients.
Wijayanti et al. [68]	Quasi-experimental study	Mobile application 'ER-LINA'	TB patients, health workers	Jakarta (Indonesia)	N.A.	No	ERLINA provides audio-visual media, use of straightforward language and communication with assigned health worker. It also allows real-time data monitoring without internet.
Saha et al. [16]	Quasi-experimental study	Mobile application; web-based application; physical device 'TMEAD'	TB patients	Nasik, Maharashtra (India)	90% vs. 99% (B)	No	The tuberculosis monitoring encouragement adherence drive (TMEAD) reminds, dispenses, and senses a patient's adherence to the treatment regime. Web-based application provides real-time monitoring with daily updates and patient analytics to health institutions. Mobile application provides instant updates and a quick view for the on-field TB health worker.
Wu et al. [69]	Prospective cohort study	Mobile application; smart pillbox	TB patients	Shanghai (China)	N.A. (measured three for groups)	No	The application provides medication reminders to patients.
Wang et al. [70]	Longitudinal study	Instant messenger 'WeChat'; smart pill-box	TB patients	China	83.8% vs. 95.3% vs. 95.7% (C, Control group vs. WeChat group vs. pillbox group)	Yes	WeChat and EMM were studied as separate interventions.
Tello-Cajiao et al. [71]	Implementation study	Instant messenger 'WhatsApp'	TB patients	Cal (Colombia)	N.A. vs. 98% (A, only end-line %)	Yes	WhatsApp was used for video calls between patient and health worker to ensure that the patient ingests the medication.
Abas et al. [36]	Development and validation study	Mobile application 'GR-VOTS'	IT experts, health workers, health administrators	Malaysia	N.A.	No	Gamified real-time video observed therapies (GR-VOTS) uses gamification of treatment schedule to improve adherence.
Levine et al. [72]	Cross-sectional study	Voice calls; message prompts	TB patients	Connecticut (USA)	N.A. - 94.3% (A, only endline %)	Yes	-

Chen et al. [21]	Pre-post study	Medication label '99DOTS'	TB patients	Himachal Pradesh (India)	93.1% - 92.9% (A, measured favourable treatment outcome)	Yes	The intervention caused a decline in favourable outcome. However, the decline was not statistically significant.
Rodrigues et al. [43]	Cohort study	Mobile application 'v.Cure'	TB patients	Bangalore, Karnataka (India)	94% (measured acceptability of videos)	Yes	v.Cure was used to record medication ingestion videos by patients. It also sent adherence text reminders.
Musiimenta et al. [13]	Mixed methods formative study	SMS; mobile wallet 'Wise-Cash'; smart pillbox 'evriMED1000'	TB patients	Uganda	N.A. (measured financial incentives preference)	No	The My Mobile Wallet intervention is composed of a real-time medication monitor, SMS reminders, and a WiseCash component for sending mobile money incentives. The NTEP also has similar reward systems under its programme.
Foster et al. [46]	Cluster randomised trial	Web platform 'ASCENT'; smart pillbox 'evriMED'; medication label	TB patients	Addis Ababa and Oromia (Ethiopia)	N.A. (protocol)	No	Smart pillbox and medication label were used as interventions for different participant groups and their adherence was measured using ASCENT.
Liu et al. [12]	Cluster randomised superiority trial	Smart pillbox	TB patients	China	10% vs. 9% (C, measured loss to follow up)	No	A monthly review of adherence data was provided to patients, and also used to provide differentiated care for patients with adherence issues.
Zhang et al. [17]	Comparative cross sectional study	Electronic system 'e-PSS'	TB patients	Wuhan (China)	80.33% vs. 84.28% (B)	Yes	The interface of e-Patient Service System (e-PSS) is used by health workers for data collection and data management of patients, similar to Ni-Kshay. This study compares e-PSS with the paper based TB control information system (TCIS).
Manyazewal et al. [73]	Randomised controlled trial	Smart pillbox 'evriMED500'	TB patients	Addis Ababa (Ethiopia)	63.43 vs. 85.78 (C, effectiveness measured using TQSM)	No	Treatment satisfaction questionnaire for medication version 4 (TSQM 1.4) was used to compare effectiveness, side effects and convenience between arms of the study.
Jerene et al. [25]	Pragmatic cluster randomised trial protocol	Web platform 'ASCENT'; smart pillbox 'evriMED'; medication label 99DOTS	TB patients	South Africa, Tanzania, Ukraine and Philippines	N.A. (protocol)	No	Smart pillbox and medication labels to be used as interventions in different facilities and their performance to be measured using ASCENT.
Mukora et al. [33]	Qualitative study	Smart pillbox 'evriMED'; SMS; voice calls	Health workers, stakeholders	South Africa	N.A.	No	Health workers were surveyed and thematic analysis was used to discuss the feasibility and effectiveness of the interventions.
Htet et al. [74]	Survey study	Mobile application	Community members	Mandalay (Myanmar)	N.A.	Yes	Mobile application used to calculate the TB risk propensity of patients by uploading their details.
Tumuhimbise et al. [75]	Qualitative study	Mobile application 'Tuuka'; SMS	Health workers	Mbarara (Uganda)	N.A. (measured usability)	Yes	The module for SMS reminders was also integrated within the application.

Sekandi et al. [76]	Cross-sectional qualitative study	Mobile application	TB patients	Kampala (Uganda)	N.A.	Yes	The application is used for asynchronous monitoring, that is, patients need to record and submit videos of ingesting medicine.
Ross et al. [32]	Randomized controlled trial	Smart pillbox 'Wisepill RT3000'	TB patients	Durban, KwaZuluNatal (South Africa)	N.A. (protocol)	No	Study included four arms, with the pillbox being one of the interventions. Participants using the pillbox could choose a text message reminder from a guided menu, and received weekly messages to encourage adherence.
Walle et al. [77]	Cross-sectional; Structural equation modelling	SMS	Health workers	Ilu Aba Bor and Buno Bedelle (Ethiopia)	N.A.	Yes	Structural equation modelling was used to measure the intention and attitude towards using SMS by health workers.
Kiwanuka et al. [78]	Survey study	Medication label 99DOTS; SMS; voice calls	TB patients	Uganda	N.A.	Yes	-
Cheng et al. [79]	Randomized controlled trial	Mobile application 'Bac Sy Minh (Dr Smart)'	TB patients	Vietnam	N.A. (measured cost effectiveness)	Yes	Participants were provided money to cover the data usage costs.
Shah et al. [80]	Exploratory qualitative study	Mobile application 'Ni-Kshay SETU'	Health workers, stakeholders	Jharkhand and Gujarat (India)	N.A.	Yes	Ni-Kshay SETU is developed by Indian Institute of Public Health, Gandhinagar and follows NTEP protocols. However, it is outside the official Ni-Kshay framework under NTEP.
Abas et al. [49]	Single-arm intervention study	Mobile application 'GR-VOTS'	TB patients	Malaysia	81% vs. 90.87% (B)	No	Gamified real-time video observed therapies (GR-VOTS) uses gamification of treatment schedule
Zhou et al. [81]	Cohort study	Mobile application; smart pillbox	TB patients	Yiwu city, Zhejiang China)	89.6% vs. 94.3% (B)	Yes	Participants had to choose between application used to send reminders and smart pillbox as interventions. A management website was provided for medical staff to monitor patients' medication adherence.
Maro et al. [34]	Mixed methods study	Smart pillbox 'evriMED'; SMS	TB patients	Kilimanjaro (Tanzania)	N.A. (based on demographics)	No	EvriMED is a medication dispenser with internet connectivity that can send real-time SMS reminders.
Wei et al. [48]	Randomized controlled trial	Smart pillbox; mobile application; instant messenger 'WeChat'	TB patients	Tibet	36% vs. 9.8% (C, measured poor adherence to treatment)	No	The pillbox also has audio message reminders. An associated application to facilitate adherence monitoring and communication between patients and healthcare workers and a free smartphone data package was also part of the intervention.

Note: In effectiveness column, (A) is 'baseline adherence % - end-line adherence %'; (B) is 'in-person intervention vs. telemedicine intervention'; (C) is 'control group adherence vs. intervention group adherence'. Details beyond these categories have been specified in parentheses.

TABLE 3: GLOBAL BEST PRACTICES VS NI-KSHAY FRAMEWORK

Domain	Global Best Practices	Current Status in Ni-Kshay	Identified Gap	Feasibility in India	Adaptable Recommendation
Patient Engagement & Support	Patient-centred mobile apps enabling self-monitoring, adherence tracking, education, and communication	Patient information largely managed by healthcare workers; limited active patient-side engagement	System is provider-driven; weak patient empowerment and interaction features	High (apps already exist; patient literacy improving)	Strengthen patient interface with self-monitoring dashboard, educational material, symptom reporting, and structured follow-up prompts.
Tele-Counselling	Counselling delivered by trained TB health professionals; structured behavioural support protocols	Ni-Kshay Sampark provides tele-counselling but via non-medical call agents	Potential misinformation; absence of clinical qualification and expertise in counselling	Moderate (large population, workforce training burden, and policy integration challenges)	Hybrid model with medically trained counsellors for complex cases; standardized counselling scripts; clear escalation process; phased rollout rather than nationwide at once.
Communication Channels	Multi-channel communication: SMS, voice, instant messaging, app notifications, two-way interaction	SMS reminders and telephonic counselling exist; WhatsApp is used informally	No formal integrated messaging platform within Ni-Kshay; limited two-way structured communication	Moderate (significant number of patients are low-tech users)	Integrate app or platform linked two-way messaging system; retain SMS for low-tech users
Digital Adherence Technologies (DATs)	Smart pillboxes (MERM), medication labels, automated tracking dashboards integrated with apps	Smart pillboxes and 99DOTS exist; alerts and reminders are in use	Fragmented integration; underutilisation of real-time analytics	High	Consolidate DATs into unified Ni-Kshay dashboard; real-time adherence monitoring
Video-Supported Treatment (VDOT)	Widely validated VDOT systems improving adherence and reducing burden	No integrated VDOT in Ni-Kshay; limited due to internet coverage challenges	Lack of in-system VDOT functionality; reliance on voice calls	Moderate (selective due to digital divide; realistic mainly for urban, higher-income populations)	Pilot VDOT in urban / connectivity-strong districts
Integrated Telemedicine Ecosystems	Unified platforms integrating app, dashboard, VDOT, messaging, pillboxes, reminders	Ni-Kshay app + Ni-Kshay Sampark operate as separate systems	System fragmentation; parallel telemedicine entities	Moderate	Integrate Sampark into Ni-Kshay ecosystem or create structured interoperability
Data Use & Analytics	Real-time dashboards, predictive analytics, early identification of risk of default	Primarily monitoring and registry functions	Limited analytical analysis for proactive intervention	Moderate	Introduce intervention focussed clustering and risk-flagging processes
Equity & Access	Offline capability, low-data solutions, multilingual design, inclusive design	Internet connectivity challenges; reliance on telephony and SMS for many	Digital divide limits advanced telemedicine reach	High for low-tech tools; Moderate for video	Prioritize SMS/voice + DAT strengthening; selective VDOT rollout; vernacular and low-bandwidth app optimisation

TABLE 4: USER-CENTRIC DESIGN ENHANCEMENTS FOR IMPROVING NI-KSHAY FRAMEWORK

Recommendation	Description of suggestion	Name of application	Integration proposal	Reasoning behind recommendation
Offline function	The application should be able to save changes made in online mode. Later, it should automatically update the information when internet becomes accessible.	Ni-Kshay application and TB Arogya Saathi	-	Internet availability is a huge issue in India. This would reduce the waiting time of health workers when they are doing field visits.
Health worker forum	The forum is used for communication amongst health workers. Users can post queries in the forum where other health workers can answer. Answers can be upvoted or downvoted based on their usefulness and correctness.	Ni-Kshay application	The forum should be available on the homepage of the Ni-Kshay application.	Instructional and technical issues with the application often need immediate attention. Since updates aren't instant, this forum will offer health workers insights on how others handle such situations, serving as user feedback.
Patient forum	This forum is used for communication amongst TB patients. Similar to the health worker forum, TB patients can post queries in the forum which other TB patients can answer. Answers can be upvoted or downvoted based on their usefulness and correctness to ensure false information is not spread. TB patients can visit archives for useful information.	TB Arogya Saathi	The forum should be available on the homepage of the TB Arogya Saathi application.	TB patients can find the forum helpful regarding side effects, motivation, destigmatization, and a sense of community.
Notepad	A notepad section will help users keep a tab of their progress or manage their daily routine.	Ni-Kshay application and TB Arogya Saathi	The notepad should be available inside the patient/health worker forum since both are text-based tools.	It can be used to create to-do lists, remember medicine names and schedules, and manage appointments for TB patients. Health workers can utilize the notepad to organize their daily workload. It will be useful for recording and sharing information on the forum.
Points and badge rewards (gamification)	Patients are presented with a treatment timeline and milestone indicators. As they progress, they earn points based on adherence, displayed on the app's progress meter. Better adherence results in higher-ranked badges. Milestones include complete adherence for a period, completing TB treatment tutorials, and medication changes.	TB Arogya Saathi	The home page, treatment details page, adherence details page should be used to integrate the suggestion.	Gamifying will improve the motivation of patients. They will be inclined to earn higher rewards and badges on their profile for which they will improve their adherence rates.
Leaderboard (gamification)	The leaderboard ranks patients based on their adherence performance, including points and badges. These leaderboards can be categorized by geography, demographics, type of intervention, and time period. Patients can see their ranking and view the points and badges of others, while maintaining anonymity.	TB Arogya Saathi	The leaderboard shortcut should be available on the homepage of TB Arogya Saathi.	Patients can access these leaderboards to see their adherence performance ranking. This feature motivates them to improve, allows them to compare their progress with others, and helps destigmatize the TB medication process.

RESULTS AND DISCUSSION

The COVID-19 pandemic and the WHO's "End TB Strategy" have accelerated the adoption of telemedicine for TB treatment [20]. Table 2 summarizes the reviewed articles, detailing author information, study type, intervention, participant characteristics, geography, and effectiveness. The studies vary in how effectiveness is assessed: (a) Baseline versus end-line adherence (b) Comparison of in-person and telemedicine interventions (c) Control group versus intervention group adherence. Additional notes are included where effectiveness could not be measured, such as in ongoing studies.

The review categorizes telemedicine interventions used in TB treatment. Most studies, except Chen et al. [21], reported positive outcomes. Video-assisted DOTS (VDOT) and health worker phone calls for medication adherence have demonstrated effectiveness [22,23]. Cost-effective methods like medication labels (e.g., 99DOTS) are widely adopted in high TB-burden countries [11,24,25]. SMS reminders are effective in medication adherence and information dissemination [26,27]. Instant messaging apps, such as WhatsApp and WeChat, are increasingly used for communication between patients and health workers due to their convenience [28,29,30].

Smart pillboxes, such as evriMED and WisePill (also called medication event reminder monitors or MERM), are another important tool. These devices store TB medication and electronically track when opened, transmitting data to a patient management system. They are typically paired with SMS and voice call interventions [31,32,33,34].

Mobile applications designed explicitly for TB medication adherence have emerged as a significant advancement. These apps feature interfaces for patients, health workers, and doctors, enabling schedule management, communication, and treatment monitoring [35,36,37,38,39]. Many are designed to facilitate VDOT [40,41,42,43], with popular apps such as sureAdhere and emocha being widely used [14,44]. Applications are also employed for presumptive TB screening, documenting side effects, and patient-health worker communication [45]. For example, the ASCENT app monitors TB treatment via smart pillboxes and medication labels [24,46], while WelTel facilitates SMS, voice, and video communication between patients and health workers [47].

Mobile applications often integrate with other telemedicine tools, including smart pillboxes, SMS, voice calls, and mobile wallets, yielding positive results [48]. Discussions have also emerged about gamifying TB medication adherence through apps [49]. Before presenting recommendations, this review will examine the reasons for TB treatment defaults in India and the telemedicine initiatives for TB elimination under NTEP.

CASE: TB ELIMINATION IN INDIA

To complement the literature review and ground the findings in practice, this article adopts a case study approach to examine the use of telemedicine for TB treatment in India. Case studies are suitable for public health research as they allow detailed examination of complex health system interventions. India's high TB burden and nationwide implementation of the Ni-kshay platform under the NTEP provide a relevant setting to explore treatment adherence challenges. This approach allows for an assessment of how digital tools interact with social, economic, and health factors contributing to treatment default. It also aids in identifying practical gaps and opportunities to strengthen telemedicine-supported TB care.

DEFAULT IN TB TREATMENT

India's TB eradication program faces multiple challenges, including non-adherence to treatment and delays in testing. Non-compliance is widespread, driven by direct and indirect financial burdens, despite free treatment availability at public facilities [82,83]. Many patients remain unaware of these free services [84]. Social stigma remains a persistent issue, causing treatment default despite efforts to reduce stigma [19,85,86]. Misconceptions about TB and lack of scientific awareness exacerbate the stigma problem [84,85].

Additional factors contributing to treatment default include drug side effects, fear of hospitalization, long waiting times, and lack of family support [84,82]. Patients in the private sector are harder to retrieve due to challenges like treatment

costs, travel, and perceptions of ineffective medications [15,19]. Private providers are incentivized for TB case notifications, even if patients continue private treatment [19].

Certain populations face disproportionate challenges. Low-income households struggle with treatment affordability, delaying care-seeking and reducing adherence. Poverty is both a risk factor and an outcome of TB [19]. Patients with comorbidities like HIV or diabetes are prone to non-adherence due to resistance, stigma, and financial constraints. Geriatric patients face additional challenges, including forgetfulness and comorbidities, which elevate default rates [87]. Migrant TB patients often default due to a lack of employer support and familial pressures [84]. Gender and sexual identity discrimination, along with household responsibilities and limited autonomy, further affect adherence, particularly among women and female sex workers [19,88]. Drug resistance complicates treatment, increasing the likelihood of default, especially in MDR-TB cases [89]. Many patients default prematurely upon feeling better, particularly in MDR-TB cases, despite ongoing efforts to mitigate non-adherence [89,90].

INTERVENTION UNDER NTEP

High treatment default rates challenge India's TB eradication efforts, increasing the burden on government programs. Under the National TB Elimination Programme (NTEP), "Ni-Kshay Diwas" (an observance and community engagement day) is observed on a day every month to retrieve patients lost to follow-up. This involves health officials, community leaders, and healthcare workers across public and private centers [19]. However, retrieving defaulters remains challenging [15], necessitating interventions that target default-causing behaviors during diagnosis and treatment.

To address adherence challenges, the government implements direct benefit transfer (DBT) schemes under NTEP, which provide financial support to patients. Programs like Ni-Kshay Poshan Yojana (NPY) offer nutritional support and transportation incentives for those in remote areas. Economic incentives are also provided to healthcare workers to encourage successful treatment completion. Additionally, community engagement initiatives aim to raise awareness, reduce social stigma, and promote health-seeking behaviors [19].

TELEMEDICINE INTERVENTIONS

Despite efforts to reduce defaults, adherence challenges persist. Telemedicine interventions through the Ni-Kshay framework are critical in mitigating defaults. Ni-Kshay Sampark, a dedicated call center, assists TB patients and healthcare providers daily. It includes an online grievance system and tele-counseling services, which help dispel misconceptions and enhance patient self-care [28].

The Ni-Kshay mobile application and web portal serve as patient information management systems for registered healthcare workers. Patients can be added to the database through public health workers or private practitioners and can track their progress via the app. This has improved treatment outcomes and reduced follow-up losses. Less tech-savvy patients are supported by their healthcare workers, while those more proficient in technology can monitor their treatment independently.

Ni-Kshay Sampark operates separately from the Ni-Kshay app and provides tele-counseling by customer support executives who are not medical professionals. While useful, this can lead to miscommunication if their advice differs from that of healthcare workers. The Sampark service also uses SMS for patient engagement, and smart pillboxes send audiovisual reminders to ensure medication adherence. The "99DOTS" system also alerts patients who miss doses by sending SMS reminders [91].

Telemedicine has proven effective for TB management, especially with Video Directly Observed Therapy (VDOT), which has shown positive results for TB treatment adherence [92]. However, less than 50% of India has internet access [93], making it difficult for low-income patients to benefit from video consultations. Given the high TB burden, providing internet data packs would be costly, and the Ni-Kshay framework currently lacks integrated video-calling capabilities.

Health workers mainly rely on voice calls and in-person visits, occasionally using messaging apps like WhatsApp for communication, though these are not formal telemedicine tools under NTEP. Telephonic counseling has been crucial in ensuring adherence among multi-drug-resistant TB patients [94], while telemedicine has been used to monitor TB patients during the COVID-19 pandemic [20, 95]. Video-assisted telemedicine offers potential, particularly for managing vulnerable groups such as women, elderly patients, and those with limited access to healthcare, but nationwide implementation remains challenging.

STRENGTHENING NI-KSHAY FRAMEWORK

COMPARING WITH GLOBAL TELEMEDICINE EVIDENCE

A comparison of the Ni-Kshay framework with global initiatives in TB elimination highlights several similarities and differences in the use of mobile applications, VDOT (Video Directly Observed Therapy), smart pillboxes, medication labels, and SMS-based interventions. While the Ni-Kshay app supports smart pillboxes and 99DOTS medication labels for adherence management, it lacks support for synchronous or asynchronous VDOT [71].

VDOT has proven highly effective in managing TB treatment adherence globally [44, 41]. However, providing free VDOT to every TB patient in India may not be feasible due to infrastructural challenges, scalability, and patient-specific issues such as internet access, data costs, and familiarity with video technology. Implementing a nationwide VDOT system would be cost-intensive, requiring significant investment in infrastructure and training. Patients who can afford private healthcare or VDOT can still track their adherence through the Ni-Kshay or TB Arogya Saathi applications (Aarogya Sathi is a digital support application under NTEP - <https://tbcindia.mohfw.gov.in/tb-aarogya-sathi/>), alongside general-purpose tools like Adobe Connect [23], Skype [14], and Zoom [10]. These digital platforms allow video calls or recordings, though adherence tracking typically occurs through a separate application.

Medication labels and smart pillboxes within Ni-Kshay use SMS or mobile apps to send reminders and track missed doses [34, 48]. SMS is also employed for awareness campaigns and reminders [26]. In the Ni-Kshay framework, SMS and voice calls are common tools for communication, though SMS functions outside of the Ni-Kshay app and are not automated. Only one reviewed application had integrated SMS functionality [75]. Nonetheless, updating a patient's profile in Ni-Kshay can trigger SMS notifications, and healthcare workers can use voice calls when necessary [19]. A chatbot is not part of Ni-Kshay [53]; instead, Ni-Kshay Sampark and informal communication through voice calls or messaging apps between patients and healthcare workers fulfill this role.

Mobile wallets have been used to distribute financial incentives to TB patients [13]. Through the TB Arogya Saathi app, patients can link their accounts to the DBT (Direct Benefit Transfer) schemes under NTEP. However, this feature is unavailable in the Ni-Kshay app [19].

IMPLICATIONS AND RECOMMENDATIONS

The Ni-Kshay framework constitutes a comprehensive 'technology + human' integrated system supporting TB elimination in India. It encompasses a wide range of telemedicine interventions, implemented variably across different socio-economic contexts, in accordance with feasibility and implementation constraints. We compared individual telemedicine components of the Ni-Kshay framework with the global best practices evidenced in the literature. As comprehensive as it is, some gaps remain in the Ni-Kshay framework. These gaps are listed in Table 3, along with their potential feasibility for India, and potential recommendations to commence their integration into the Ni-Kshay framework. Furthermore, closing each identified gap is an enormous challenge considering the sheer scale at which TB elimination needs to be addressed in a country like India. A clear example of this is the implementation of VDOT. Literature demonstrates VDOT as an effective intervention for TB treatment adherence and outcomes [23, 40, 41, 42, 43, 44]. Pilot studies conducted in India for VDOT also show encouraging results [22]. However, VDOT is not feasible nationwide. While it can be used in urban settings with strong internet connectivity, such accessibility represents a very small fraction of

India's population [19, 83]. A substantial digital and financial divide exists, especially in the rural and socio-economically disadvantaged settings [15, 82, 83, 84, 86].

The infrastructural requirements, internet dependency and associated implementation costs make nationwide implementation of VDOT into the Ni-Kshay framework highly difficult. In contrast, voice calls as an alternative to VDOT remains practical and cost-effective [22, 55]. Other countries like Ethiopia and Uganda have also adopted voice calls over VDOT due to the costs and challenges associated with the latter [58, 59, 78]. Thus, understanding the context in which VDOT, despite being a global best practice, is not integrated within the Ni-Kshay framework becomes important. Recommendations towards closing the gaps in the Ni-Kshay framework cannot always be to adopt the global best practice.

On the other hand, it is pragmatic to identify opportunities of improvement in the interface design and features of the Ni-Kshay application and TB Arogya Saathi. Since these applications are already in use, they do not require additional infrastructure investments. Moreover, health workers are provided training for using these applications and patients are also familiar with them. At the same time, it is not advisable to integrate every identified feature into Ni-Kshay, as this may introduce unnecessary complexity and reduce the app's usability.

Several mobile apps were identified in the literature that are used for monitoring and analyzing medication adherence. Upon comparison, the Ni-Kshay app covers most of the essential features offered by these apps. For example, the calendar view that visualizes patient progress, is a common approach in adherence applications [43, 36]. Both Ni-Kshay and TB Arogya Saathi offer a user-friendly interface that is easy to navigate and avoids clutter. Some missing interventions are already covered through alternative methods. For instance, Ni-Kshay Sampark and informal communication between patients and healthcare workers lessen the need for a chatbot.

Ultimately, we finalize a set of meticulous, actionable design and UX improvements that can improve the utilization of Ni-Kshay application and TB Arogya Saathi, as detailed in Table 4. The focus of these recommendations is to potentially enhance workflow connectivity and interoperability without hindering existing processes.

THEORETICAL AND PRACTICAL CONTRIBUTIONS

THEORETICAL CONTRIBUTIONS

This review also asserts that global standards in telemedicine interventions for TB medication adherence and outcomes do not represent universally transferable solutions. By systematically comparing the current Ni-Kshay framework with research evidence, the review argues for a pragmatic and context-appropriate framework, wherein adoption of telemedicine interventions must be balanced against infrastructural realities, cultural contexts, and socio-economic constraints.

This research also helps in conceptualizing the telemedicine infrastructure as a hybrid ecosystem, wherein health workers and technological tools play an equally important role. This helps in reinforcing the perspective that telemedicine policies and infrastructure for TB elimination need to consider the human intermediaries involved in the process.

Furthermore, it identifies that the gaps in Ni-Kshay framework as compared to global standards are not always system deficiencies. Some of these occur due to policy constrained by economic and social constraints, offering the interpretation that selective non-adoption of certain tools, such as VDOT, is strategic in nature rather than a system failure. Finally, it contributes to the discussion on patient-centered versus provider-centered digital health systems. While research evidence increasingly prioritizes patient empowerment and self-engagement, the Ni-Kshay framework is largely provider-driven. The recommendations provided in this research for adoption into the Ni-Kshay framework considers a balance between these two approaches.

PRACTICAL CONTRIBUTIONS

This research demonstrates why strengthening low-bandwidth, cost-effective tools, such as voice calls, SMS-based reminders, and digital adherence technologies already embedded within Ni-Kshay framework, represents a sustainable and context-responsive approach. It also contributes a set of pragmatic recommendations for improving the Ni-Kshay and TB Arogya Saathi applications without imposing additional infrastructural burden.

The recommendations for offline functionality, structured messaging systems, interoperability improvements, unified dashboards, and workflow-supporting design features are grounded in the realities of daily field operations of health workers. These suggestions reinforce system usability and reduce friction for health workers. They also enable smoother workflow in rural and low-connectivity environments. Moreover, the proposed design enhancements with respect to health worker forums, notepad utilities, and analytics dashboard can contribute to worker empowerment by fostering peer learning and providing real-time decision support.

Patient-facing forums, self-monitoring dashboards, educational components, and carefully designed gamification features have the potential to enhance motivation, promote adherence behavior, reduce stigma, and cultivate a sense of shared patient community. Finally, and importantly, this study contributes to practice by not only recommending what should be enhanced, but also clarifying what should not be prioritized at present.

CONCLUSION

This article analyzed the Ni-Kshay framework under NTEP, India's initiative to eliminate TB, focusing on addressing medication non-adherence. India presents a unique case where in-person supervision has shown positive results, while telemedicine is more effective when combined with face-to-face interventions. Telemedicine complements in-person methods, helping to reduce TB rates across the country.

A systematic literature review, following PRISMA guidelines, compared the Ni-Kshay framework with global telemedicine approaches for TB management. The current framework is well-structured and has contributed to TB elimination in India. However, several areas for improvement were identified, though these require further study in the Indian context before implementation. These findings, together with the recommendations outlined in this study, highlight the importance of context-appropriate, scalable, and user-centered enhancements to strengthen the Ni-Kshay ecosystem. Operationally, tuberculosis elimination programs operating in volatile and resource-constrained environments encounter significant challenges, including demand uncertainty, variable patient volumes, and fluctuating healthcare resource availability. The integration of telemedicine with artificial intelligence (AI) can function as a flexible and adaptive resource, enhancing programmatic resilience by supporting personalized adherence interventions, and optimized treatment strategies in unstable settings [97, 98]. One limitation of this study is the lack of consideration of potential delays due to increased system load from integrating new features.

Telemedicine can also play a crucial role in reducing the stigma surrounding TB, a significant issue in India. Future research should explore the use of gamification and technology-based tools for raising awareness and fostering open communication, which could help destigmatize the disease at both individual and societal levels.

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CONFLICT OF INTEREST STATEMENT

The Author(s) declare(s) that there is no conflict of interest.

ETHICAL APPROVAL AND INFORMED CONSENT

This research did not involve human participants. Publicly accessible documents were used for this systematic review, and ethical approval is not required.

SOURCE OF DATA AND AVAILABILITY STATEMENT

The data for this systematic review has been derived from publicly available, peer-reviewed articles. Reference for each included article is provided in the references section.

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AI-ENHANCED CERVICAL CANCER SCREENING: INTEGRATING AUTOMATED DIAGNOSTICS AND SELF-SAMPLING PLATFORMS

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ABSTRACT

This is a systematic review that summarizes the existing body of literature about the incorporation of artificial intelligence (AI) and automated diagnostic frameworks and scalable self-sampling systems to detect cervical cancer screening. The analysis particularly reviews AI use in risk stratification and image diagnostics applications and compares the performance metrics, scalability prospects, economic analysis, and practical implementation of the applications. The extensive review of peer-reviewed publications, by analyzing articles published during the 10-year interval between January 2014 and June 2024, shows that deep learning architecture consistently demonstrates sensitivity and specificity rates over 90%, which are much higher in controlled research studies than traditional cytology and colposcopy processes 1,37.

The integration of patient self-sampling approaches contributes greatly to the screening participation rates, especially when it comes to underserved and resource-restricted settings. Extensive implementation literature shows significant potential in terms of reducing costs and improving access to healthcare services, but major issues still exist when it comes to data heterogeneity, clinical validation processes, and integration frameworks in health systems. The aggregate results highlight the potential sponsorship these AI-based solutions have to achieve in enhancing the global cervical cancer prevention strategies and bring them closer to the potential goals of elimination set by the World Health Organization.

KEYWORDS

artificial intelligence, cervical cancer, automated diagnostics, sampling platforms

INTRODUCTION

THE GLOBAL BURDEN AND SCREENING EVOLUTION

Cervical cancer remains a severe women health issue at the global level, and especially high-income countries are compared to low- and middle-income countries (LMICs), in which 90% of the cervical cancer-related deaths are observed [23,33]. The ongoing burden of the disease is in the face of the existing measures to prevent the disease, which points to the necessity of new screening methods that can solve the current barriers in the implementation process. The screening techniques have been significantly advanced since the initial Papanicolaou smear cytology and visual inspection with acetic acid (VIA) to use molecular human papillomavirus (HPV) testing and new digital imaging techniques [13,38]. Recent developments stress the applications of artificial intelligence-based methods that promote the accuracy of the diagnosis and the effectiveness of the programs in terms of scalability. The importance of these technological advances to the health of the population is immense because the earlier the precancerous lesions are identified and managed, the fewer cases and deaths due to cervical cancer can be experienced [10,15].

CURRENT CHALLENGES IN SCREENING IMPLEMENTATION

In spite of the significant technological advancement, the issues of implementation have remained quite serious, especially in the environment with limited resources where the disease burden is the most severe [21,39]. The ongoing use of highly qualified staff to interpret cytologic images and perform colposcopic evaluation and a high degree of disparity in diagnostic accuracy and inadequate healthcare facilities pose significant obstacles to the realization of universal screening coverage [21,39]. Self-sampling of HPV test is one of the strategies that have been shown to contribute to better involvement of participants and lower the cost of the program, yet its combination with AI-based triage and diagnostic systems is not explored thoroughly [8,25]. Moreover, although AI algorithms have been shown to be highly accurate in terms of image recognition and lesion classification related tasks, there are multiple constraints that can hinder their implementation in everyday clinical settings. These are the lack of well annotated datasets, variability of the domain on imaging platforms, and the lack of clinical validation in diverse populations [20,1,28].

CONCEPTUAL FRAMEWORK AND REVIEW OBJECTIVES

This review is designed based on three interrelated conceptual pillars, namely, automated diagnostics, scalable self-sampling platforms, and AI approaches towards risk stratification and image recognition. Automated diagnostics include AI-powered systems, which analyze cervical images or cytology slides to identify precancerous alterations with a minimum of human involvement [38,37]. Self-sampling systems can be scaled to allow women to practice self-sampling, which allows women to comfortably acquire vaginal samples on their own and contributes to wide-range screening and accessibility [10,7]. The integrative component can be considered the AI algorithms, which links these elements together through offering advanced risk stratification and diagnostic assistance, in effect, linking molecular HPV outcomes with image-based tests [33,1]. The main goal of this systematic review is to provide a critical assessment of the processes of development, validation, and implementation of automated diagnostics and scalable self-sample systems in cervical screening based on AI algorithms to conduct the triage and image recognition processes. This systematic review will be used to evaluate the evidence on the accuracy, feasibility, and clinical usefulness of these technological advances and to fill any knowledge gaps and existing discussions in the area. This review will help to develop a progress towards improved cervical cancer prevention strategies especially in LMICs where the burden of the disease is the highest and the healthcare resources are the most limited ones.

METHODOLOGY

LITERATURE SEARCH STRATEGY

A literature scoping review was carried out based on the methodological recommendations of scoping reviews [42,43]. The search was conducted using various electronic databases such as Pubmed, Scopus, Web of science, and a few engineering and computer science repositories (IEEE Xplore, ACM Digital Library, and repositories arXiv). They were added as special repositories to retain the notable amount of AI and engineering-oriented studies that are not necessarily

covered in biomedical databases. The search strategy was formulated to find peer-reviewed articles and conference papers that have been published since January 1, 2014, and June 30, 2024. The search was carried out on July 10/12, 2024. The overall research question that informed the review was the following: What is the existing evidence on automated diagnostics and scalable self-sampling platforms in cervical screening with the help of AI algorithms to triage and identify images? In order to have a complete coverage, the main question was developed into particular search strings with Boolean operators and other MeSH/Emtree terms. One search query used in PubMed was: Artificial Intelligence"[Mesh] OR Deep Learning"[Mesh] OR Machine Learning"[Mesh]] AND (Uterine Cervical Neoplasia/diagnosis"[Mesh] OR Uterine Cervical Neoplasia/prevention and control"[Mesh] OR Mass Screening"[Mesh]). Other databases were done using similar adapted strings. No language filters were used initially, but only studies in English language were finally incorporated.

SELECTION CRITERIA AND PROCESS

Explicit inclusion and exclusion criteria were used in the selection of the study. The inclusion criteria included: (1) articles investigating AI/ML applications in the screening of cervical cancer; (2) articles involving self-sampling procedures; (3) articles that reported diagnostic accuracy or implementation outcomes; (4) articles in peer-reviewed journals or conference proceedings; and (5) articles published in various healthcare settings including LMICs. We also added conference proceedings to help capture newly emerging technology but the preliminary nature of the proceedings is recognized as a weakness of the synthesis. These exclusion criteria were: (1) non-English publications; (2) lack of primary data in the study (e.g., editorials, commentaries but no new data); (3) research on screening but not on treatment; and (4) articles older than 2014. The first database queries provided 265 distinct records. Citation chaining (both backward and forward) found one more 115 potentially relevant records and made a total of 380 candidate papers to screen the titles/abstracts. Upon screening of the title/abstracts on the inclusion/exclusion criteria, 369 papers were included to access full-texts. After full-text screening concerning relevance and methodological clarity, 50 studies were listed as highly relevant in accordance with predetermined criteria (methodological rigor, sample size and direct relevance to AI integration with screening/self-sampling and contribution to key outcomes). These 50 high-relevance studies that are mostly primary diagnostic studies, implementation research, and systematic reviews, draw the data used in the narrative synthesis and presented in the tables (Tables 1-3). The bigger group of 369 enlightened the larger contextual interpretation.

QUALITY ASSESSMENT AND DATA EXTRACTION

The scoping nature of the review and the heterogeneity of the included study designs (diagnostic accuracy, implementation science, health economics) made it impossible to use a single risk-of-bias tool. Rather, the common framework of relevance and methodological appraisal was derived out of scoping review methodologies. The evaluation of each study in this framework was based on: 1) Methodological Quality (objectives are clear, study design is appropriate, sample size is justified), 2) Clinical/Technical Relevance (clear application of this study to AI in cervical screening), 3) Reporting Completeness (reported outcomes, limitations are clear), and 4) Innovation/Potential Impact. Studies, which received a high score on these areas, were classified as highly relevant. In the case of diagnostic accuracy studies, we admit the possibility of high risk of bias (e.g., spectrum bias, verification bias, overfitting) that is typical of AI research. We do not blindly believe reported metrics such as sensitivity being greater than 90% and therefore make the interpretation that these metrics reflect the performance when certain research conditions are met and do not necessarily mean that it can be used in the real world to provide a superiority to the currently used methods. The extraction of data was conducted according to a unified protocol, which included the following characteristics of the studies, AI tool, and methods of comparison, measurement outcomes (sensitivity, specificity, AU), implementation, and limitations.

RESULTS: DESCRIPTIVE ANALYSIS OF INCLUDED STUDIES

The analysis of the literature shows that the area of research on AI use in cervical cancer screening is rapidly developing (Table 1). The studies that have been included cover a wide array of technologies, such as deep learning-based image recognition, automated cytology analysis solutions, as well as integrated solutions that incorporate self-sampling with AI-based diagnostics.

TABLE 1: COMPREHENSIVE SUMMARY OF KEY STUDIES ON AI-ASSISTED CERVICAL SCREENING

Study	Primary Focus	Sample Size/Setting	Key Findings	Performance Metrics
[33]	HPV genotyping + AVE	Multi-country resource-limited settings	High sensitivity/specificity with combined approach; effective triage strategy	Sensitivity: 94%; Specificity: 91%
[1]	DL model validation	Multi-institutional dataset	Robust, reproducible deep learning model with strong clinical translatability	AUC: 0.89
[15]	Large-scale AI screening	Rural/urban China population	Successful full-coverage program with high efficiency and cost-effectiveness	Cost: ~US\$7 per person
[10]	Self-sampling impact	Diverse healthcare settings	Participation increased 1.5-2.5 times; cost reduction of 32-48%	Acceptance: >85%
[38]	Automated dual stain	Multi-center validation	Improved specificity; reduced unnecessary colposcopies; cloud-based accessibility	Specificity: 93%
[37]	AI cytology grading	Large diverse datasets	Significant improvement in cytopathologist performance; enhanced diagnostic efficiency	Sensitivity: +13.3% improvement
[28]	AI + HPV in Zambia	High HIV prevalence setting	Effective risk-based triage; potential for point-of-care use in LMICs	AUC: 0.87
[39]	AI-supported screening	Urban/rural China	Low-cost implementation; high participation rates; integrated health worker model	Cost: ~US\$6.31 per woman

GEOGRAPHICAL AND METHODOLOGICAL DISTRIBUTION

The articles considered are a research work conducted on a global scale, and some of the major contributors of the research are China, the United States, other European states and various LMICs such as Zambia, Uganda and Indonesia. This geographical diversity offers a good avenue of understanding how AI technologies are used in various health care systems and resource settings. The studies have a variety of designs, such as laboratory-based development of the algorithm, clinical validation studies, randomized controlled trials, implementation research, and systematic reviews, methodologically. Most studies that dealt with AI concentrated on convolutional neural networks (CNNs) and deep learning models, whereas self-sampling studies have focused on usability, acceptability, and agreement with clinician-collected samples.

THEMATIC ANALYSIS: AI ALGORITHMS FOR TRIAGE AND DIAGNOSIS

Technical Architectures and Performance:

The reviewed literature demonstrates substantial advancement in AI algorithms for cervical image analysis and triage decision support (Table 2) [1,31]. Deep learning models, particularly convolutional neural networks (CNNs), have emerged as the predominant architectural approach, achieving consistently high performance metrics across multiple studies [1,31]. These models have demonstrated remarkable capability in identifying subtle morphological features

associated with precancerous changes, including nuclear enlargement, hyperchromasia, and nuclear membrane irregularities. Recent innovations include the development of transformer-based architectures and multi-branch deep learning models that capture both local and global image features, further enhancing diagnostic accuracy [3,36]. Several studies have incorporated attention mechanisms that improve model interpretability by highlighting regions of interest corresponding to clinically relevant features [20].

Integration with Molecular Diagnostics

One of the major tendencies of recent studies is the combination of AI-based image analysis with molecular tests, in particular HPV genotyping. Such multimodal strategy has proven to be better performing than the two methods alone resulting in better ability to stratify risks and triage decisions [33,28]. HPV16/18 genotyping coupled with automated visual evaluation (AVE) has demonstrated specific potential in locating women with the greatest risk of progressive disease and reducing the number of women referred to colposcopy needlessly. The improved methods use other molecular biomarkers including p16/Ki-67 dual staining and the use of methylation markers and then develop a total risk assessment algorithm to inform clinical decisions 38,32. Such integrated systems are a step towards customized screening guidelines in accordance with individual risk factors as opposed to blanket ones.

Performance Validation Across Modalities

AI algorithms have been tested on various imaging modalities such as colposcopic images, liquid-based cytology images, whole slide images and on visual inspection with acetic acid (VIA) images. Results indicate consistent values of AUC of above 0.85 and most models demonstrate performance measures of above 0.90 30,37. Liquid based cytology analysis generally has the highest performance whereas VIA-based applications exhibit more fluctuating outcomes owing to discrepancies in image quality and acquisition procedures 11.

TABLE 2: PERFORMANCE COMPARISON ACROSS AI APPLICATIONS

Application Area	Typical Sensitivity	Typical Specificity	Primary Challenges
Liquid-based cytology	92-97%	89-94%	Dataset diversity; annotation consistency
Colposcopic image analysis	88-93%	85-91%	Image quality variability; lighting conditions
VIA image interpretation	80-90%	85-95%	Standardization; subjective reference standards
Whole slide imaging	93-98%	90-96%	Computational requirements; storage needs

THEMATIC ANALYSIS: SELF-SAMPLING PLATFORMS AND INTEGRATION

Technological Developments and Acceptability

HPV testing on self-sampling has experienced a major technological development of a swab-based system to the more advanced and complex collection kits with built-in preservation medium. The literature reviewed presents a high level of acceptability among various groups of people and the preference rates of self-sampling instead of clinician collection are observed in the majority of the reviewed literature as between 60% and 85% [10,8]. The perceived privacy, convenience, comfort, and aversion towards pelvic examinations are the main factors that should be considered when determining acceptability. The latest innovations are aimed at creating easy-to-use equipment with easy-to-follow instructions, proper ergonomics, and inbuilt sample adequacy indicators. The support methods such as mobile apps and video tutorials have also enhanced appropriate sample collection and confidence among the users 2[5,41].

Integration with AI Diagnostics

Self-sampling combined with AI-controlled diagnostics is a promising solution towards scalable cervical screening in particular. Other studies established that self-collected samples can be equivalent to clinician-collected samples when subjected to current PCR-based tests and treated using AI algorithms [33,7]. The internet based platforms have proven to be a good means of delivering self-sampling kits, support in instruction and reporting of results. Such systems normally embrace the use of digital health technologies in registering participants, tracking the kits, delivering the results, and organizing the follow-ups [25,41]. Results interpretation and risk stratification may be performed automatically through the introduction of AI elements and, thus, the triage of HPV positive women will become efficient without involving clinicians instantly.

Impact on Screening Coverage and Participation

The greatest benefit of self-sampling methods is that they have been shown to boost screening attendance rates, especially those in hard to reach and underscreened groups. Research has continued to record higher participation rates of 1.5 to 2.5 times than the traditional screening invitations [10,8]. This has been more especially in the rural community, low-resource settings, and among women who have already refused clinic-based screening. Self-sampling allows overcoming numerous traditional impediments to screening participation, such as transport issues, time, cultural modesty, and prior unsuccessful experiences with healthcare [10]. Self-sampling platforms together with AI-based diagnostics will establish end-to-end diagnostics screening pathways that reduce the necessity of dedicated healthcare infrastructure but retain the high diagnostic quality of the procedures.

THEMATIC ANALYSIS: IMPLEMENTATION IN RESOURCE-LIMITED SETTINGS

Adapted Technologies for Low-Resource Environments

A substantial part of the examined literature is concerned with the adaptation of AI technologies to apply them in the resource-limited environment, especially in the LMIC where the epidemiological burden of cervical cancer is the largest. Some of these adaptations involve the creation of lightweight AI models, which can be used in mobile devices, the creation of portable imaging systems, and cloud-based systems that reduce the need to have a lot of local infrastructure [26,29]. Applications that can be operated through Smartphone have become one of the most promising tools in low-resource environments, where mobile technology is diffused widely, and thus used to facilitate cervical screening. The latter applications usually include image acquisition scheme, AI-based analysis, and result reporting features within one unified system [11,14]. Various researches have found out that community health workers who are least trained can effectively use these tools to carry out the screening and make relevant decisions regarding referral.

Task-Shifting and Workforce Development

When AI-assisted screening is introduced in LMICs, the strategy that is regularly implemented is task-shifting which enables nurses, midwives, and community health workers to carry out screening services that were once undertaken by physicians. This method contributes to solving severe gaps in the number of specialized healthcare staff and at the same time ensures the quality of screening with AI-based decision support [28,21]. Healthcare worker training opportunities are usually oriented to the work with a device, its control of image acquisition and control over the quality of the results, as well as to the proper procedure of referral. Research has shown that given training and encouragement, non-expert medical personnel can reach screening accuracy similar to highly skilled practitioners under the guidance of AI-based applications [18,28].

Infrastructure and Logistics Considerations

The ability to implement successfully in any resource-restricted environment should be attentive to the facilities demand such as power supply, internet connectivity, systems of transportation of samples, and maintenance of technological equipment. A number of studies have come up with innovative solutions to these issues such as solar-powered charging system, offline mobile applications and hub and spokes modes of sample processing [39,15]. Cloud-based platforms have been especially useful in LMIC environments, which enables sophisticated AI analysis to be conducted remotely with only simple image acquisition requirements at the point of care. This would reduce the costs of high-cost local computing infrastructure and maintain access to the most developed AI algorithms [15,38].

CRITICAL ANALYSIS AND SYNTHESIS

Methodological Strengths and Limitations

The literature review shows that various methodological strengths have been used, such as, in most studies, the use of multi-centers datasets, prospective validation designs, and comparison with histopathological gold standards (Table 3). Nevertheless, there are still major limitations that influence the interpretation and extrapolability of results.

TABLE 3: CRITICAL ANALYSIS OF METHODOLOGICAL ASPECTS

Aspect	Strengths	Limitations
Study Design	Increasing number of prospective studies; multi-center collaborations	Limited long-term follow-up; few randomized controlled trials
Dataset Diversity	Efforts to include diverse populations; multi-ethnic representation in some studies	Still predominantly limited to specific regions; insufficient representation of some ethnic groups
Reference Standards	Use of histopathology gold standard in many studies; expert consensus panels	Verification bias in some studies; variability in reference standards
Technical Validation	Internal validation reported in most studies; some external validation efforts	Limited independent external validation; reproducibility testing insufficient
Clinical Integration	Some studies report real-world implementation experiences	Few studies assess integration into existing healthcare systems

Consistency and Variability in Findings

The literature reviewed shows that there is a general consistency when it comes to the accuracy of AI algorithms in diagnosis with the majority of studies reporting sensitivity and specificity of over 90% precancer detection. Nonetheless, there is great inconsistency in the performance measures of different works, which depend on different factors such as image acquisition scheme, image characteristics, AI structure, and image benchmarks. Research shows a constant increased screening attendance when self-sampling sampling methods are used but the degree of increased attendance is different depending on the population, invitation strategy and the cultural backgrounds. Likewise, although there is a lot of publicity on cost cuts, the magnitude of savings is limited to the scale of implementation, prevailing infrastructure and nature of healthcare systems.

Addressing Bias and Confounding Factors

The existing evidence base is subjected to several possible biases. The problem of verification bias is especially alarming in investigations whereby only those women who had positive screening test outcomes/lesion or could see them, receive confirmatory tests, which may exaggerate sensitivity estimates [14]. Spectrum bias is an issue that could be encountered in such studies that are based in specialized referral centers and not general screening populations. The high number of studies in high volume research centers might provide expertise bias that could overestimate performance that could be reached in the real practice. Also, the developers of technologies often fund the studies themselves, which also causes a possible conflict of interest that should be taken into account during the interpretation of the results.

IMPLEMENTATION CHALLENGES AND BARRIERS

TECHNOLOGICAL AND INFRASTRUCTURE BARRIERS

There are a number of technological obstacles to the use of AI-assisted cervical screening, especially in resource-constrained locations. These are unstable electricity, low internet access, poor technology maintenance facilities and lack of sufficient digital infrastructure [21,39]. The quality and performance of devices may have an impact even in cases where technology is used; differences in quality and performance may influence the quality of image form and further AI analysis. There are also other difficulties in remote locations with sample transportation and storage. Self-collected samples are frequently to be delivered to centralized laboratories to be processed and in such cases, an effective cold chain network and efficient logistics networks are necessary [10,41]. Transportation delays or cold chain interruptions may damage the quality of samples and influence the accuracy of the test.

WORKFORCE AND TRAINING REQUIREMENTS

Effective AI-assisted screening is impossible without the right workforce development and training programs. The healthcare personnel must be trained not only on the technical aspects of using the devices, as well as collecting samples, but also the interpretation of the results offered by AI and the correct decisions regarding the process of patient treatment [18,21]. Another important obstacle is resistance to technological change in the field of healthcare professionals. The clinicians might also be reluctant to embrace AI technologies because they fear loss of jobs, lacks trust or even aversion to technology-based healthcare reasons [17]. To overcome this resistance, it is necessary to show evident clinical benefits, conduct extensive training, and engage clinicians in the planning of the implementation.

REGULATORY AND QUALITY ASSURANCE CONSIDERATIONS

The regulation of AI-based medical devices remains dynamic, and it is unclear how to get approval and what compliance standards to follow. The regulatory standards of medical devices, software as a medical device (SaMD), and in vitro diagnostics vary across different countries, making it more difficult to implement AI screening solutions worldwide [17,19]. To guarantee the uniformity of the AI algorithms in various environments and populations, quality assurance programs should be designed. Such programs are supposed to involve periodic performance monitoring, updating of algorithms with new data, and controlling the performance decadence or drift with time [1,20].

ECONOMIC AND SUSTAINABILITY CHALLENGES

Although AI-assisted screening may be promising in terms of cost reduction, the initial cost of the technology purchase, infrastructure building and employee training may be high [39,15]. A majority of healthcare systems especially those in the LMICs have a constraint in their budget that restricts their capacity to invest in these upfront costs. The models of sustainable financing should be created to cover the current expenses of the AI-assisted screening programs, such as the software updates, equipment maintenance, consumables, and employee education. Even a successful implementation of the programs can become a problem without a sustainable financing to ensure long-term functioning of the program [15,6].

ETHICAL, LEGAL, AND SOCIAL IMPLICATIONS

Data Privacy and Security Concerns

There is a high concern on data privacy and security when using AI-assisted screening especially when this technology is used with cloud-based technologies and mobile applications. HIPAA and cervical images are sensitive personal information that must be well protected against unauthorized access or breach [17,19]. Data warehousing and data collection should also adhere to the data protection laws including the General Data Protection Regulation (GDPR) in Europe or the Health Insurance Portability and Accountability Act (HIPAA) in the United States. Nevertheless, a significant number of LMICs do not have a full-scale data protection legislation, which results in the existence of regulatory loopholes that need to be sealed with the help of ethical principles and organizational rules.

Algorithmic Bias and Health Equity

A possible algorithmic bias is a serious moral issue in screening with the help of AI. Unless training datasets are made diverse enough, AI algorithms might not behave similarly to various demographic groups, possibly worsening any existing disparities in health [1,17]. It is especially relevant to cervical cancer that is already disproportionately represented among the populations that are marginalized. Interventions to promote health equity should incorporate a deliberate consideration of how a wide range of populations are represented in training data, routine audits of the way algorithms perform across demographic groups, and specific approaches towards accessing underserved groups of people [33,10]. In the absence of such initiatives, AI technologies will contribute to or even even increase the existing health disparities.

Informed Consent and Health Literacy

The application of AI technologies places some new complexities on the informed consent process. The patients should know how their data will be processed, what AI should help them with their health, and what are the limitations of the AI technology [17]. This will necessitate a concise communication strategy that is culturally sensitive and health literate to different levels. When self-sampling is cited, it can be difficult to have a really informed consent in the situation when it is not connected with a direct contact with a healthcare professional. There is a need to come up with digital consent procedures that will be both inclusive and user-friendly where women are made aware of the consequences of participation [25,41].

Regulatory Frameworks and Liability

The fast pace of the progress of AI technologies has exceeded the creation of proper regulations and liability standards. The issue of accountability in cases of AI malfunctions, whether it should be the developers, healthcare providers, or the institutions, are quite open in nature [19]. Such regulatory uncertainty can lead to adoption and innovation impairment. Quite extensive regulatory frameworks need to be established that allow patient safety and innovation. These outlines are to discuss the methods of algorithm validation and continuous monitoring, transparency, and the distribution of liability [17,32].

FUTURE RESEARCH DIRECTIONS

ALGORITHM DEVELOPMENT AND VALIDATION

Various approaches should be focused on in the future work on more efficient and universal AI algorithms. Federated learning algorithms that facilitate the training of models at different institutions without direct data exchange can be used to generate more diverse and representative training images and overcome privacy issues [17,20]. Demystified AI approaches that give clear decision making procedures will be critical in establishment of clinical confidence and easy adoption [32,9]. The need to determine the actual generalizability and define possible performance differences in the subpopulations necessitate the urgency of prospective multi-center validation studies in different geographical and demographic populations [1,14]. Such studies ought to use standardized protocols and outcome measures in order to make cross-study comparisons meaningful.

IMPLEMENTATION SCIENCE RESEARCH

The research on the implementation science should be oriented on the best plans of incorporating AI technologies into the current healthcare systems, especially in resource constrained environments. This involves analyzing various service delivery models, training methods and financing mechanisms in order to find out the most effective in particular circumstances [21,39]. More longitudinal research is required to determine the viability of AI-assisted screening programs in the long term, their effect on health outcomes, cost-efficiency, and health systems efficiency [15,6]. Such studies must also look at the way programs develop and change with the challenges and the emerging circumstances.

HEALTH ECONOMIC EVALUATIONS

There should be extensive health economic appraisals to inform the decisions in resource allocation and policy formulations. These assessments must not only consider the direct costs, but also the extended economic effects of the cost, such as productivity losses and opportunity costs [15,39]. The financing models should be contrasted to find the

sustainable solutions related to different contexts of the healthcare system. Budget impact analyses may assist healthcare systems to realize the monetary cost of implementing AI technologies, such as the amount of funds needed to invest in these technologies and the expense involved in running them on a regular basis [10,8]. This is to be done through analysis of the potential cost saving due to less advanced treatment of cancer and better productivity.

ETHICAL AND SOCIAL CONSIDERATIONS

Future studies must cover such important ethical and social issues as measures against algorithmic bias, fair access, and culturally sensitive implementation methods [17,10]. Community engagement studies might be used to make sure that AI technologies are created and introduced in a way, which does not go against the community values and preferences. Research on the psychological effect of AI-assisted screening on the patient and healthcare provider is required to comprehend and overcome any possible concerns [18,4]. This involves studies on formation of trust, preference of decision making and communication strategies.

POLICY AND PRACTICE IMPLICATIONS

GUIDELINE DEVELOPMENT AND STANDARDIZATION

The facts presented in favor of AI-guided cervical screening can be used to build the new clinical guideline, involving the use of these technologies in practice. These guidelines are expected to give explicit guidelines on how and where to be used, quality standards and considerations to be taken during implementation [33,38]. International cooperation may assist in making the guidelines more harmonized between countries with some flexibility in adapting certain requirements of the context. Standardization attempts must aim at creating standardized image acquisition protocols, data labeling protocols, validation of protocols and reporting of performance [1,20]. Such standards will simplify the comparison of technologies, enhance the reproducibility of technologies, and help the regulatory approval processes.

HEALTH SYSTEM INTEGRATION STRATEGIES

The effective implementation of AI technologies presupposes the need to plan and develop capacities within healthcare systems. These involve the evaluation of infrastructure requirements, training, development, creating referral channels, and developing monitoring and evaluation systems [39,6]. The process of integration must be progressive and repetitive, and learning and adjustment influenced by experience are possible. Task-shifting interventions could be very useful in overcoming the shortage of workforce by allowing nurses, midwives and community health workers to carry out screening interventions with the assistance of AI [28,21]. Proper training, supervisory and career development opportunities should be provided to accompany these strategies.

FINANCING AND SUSTAINABILITY MODELS

The AI-assisted screening should have sustainable financing models that should be created in line with the overall healthcare financing systems. This can involve participation in national health insurance programs, performance-based funding structures or government-business alliances [15,10]. It should be financed not only on the initial implementation but also on the costs incurred due to the continuous implementation like software updates, equipment and quality assurance. Economic rationales of investment in AI-aided screening must focus on more than direct healthcare savings, but on more general economic benefits such as productivity improvements and economic growth [39,8]. Such arguments are able to facilitate in gaining political support and allocation of resources.

CONCLUSION

Connection of artificial intelligence with automated diagnostics and self-sampling systems is a radical approach to the screening of cervical cancer that will overcome the limitations of the traditional methodology. The accuracy in diagnostic tests by AI algorithms and especially deep learning models have been shown to be at consistently high levels surpassing the traditional cytology and human visual inspection methods. These technologies, when used together with self-sampling procedures, result in an astounding enhancement of screening accessibility and participation, especially in underserved and resource-constrained communities. The feasibility and cost-effectiveness of AI-assisted screening programs have

been proven by large-scale implementation studies, particularly in LMICs [6,15]. These programs are based on cloud-based solutions, mobile devices, and the use of task-shifting solutions to address infrastructure and staffing limitations and ensure the delivery of high-quality screening services. The outcome would be a more scalable, effective, and patient-centered cervical cancer prevention method that is in line with the global elimination objectives. Nevertheless, there are still great challenges, which need to be met in order to achieve the maximum of these technologies. They are a lack of external validation of AI algorithms, bias and health equity in AI algorithms, infrastructure needs in resource-constrained environments and regulatory changes. Further research and development is also needed to ensure that the systems can be sustained in the long term and fit the established healthcare systems. Further development will require further innovation in the development of the algorithms, extensive research in a variety of populations, careful consideration of the implementation science, and an ethical and social concern. A cervical screening with AI and a proper level of investment, cooperation, and care regarding equity can significantly decrease the global cervical cancer burden and bring the world closer to the desired outcome of eradication.

AUTHORSHIP

All authors have made substantial contributions to the conception, design, and execution of this systematic review. Each author has contributed to the analysis and interpretation of the data, drafting and revising the manuscript, and has approved the final version for submission. The order of authors reflects their relative contributions to the work.

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CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

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EFFICACY OF FINANCIAL INCENTIVES IN AIDING SMOKING CESSATION AMONG PREGNANT WOMEN: A SYSTEMATIC REVIEW AND META-ANALYSIS

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ABSTRACT

BACKGROUND:

Research on the use of financial incentives in tobacco cessation is an emerging field that is based on the concept that providing rewards or reinforcers will increase the chance of drug-avoiding behavior. The current systematic review aimed to assess the available literature on the effectiveness of financial incentives in smoking cessation among pregnant women.

MATERIALS AND METHODS:

The earliest date accessible up until November 30, 2023, was thoroughly searched in databases including Scopus, PubMed, Cochrane, Science Direct, LILACS, ScienceDirect, Web of Science, and Google Scholar. The review only comprised randomised controlled trials. Six full-text publications that met the requirements for eligibility underwent additional processing for data extraction, qualitative and quantitative analysis.

RESULTS:

The meta-analysis showed that financial incentives are more effective as compared to counselling alone in aiding smoking cessation among pregnant women with a 95% CI of odds ratio (OR): 2.59 [2.05, 3.26]; $P=0.51$; Test for heterogeneity: $P<0.00001$; $I^2=0\%$.

CONCLUSION:

Financial incentives along with tobacco cessation counselling were found to be beneficial when it comes to helping pregnant smokers quit. However, in the postpartum period, a decrease in the cessation rates was observed. Therefore, the long-term effectiveness of financial incentives in smoking cessation needs to be assessed.

KEYWORDS

incentive, smoking cessation, pregnant women

INTRODUCTION

Smoking during pregnancy raises the risk of several acute and long-term health issues for both the mother, such as a higher chance of pre-eclampsia, placental anomalies, and early membrane rupture, [1] and the unborn child, such as increased risk of birth abnormalities, premature birth, low birth weight, and higher incidence of unexpected infant mortality. [2] While

women who smoke during pregnancy may lose up to ten years of life, those who permanently quit will have an almost normal lifetime. [3]

According to a study conducted by Lange et al, The prevalence of smoking during pregnancy was found to be 8.1% (95% CI 4.0–12.2) in the European Region, 5.9% (3.2–8.6) in the Americas Region, 1.2% (0.7–1.7) in Southeast Asia, 1.2% (0.0–3.7) in the Western Pacific Region, 0.9% (0.0–1.9) in the Eastern Mediterranean Region, and 0.8% (0.0–2.2) in the African Region. Across the globe, daily smokers constituted 72.5% (95% CI 70.4–75.0) of pregnant women who smoked. [4] This implies that smoking while pregnant is still a common practice in many nations. These results highlight the need for better access to smoking cessation programs for expectant mothers as well as initiatives for health promotion and smoking prevention.

Both the percentage of pregnant smokers who use cessation therapies and the success rate of most cessation programs for pregnant women (6%) are low. [5] The US Preventive Services Task Force concluded that while behavioral therapies are very beneficial in helping people quit smoking, there is not enough data to determine the risks and benefits of pharmacological interventions. [6] A recent Cochrane review indicated that nicotine replacement therapy increased the likelihood that pregnant women will stop smoking. However, this data is not very reliable because the impact did not persist when non-placebo controlled randomised controlled studies were removed from the analysis. Also, there is little evidence to support the claim that nicotine replacement treatment affects birth outcomes, namely birth weight. [7] Therefore, research into new treatment options is necessary to assist pregnant smokers in quitting. [8]

Based on the hypothesis that offering rewards or reinforcers will enhance the likelihood of drug-avoiding behavior, a new field of research is exploring the use of financial incentives in tobacco cessation. [9] According to a theory, financial incentives may function through operant conditioning behavioral processes (positively rewarding the desired behavior) or by offering short-term gain for behavior change that, although perceived as less proximal to the individual, ultimately results in long-term gain (delay discounting). [10] Encouragement to join the program, process compliance, and quitting at predetermined stages can all be rewarded with incentives. These rewards are typically only granted if a biochemically-confirmed cessation outcome is produced. [10] For these goals, a range of rewards have been employed, such as cash payments, salary bonuses, vouchers exchangeable for commodities (apart from alcohol and cigarettes), leisure activities, or promotional items like bags, pens, and T-shirts. [11]

A mixed methods study [12] and several clinical studies [13,14,15] have suggested that financial incentives would be suitable to help smoking cessation during pregnancy. However, there is a dearth of systematic review evaluating the efficacy of financial incentives in helping pregnant women quit smoking. Hence, the aim of this review is to assess and compare the available data on the effectiveness of financial incentives in smoking cessation among pregnant women.

MATERIALS AND METHODS

The systematic review was conducted in compliance with the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines. [16]

STUDY REGISTRATION

The protocol and study details have been registered in PROSPERO. (Registration number: CRD42023492333).

FOCUSED QUESTION

What is the effect of financial incentives on smoking cessation compared to standard therapy among pregnant women?

PICO ANALYSIS

Population: Pregnant women; **Intervention:** Financial incentives; **Comparator:** Standard therapy; **Outcome:** Smoking cessation

SEARCH STRATEGY

A comprehensive search was carried out from the earliest date possible to November 30, 2023, across databases such as PubMed, Cochrane, Scopus, Lilacs, ScienceDirect, Web of Science, and Google Scholar in order to find pertinent materials. To locate further publications, a manual search of important journals, conference proceedings, unpublished articles, and cross-references was carried out. The authors were notified if the papers were not published. The specific search strategies used for each database are detailed in Table 1.

TABLE 1: SEARCH STRATEGIES FOR VARIOUS DATABASES

Database	Search string
PubMed	((["Financial Incentives"][MeSH] OR "financial incentive" OR "monetary reward" OR incentive-based) AND ("Smoking Cessation"[MeSH] OR "smoking cessation" OR "quit smoking" OR "tobacco cessation") AND ("Pregnancy"[MeSH] OR "Pregnant Women"[MeSH] OR pregnant women OR expectant mother OR pregnancy))
Cochrane Library	(["Financial Incentives"] OR "financial incentive*" OR "monetary reward") AND (["Smoking Cessation"] OR "smoking cessation" OR "quit smoking") AND ([Pregnancy] OR ["Pregnant Women"] OR pregnant women OR expectant mother OR pregnancy)
Scopus	TITLE-ABS-KEY ("financial incentive" OR "monetary reward" OR incentive-based) AND ("smoking cessation" OR "quit smoking" OR "tobacco cessation") AND ("pregnant women" OR "expectant mother" OR pregnancy)
Lilacs	(("financial incentive" OR "monetary reward") AND ("smoking cessation" OR "quit smoking")) AND ("pregnant women" OR "pregnancy"))
ScienceDirect	("financial incentive" OR "monetary reward" OR incentive-based) AND ("smoking cessation" OR "quit smoking") AND ("pregnant women" OR "expectant mother" OR pregnancy)
Web of Science	TS=("financial incentive" OR "monetary reward" OR incentive-based) AND TS=("smoking cessation" OR "quit smoking") AND TS=("pregnant women" OR "expectant mother" OR pregnancy)
Google Scholar	"financial incentive" OR "monetary reward" "smoking cessation" "pregnant women"

INCLUSION CRITERIA

- Studies on pregnant women
- Study design: Randomized controlled trials (RCTs)
- Studies comparing the effectiveness of financial incentives with standard therapy in smoking cessation
- Articles available in English language

EXCLUSION CRITERIA

- Articles assessing the effectiveness of financial incentives as a secondary outcome
- Case reports, cross-sectional studies, longitudinal studies, case-control studies, cohort studies, feasibility studies, in-vitro studies, and reviews

SOURCES USED

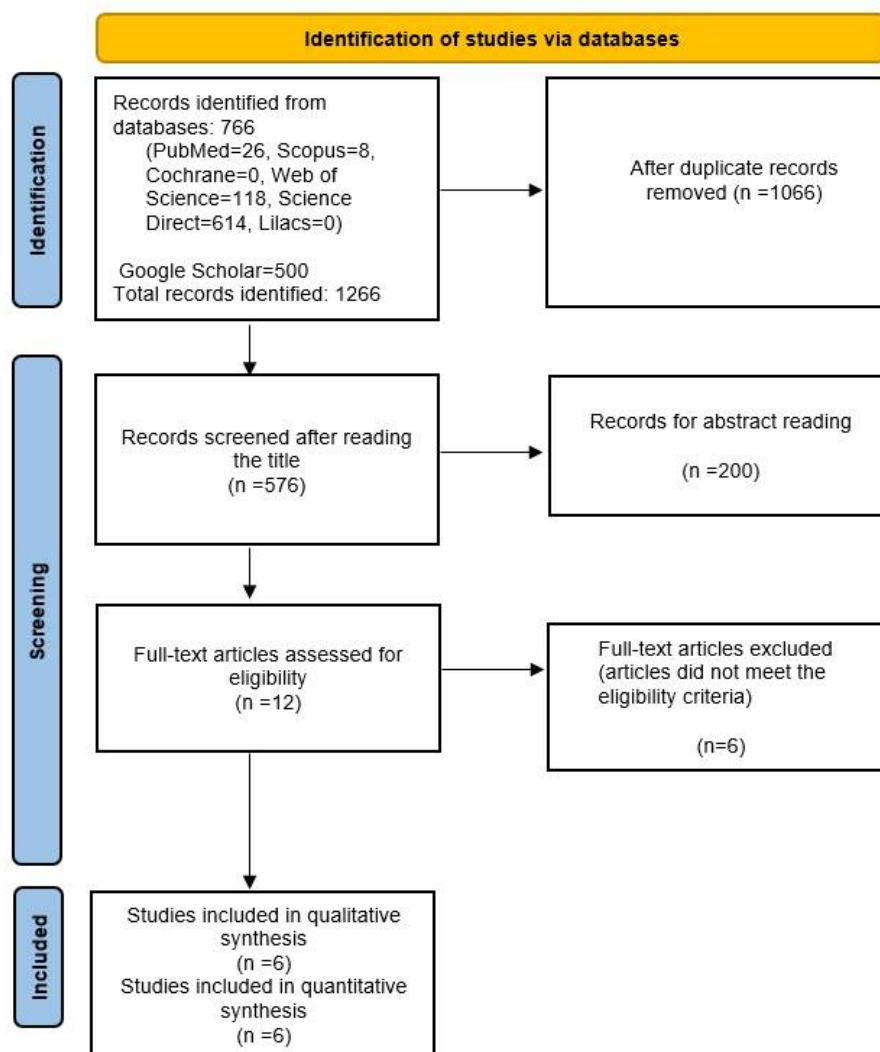
PubMed, Scopus, Cochrane, Web of Science, LILACS, ScienceDirect, Google Scholar

SCREENING AND SELECTION

The reviewers (SM and RM), perused the study titles independently. If the same articles were found in multiple databases, they were excluded due to duplication. Titles and abstracts were screened to assess their relevance to the review

question. Articles that met the inclusion criteria, or for which eligibility could not be clearly determined, were selected for full-text review. After retrieving the full-text documents, their eligibility was assessed. If the papers satisfied the eligibility conditions, they underwent additional processing for data extraction (Figure 1). The reference lists of the full-text articles were manually scanned to locate other studies.

FIGURE 1. PRISMA FLOWCHART



DATA EXTRACTION

The following details were gathered independently by two reviewers and entered into an Excel spreadsheet (MS Excel 2020): author details, study year, study location, study design, participant demographics, intervention, outcome assessed, study duration, financial incentives provided, outcome, and inference of the included study. English translations of publications written in other languages were made with Google Translate. [17] The appropriate authors were contacted to obtain the full texts or any missing information where full-text publications were not accessible. Discussions were used to settle disagreements.

RISK OF BIAS ASSESSMENT

The risk of bias both within and across the included studies was assessed using the Cochrane Risk of Bias tool (version 1). [18] The bias was categorized as "high risk," "unclear risk," or "low risk" based on the following components: random sequences generation, the concealment of allocation, the blinding of participants and personnel, the blinding of outcome assessment, the incomplete outcome data, the selective reporting, and other factors.

A study was classified as "low risk" if all of the prerequisites were satisfied. A study was classified as "high risk" if any one of the requirements was satisfied. A study was categorized as having "unclear risk" if one criterion was "unclear risk" and no other criterion was "high risk." Disagreements were settled by consensus.

QUALITY OF EVIDENCE

The included studies' level of evidence was assessed using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) Assessment Tool. [19] Four categories were used to classify the evidence's quality: very low, low, moderate, and high. The GRADE categories of risk of bias, imprecision, consistency, indirectness, and publication bias were employed to assess the quality of the evidence.

DATA ANALYSIS

For qualitative synthesis, the resulting data was entered into the data extraction table, and for quantitative synthesis, meta-analysis was conducted after that. The difference in outcome between the financial incentive group and the standard therapy group was evaluated using a random effect model. A random-effects model was chosen a priori to account for potential clinical and methodological differences between studies, such as variations in incentive type, participant characteristics, and outcome assessment, regardless of the observed level of statistical heterogeneity. The odds ratio at a 95% confidence interval (CI) was estimated using the total number of events and participants in each group. To evaluate the heterogeneity among the results of the included studies, the I² statistic and Chi-square tests were employed. If the p value was less than 0.1, heterogeneity was deemed statistically significant. Review Manager 5.4.1 was used to carry out the statistical analysis. Subgroup analyses were planned in advance; however, they were not undertaken because statistical heterogeneity was minimal (I² = 0%), and the small number of included studies meant that any subgroup comparisons would have been underpowered and potentially misleading.

RESULTS

SEARCH AND SELECTION OF RESULTS

A total of 766 records were retrieved from electronic databases, including PubMed, Scopus, Cochrane Library, LILACS, ScienceDirect, and Web of Science. Due to the very large number of results from Google Scholar and the rapid decline in relevance beyond the first few hundred entries, the first 500 most relevant Google Scholar records were screened, following recommended systematic review practices. After removing duplicates, a total of 1066 unique records remained from all sources. Two reviewers (SM and RM) independently screened the titles to determine their relevance to the review question. Records were excluded at this stage if they were clearly irrelevant—for example, animal studies, reviews, non-English publications, studies not involving pregnant women, or studies not addressing financial incentives or smoking cessation. This initial screening reduced the pool to 200 records for abstract review.

The abstracts were then independently evaluated for eligibility. Studies were excluded if they did not assess financial incentives for smoking cessation, were not randomized controlled trials, included non-pregnant populations, or did not report relevant outcomes. Following this step, 12 studies were selected for full-text retrieval.

Full-text articles were carefully reviewed against the inclusion criteria. Studies were excluded if they did not meet the study design requirements, lacked sufficient outcome data, or did not focus on the target population or intervention. Ultimately, 6 studies met all criteria and were included in the final analysis (Table 2). Additionally, reference lists of the included studies were manually checked to identify any further relevant articles.

TABLE 2: CHARACTERISTICS OF INCLUDED STUDIES

Name of author, year	Place of study	Type of study	Participant description	Intervention	Outcome assessed	Study duration	Financial incentive given to the participants	Outcome	Inference
Tappin et al, 2022 ^[20]	Scotland	Single-blinded phase III RCT	Sample size: 944 Mean age: 27.9 years	Intervention group: tobacco cessation counselling + financial incentives (n=472) Control group=tobacco cessation counselling+ offer of NRT (n=472)	Breath carbon monoxide levels and saliva cotinine levels	For at least 8 weeks in late pregnancy (34-38 weeks of gestation) and 6 months post-partum	Up to £400 shopping vouchers	During pregnancy 27% participants stopped smoking from the intervention group and 12% from the control group (adjusted odds ratio 2.78 (1.94 to 3.97) P<0.001). Post-partum 5.7% were non-smokers in intervention group and 4.4% from control group 6 months post-partum	Incentive-based interventions are successful in helping pregnant smokers quit.
Kurti et al, 2022 ^[21]	Burlington	RCT	Sample size:90 Mean age: 31.63 years	Intervention group: tobacco cessation counselling + remote financial incentives using mobile app (n=42) Control group: only tobacco cessation counselling (n=48)	Self-reported 1 week abstinence + salivary cotinine levels	Assessment before treatment assignment An early pregnancy assessment: 1 month after treatment assignment A late pregnancy assessment at ≥ 28-weeks gestation), and at 4-, 8-, 12-, and 24-weeks postpartum	Average incentive: \$330.52±\$446.18	Individuals assigned to intervention group had nearly 4-fold greater odds of smoking abstinence across antepartum and postpartum assessments compared to control group ($\chi^2_1 = 6.96$; adjusted odds ratio, 3.82; 95% CI, 1.63-8.92; P = .008)	Pregnant smokers can successfully quit with incentive-based interventions

Berlin et al, 2021 [22]	France	Single-blinded RCT	Sample size: 460 Mean age: 29 years	Intervention group: tobacco cessation counselling + financial incentives (n=231) Control group: tobacco cessation counselling; no financial incentives upon abstinence; only show up fees given (n=229)	Self-report of no smoking in the past 7 days and breath carbon monoxide levels	Visit 1: set quit date Visit 2-6: up to the expected delivery date	If the intervention group continued to abstain, they would receive a voucher worth €20, and further progressively increasing vouchers at each study visit All participants (intervention + control) received a €20 show-up fee at each of six visits.	During pregnancy The continuous abstinence rate was significantly higher in the intervention group (16%, 38/231) than control group (7%, 17/229) odds ratio 2.45 (95% confidence interval 1.34 to 4.49), P=0.004). The point prevalence abstinence rate was higher in intervention group as compared to control group (odds ratio 4.61, 1.41 to 15.01, P=0.011)	Pregnant smokers who receive financial incentives for quitting are more likely to have abstained from smoking than those who do not.
Kurti et al, 2020 [23]	Burlington	RCT- pilot study	Sample size: 60 Mean age: 30.4 years	Intervention group: tobacco cessation counselling + remote financial incentives using mobile app (n=30) Control group: only tobacco cessation counselling (n=30)	Breath carbon monoxide levels and saliva cotinine levels	Assessment before treatment assignment An early pregnancy assessment: 1 month after treatment assignment A late pregnancy assessment at ≥ 28-weeks gestation), and at 4-, 8-, 12-, and 24-weeks postpartum	Average incentive: \$411.47 ± \$464.23.	During pregnancy 7-day point prevalence abstinence rates were greater in the intervention group as compared to control group Early- (46.7% vs 20.0%, OR=3.50, 95%CI=1.11,11.02) Late-antepartum (36.7% vs 13.3%, OR=3.76, 95%CI=1.04,13.65) Post-partum Significant findings at Four weeks postpartum (36.7% vs 10.0%, OR=5.21, 95%CI=1.28,21.24)	Incentive-based interventions are successful in helping pregnant smokers quit.

								Eight-weeks postpartum (40.0% vs 6.7%, OR= 9.33, 95%CI=1.87,46.68) Non-significant findings at 12 weeks postpartum (23.3% vs 10.0%, OR=2.74, 95%CI=0.63,11.82) 24- weeks postpartum (20.0% vs 6.7%, OR=3.50, 95%CI=0.65,18.98)	
Olson et al, 2019 [24]	New Hampshire	RCT	Sample size: 134 Age: not mentioned	Intervention group: tobacco cessation counselling + financial incentives (n=66) Control group=tobacco cessation counselling (n=68)	Urinary cotinine levels	Urinary cotinine levels assessed at any prenatal visit and at 6-to 8-week postpartum visit.	Each appointment included a \$25 gift card if the patient did not smoke and their cotinine test came back negative. Furthermore, if their cotinine test came back negative and they did not smoke, they would get a \$50 gift card during the 6- to 8-week postpartum appointment.	During pregnancy The quit rates during pregnancy did not differ between groups (Intervention 36.4%, Control 29.4%, p=0.46) Post-partum Significantly more mothers gave up smoking and maintained to abstain after giving birth in intervention group. (Intervention 31.8%, Control 16.2%, p=0.04) Odds ratio=3.48	Incorporating cotinine testing and financial incentives into current initiatives to help pregnant women quit smoking can improve the number of smokers who quit after giving birth.
Tappin et al, 2015 [25]	Scotland	Single-blinded phase II RCT	Sample size: 612 Age: 16 years and above	Intervention group: tobacco cessation counselling + financial	Cotinine levels assessed either through saliva or urine	Cotinine levels verified at 34-38 weeks of gestation	Up to £400 shopping vouchers	During pregnancy Significantly more smokers in the intervention group than control group stopped smoking: 69 (22.5%) vs 26 (8.6%).	Interventions based on incentives are successful in helping pregnant smokers quit.

				incentives (n=306) Control group=tobacco cessation counselling+ offer of NRT (n=306)					

TABLE 3: SOCIODEMOGRAPHIC CHARACTERISTICS OF THE PARTICIPANTS INCLUDED IN THE STUDIES

Study	Gestational age at first visit	Education /employment	Smoking status	Age of onset of smoking	Partner/family member with a habit of smoking	Level of addiction	Readiness to quit
Tappin et al, 2022 ^[20]	<24 weeks of gestation	Not mentioned	≤10 cigarette/day Intervention group: 59.7% Control group: 59.1%	Intervention group=14.7 ± 3.0 years Control group=14.8± 2.8 years	Intervention group=60.6% Control group=57.4%	Not mentioned	Not mentioned
Kurti et al, 2022 ^[21]	Intervention group=13.71± 5.44 weeks Control group=17.29± 5.30 weeks	More than 12 years of education Intervention group: 41% Control group: 44%	>10 cigarettes/day Intervention group:85% Control group:91%	Intervention group=15.83± 3.47 Control group=17.25± 3.80	Intervention group: 68% Control group: 58%	First cigarette within 5 mins of waking Intervention group=39% Control group=48%	Not mentioned
Berlin et al, 2021 ^[22]	< 18 weeks of gestation	Intervention group: 59% employed Control group: 65% employed	Past 7 days total cigarette count Intervention group: 56 Control group: 60	Intervention group=16.6 years Control group=16.4 years	Intervention group=72% Control group=73%	Not mentioned	(scale 0-10) Intervention group=8.3 Control group=8.4

Kurti et al, 2020 ^[23]	Intervention group: 14.9 ± 4.9 weeks Control group: 13.9 ± 4.3 weeks	More than 12 years of education Intervention group= 30% Control group= 50%	Total no. of cigarettes/day Intervention group= 19.0± 4.8 Control group=18.2 ± 5.5	Intervention group=15.4 ± 3.3 years Control group:15.6 ± 3.0years	Intervention group=73% Control group=70%	Not mentioned	Not mentioned
Olson et al, 2019 ^[24]	<12 weeks of gestation age	Intervention group=11.9 ± 2.2 years Control group=11.6 ± 2.2 years	Total no. of cigarettes/day Intervention group=17.2 ± 9.5 /day Control group=15.8 ± 7.5 /day control	Not mentioned	Not mentioned	Not mentioned	98.5% of the participants
Tappin et al, 2015 ^[25]	less than 24 weeks of gestation age	Not mentioned	>20 cigarette/day Intervention group:10.5% Control group: 17.1%	Not mentioned	Intervention group: 59.8% Control group: 66.3	First cigarette within 5 mins of waking Intervention group: 52.9% group Control group: 57.1%	Not mentioned

CHARACTERISTICS OF INCLUDED STUDIES

All the studies were randomised controlled trials [20-25]. One was a pilot study [23], one was a phase II trial [25], and one was a phase III trial [20]. In one study, both participants and the researcher were blinded [22]. In one study, researcher was blinded whereas no information was given for the participants [25]. In another study, participants were blinded but no information was given for the researcher [20]. No information regarding blinding of both, participants and researcher was given in three studies [21,23,24]. The mean age of the study participants in the included studies ranged from 25 to 31.63 years. The maximum sample size of the included studies was 944 and the minimum sample size was 60.

SOCIODEMOGRAPHIC CHARACTERISTICS

The minimum gestational age at the first visit was < 12 weeks [24] and the maximum was < 24 weeks [20,25]. In majority of the studies participants smoked more than 10 cigarettes/day except in two studies [20,22] where the participants smoked less than 10 cigarettes/day. The minimum mean age of onset of smoking was 14.7 years and the maximum was 17.25 years. Majority of the participants had a partner or a family member with a habit of smoking. The level of addiction [21,25] and readiness to quit the habit [22,24] were assessed in only two studies. (Table 3).

PLACE OF STUDY

Two studies were conducted in Scotland [20,25], two in Burlington [21,23], one in France [22], and one in New Hampshire [24] respectively.

INDUSTRY FUNDING

The funding was acknowledged in all the studies. The studies were funded by the Scottish Government [25], The Dartmouth Clinical and Translational Science Institute [24], National Institute on General Medical Sciences [21,23], French National Cancer Institute [22], and Medical Research Council, United Kingdom [20].

INTERVENTION AND REGIMEN

In all the studies, the intervention group received both financial incentives and tobacco cessation counselling out of which in two studies [21,23], the participants received remote financial incentives. In all the studies, the control group received only tobacco cessation counselling. In two studies [20,25], the control group was also offered nicotine replacement therapy products. In one study [22], a show-up fee of €20 was given to the control group. Breath carbon monoxide levels were assessed in three studies [20,22,23]. Salivary cotinine levels were assessed in three studies [20,21,23], urinary cotinine levels in one study [24], and urinary or salivary cotinine levels in one study [25]. In one study [20], the outcome was assessed at 34-38 weeks of gestation and 6 months post-partum. In one study [25], the outcome was assessed at 34-38 weeks of gestation only. In two studies [21,23], an early pregnancy assessment was done one month after treatment assignment, and a late pregnancy assessment was done at ≥ 28 weeks of gestation and at four months, eight months, 12 months, and 24 months post-partum. One study [22] had two-six follow up visits till the delivery date. In one study [24], assessment was done at any prenatal visit and six-to eight-week postpartum visits.

FINANCIAL INCENTIVES GIVEN

In three studies [20,22,25], incentives were given in the form of shopping vouchers. In one study [24], incentives were given in the form of gift cards whereas in two studies [21,23] the form of incentive was not mentioned.

STUDY OUTCOMES

During pregnancy

In all the studies, a higher number of participants stopped smoking who received both tobacco cessation counselling and financial incentives as compared to those who received only tobacco cessation counselling. The highest cessation rate among those who received financial incentives was 46.7% whereas for the control group was 29.4% [23]. The lowest cessation rate among those who received financial incentives was 16% whereas for the control group was 7% [22]. The findings were statistically significant in all the studies except for one study.

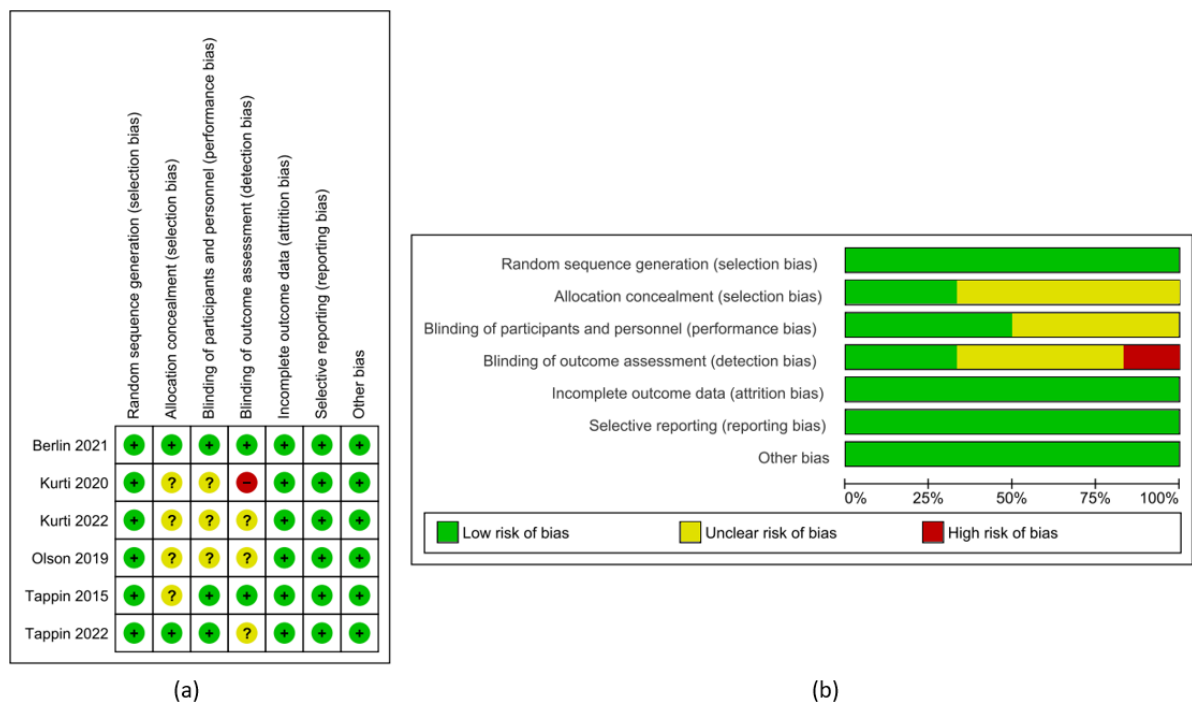
Post-partum

The post-partum tobacco cessation rate was assessed as a secondary outcome in four studies [20,21,23,24]. The tobacco cessation rates were found to decline from pregnancy to post-partum in all four studies. However, the cessation rate was higher in the intervention group as compared to the control group. The findings were significant in all the studies except in one study [23] where the findings for 12 weeks and 24 weeks post-partum were not statistically significant.

RISK OF BIAS

One study was rated as high risk [23], four studies were rated as unclear risk [20,21,24,25], and one study [22] was rated as low risk of bias. The risk of bias summary has been illustrated in Figure 2 (a). Allocation concealment and blinding of outcome assessment exhibited a low risk of bias of greater than 25% but less than 50%. Blinding of personnel and participants exhibited a low risk of bias of 50%. No bias was seen in random sequence generation, incomplete outcome data, and selective reporting, and other bias. The risk of bias graph has been illustrated in Figure 2 (b).

FIGURE 2: (A) RISK OF BIAS SUMMARY (B) RISK OF BIAS GRAPH



QUALITY OF EVIDENCE

The evidence quality was rated as "moderate" indicating that the true effect is probably not far from the estimated effect. The rating of "serious" was given to the risk of bias because one study [23] had a "high risk of bias" and four other studies [20,21,24,25] had an "unclear risk of bias." (Table 4).

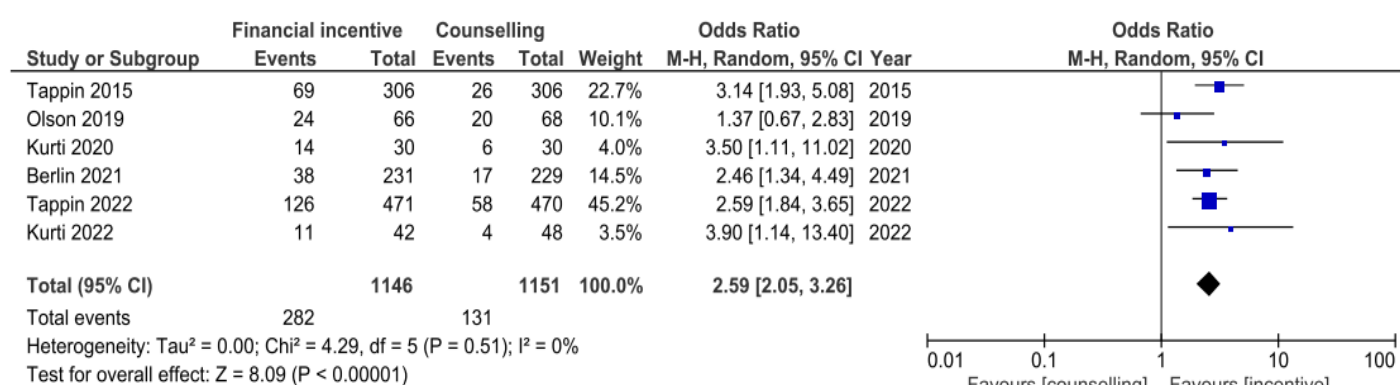
TABLE 4: QUALITY OF EVIDENCE

Certainty assessment							No of patients		Effect		Certainty
No of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	[financial incentive]	[standard therapy]	Relative (95% CI)	Absolute (95% CI)	
6	randomised trials	serious	not serious	not serious	not serious	none	282/1146 (24.6%)	131/1151 (11.4%)	OR 2.59 (2.05 to 3.26)	136 more per 1,000 (from 95 more to 181 more)	⊕⊕⊕○ Moderate

META-ANALYSIS

All six studies favored financial incentives over tobacco cessation counselling in smoking cessation among pregnant women. Overall, the meta-analysis showed that financial incentives are more effective as compared to counselling in aiding smoking cessation among pregnant women with a 95% CI of odds ratio (OR): 2.59 [2.05, 3.26]; $P < 0.00001$; Test for heterogeneity: $P = 0.51$; $I^2 = 0\%$ (Figure 3).

FIGURE 3: FOREST PLOT DEPICTING THE EFFECTIVENESS OF FINANCIAL INCENTIVES AND COUNSELLING



SENSITIVITY ANALYSIS

Sensitivity analysis excluding studies at high risk of bias [23] produced results consistent with the primary analysis, with financial incentives continuing to show a significant advantage over counselling (OR = 2.56, 95% CI 2.03–3.24; $P < 0.00001$). Heterogeneity remained minimal ($I^2 = 0\%$; heterogeneity $P = 0.40$), supporting the robustness of the findings (Figure 4).

FIGURE 4: SENSITIVITY ANALYSIS



DISCUSSION

Globally, smoking is the primary cause of disease and mortality. [26] The majority of smokers wish to stop, yet it can be quite difficult to do so. The health of smokers can be significantly improved by quitting. Money or vouchers can be used as incentives to get smokers to stop and as rewards for sticking with it. In the current review, financial incentives along with tobacco cessation counselling were found to be effective in aiding smoking cessation among pregnant smokers as compared to tobacco cessation counselling alone. However, the cessation rates were found to decline in the postpartum period.

The quit rate in the intervention group was highest in the study conducted by Kurti et al [23] (46.7%). One possible explanation for the high percentage of quits could be that the incentive offered was greater compared to other studies. The study's findings also highlight the effectiveness of smartphone-based financial incentives in demonstrating how technology can be used to spread this effective, evidence-based treatment's reach and the possible positive effects on public health that could result from doing so.

The quit rate in the intervention group was the lowest in the study conducted by Berlin et al [22] (16%). The reason could be that the majority of the participants were living with a partner/family member who was a smoker. Another reason could be that the amount of incentive given was very low which would have reduced the desire to quit the habit. Although the quit rate was higher in the intervention group in the study conducted by Olson et al [24], the findings were insignificant. The participants may not have been sufficiently motivated to quit as they had simply been given a \$25 gift card. Together, these observations suggest that the design and delivery of incentives may influence effectiveness; however, these inferences are drawn from comparisons between studies rather than from formal analyses within individual trials. Overall, while cessation outcomes varied across studies, the available evidence does not permit firm conclusions about a dose-response relationship between incentive magnitude and quitting success. Well-designed trials that directly compare different incentive levels within comparable populations are needed to clarify this issue.

Although the meta-analysis showed a clear benefit of financial incentives, there was considerable clinical variation among the included studies. The control conditions were not uniform, ranging from counselling alone to counselling combined with nicotine replacement therapy, and in some cases included show-up fees. Likewise, the incentives differed widely in their form, mode of delivery (cash, vouchers, or smartphone-based rewards), and monetary value. Follow-up periods and definitions of smoking cessation also varied across trials. Taken together, these differences limit direct comparisons between studies and indicate that the pooled effect should be viewed as reflecting an overall favourable pattern rather than a precise or universally applicable estimate of effect.

The level of addiction was assessed in only two studies [21,25] and the results suggested the level to be high. The readiness to quit the habit was also assessed in only two studies [22,24] and the results suggested that the majority of the participants were ready to quit.

Studies evaluating the postpartum quit rate have indicated a quick return to smoking, indicating the need for ongoing incentive payments to be used in the postpartum period to avoid relapse. However, postpartum smoking outcomes were reported in a variable manner and could not be combined in a quantitative synthesis. Although several studies observed a reduction in abstinence after childbirth, differences in follow-up time points and outcome definitions prevented formal pooling of these data. This underscores the need for more consistent postpartum outcome measures and longer-term follow-up in future research. Also, greater efforts are required to maintain prenatal and postpartum abstinence levels through planning for maintenance in incentive-based treatments, since exposure to secondhand smoke after delivery can have negative health effects on the baby (such as respiratory infections, exacerbation of asthma, and sudden infant death syndrome). [27]

Prenatal and postnatal incentives for pregnant smokers were discussed in a Cochrane review [28] on smoking cessation incentives. There were nine randomised trials with varied populations and interventions (cash, vouchers, gift cards, social support) included. Financial incentives demonstrated a substantial improvement over no incentives control (relative risk 2.38, 95% confidence interval 1.54 to 3.69, $n = 2273$), without variations between the prenatal and postnatal interventions. A total of 332 people took part in another systematic review [12] on financial incentives for quitting smoking during pregnancy. There was a 2.58 relative risk of quitting based on the combined effect size (95% confidence interval 1.63 to 4.07).

When incentives were given, the smoking status of those declaring abstinence was verified using biochemical testing. This procedure is the gold standard for effective trial design in studies on smoking cessation in this process. [29] Additionally, as deceit may be a legitimate criticism of incentive-based studies, it may be especially crucial that those who quit in an experiment based on rewards are demonstrated to be truly abstinent at the evaluation points.

Only two research measured the amounts of serum cotinine and breath carbon monoxide together. Serum cotinine may have been more sensitive in identifying temporally remote smoking than breath carbon monoxide, which has a comparatively short half-life [30, 31]. Hence, using both biochemical measures together may improve the accuracy of smoking status verification and reduce the likelihood of misclassification or misreporting.

Although the results of this review seem promising, it is crucial to note that there can be significant obstacles to integrating incentives into standard care or mainstream services. The general public's perception of incentives is generally unfavorable [32], with incentives being regarded as "rewarding" behavior modification for a "habit" that is thought to be self-inflicted (smoking). This might reduce the amount that trial findings can influence modifications to procedures and policies. The limitation of resources is another difficulty. Funders (like the NHS or local government in the UK) that provide funding for smoking cessation services must prioritize these programs over alternative methods of quitting smoking in order for them to be implemented in the real world. The possible negative effects of incentive programs need to be further considered. Those who relapse to smoking and do not receive a financial incentive may stop trying to quit in the future. Future trials should monitor this possible harm.

LIMITATIONS

Despite the rigorous approach used, there are certain inevitable limitations to this review. Four studies had an unknown risk of bias and one study had a high risk of bias, which may have compromised the studies' overall quality. In one study nicotine replacement therapy was offered in addition to financial incentives which could have acted as a confounding factor. The level of addiction and readiness to quit the habit were not measured in the majority of the studies. The patients' varying degrees of addiction and readiness to quit could have had an impact on the studies' findings. Two studies used smartphone apps to provide remote financial incentives. It's possible that remote incentives unintentionally catered to a more privileged and limited demographic than planned.

Despite the low level of statistical heterogeneity, there was considerable clinical heterogeneity among the included studies. Trials differed in their control interventions, the type and value of incentives offered, follow-up durations, and definitions of smoking cessation outcomes. These variations may limit the generalisability of the pooled effect estimates. In addition, postpartum outcomes were reported descriptively rather than analysed quantitatively, which restricts conclusions about the long-term effectiveness of financial incentives. These issues should be taken into account when interpreting the results.

FUTURE RECOMMENDATIONS

Future trials should incorporate pregnant smokers, medical experts, and policy makers in their conception, planning, recruiting, and design in order to evaluate the acceptability and cost-effectiveness of this treatment strategy. The necessity of taking into account the cultural setting in which the study is being done is highlighted by the disparate responses to financial incentives in different countries and even geographical areas. Regardless of the mother's smoking status, second-hand smoke exposure during pregnancy is linked to a higher risk of smoking-related health problems. Future

research should therefore evaluate the effectiveness of monetary incentives in assisting pregnant smokers' spouses in giving up their smoking. Future research and treatment that makes use of online recruitment strategies will need to figure out how to reach the largest possible portion of this population as well as how to make participation easier for women who do not have access to technology, such as by leading them in the direction of community resources that provide free computer and Internet access [33] and/or programs that give away free mobile phones to low-income people [34]. It's also important to compare the various incentive programs to see which one helps people quit smoking the most. Assessment of the level of addiction and readiness to quit the habit is necessary because these variables influence the study's outcome.

CONCLUSION

This systematic review and meta-analysis indicate that adding financial incentives to standard smoking cessation counselling is associated with higher quit rates among pregnant women compared with counselling alone. However, these findings should be interpreted with caution because of the considerable clinical heterogeneity across the included studies, particularly with respect to control interventions, the type and size of incentives, outcome definitions, and follow-up periods.

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PRESCRIPTIONS BEYOND PILLS: A SCIENTOMETRIC MAPPING OF PHARMACY IN SOCIAL MARKETING AND PUBLIC HEALTH

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ABSTRACT

BACKGROUND

The expanding role of pharmacies in community health, driven by social marketing, requires careful examination. This study examines the historical environment, analyzing the themes, contributors, and trends that have influenced this dynamic intersection.

OBJECTIVE

The study uses scientometric analysis to uncover trends in the symbiotic interaction between pharmacy and social marketing campaigns. By identifying contributions, themes, and collaborative networks, this study provides valuable insights for future research and practical applications in the fields of community health and pharmaceutical practice.

METHOD

The study utilised a meticulous strategy, incorporating the utilisation of Biblioshiny for scientometric analysis, specific keywords for document retrieval, and a dataset sourced from the Scopus database.

RESULTS

The study scrutinized 120 documents published over 43 years. An annual growth rate of 1.63% was found in the trend in publications. The USA was the leading contributor, followed by Canada and the UK. Key findings identified four thematic clusters, top journals such as the Australian Journal of Pharmacy, and high-frequency keywords such as 'social marketing' and 'family planning'.

CONCLUSIONS

This study provides an overview of the main discoveries, consequences, and recommendations for future research and practice in the subject of social pharmacy. Emphasising the crucial importance of pharmacists, the ever-changing nature of the field, and the possible influence on community health and knowledge through social marketing campaigns.

KEYWORDS

pharmacy, social marketing, community health, scientometric analysis, health education.

INTRODUCTION

Social marketing endeavors to modify or uphold individuals' conduct for the betterment of both individuals and society [1]. Today, pharmaceutical businesses have enhanced community health and engagement by adopting social marketing strategies [2]. Kang and team [3] highlighted how social marketing messages in anti-smoking advertisements shape behavioral intentions through emotional and cognitive responses—an approach parallel to pharmacy-led public health initiatives beyond pharmacotherapy. Notably, pharmacies have successfully utilized social media platforms to become significant hubs for health education and wellbeing [4]. These channels are used to disseminate health information, including specifics about medications and recommendations for well-being, hence augmenting health literacy [2]. Nowadays, pharmacists employ social marketing strategies to enhance medication adherence. SMS reminders, smartphone applications, and websites provide prescription reminders and information [5]. These endeavors enhance well-being and enable individuals to take charge of their health. Healthcare workers are praised for their dedication and perseverance in treating patients. During the pandemic, they were crucial to the healthcare system. They contributed to hospital emergency preparation, inpatient telemonitoring, and global COVID-19 treatment and preventive recommendations [6,7]. In addition, community pharmacies delivered medications to patients' residences to minimize physical interaction. In addition, they offered patient counseling and drug reconciliation using interactive platforms. Following the availability of COVID-19 vaccines, pharmacists offered instruction, guidance, supervision, and documentation of any unfavorable incidents. These pharmacists played a crucial role in disseminating information to the public regarding the disease, encompassing symptoms, transmission, home remedies, and methods of infection prevention. In addition, they heightened knowledge about vaccines too [7]. Thus, due to the increasing importance of pharmacy and related social marketing initiatives, it is crucial to comprehend the dynamics of its relationships under several facets. This investigation has significance as it provides valuable information about the academic community focused on pharmacy and social marketing initiatives. It includes details about the prominent authors, journals, and organizations involved in this field.

Recent studies emphasize the expanding role of various digital tools in pharmacy-led health promotion. Pharmacies are increasingly making use of digital marketing, mobile apps, and social media platforms to improve health behavior, medication adherence, and engagement of the patients [8]. A study by Kassem and others [9] points out that making use of strategic campaigns led by pharmacies significantly improves public health literacy, uptake of vaccination, and preventive care outreach. Further, in 2024, a team of researchers proposed a behavior change model integrating digital marketing strategies such as personalized messaging and mobile intervention [10]. Such initiatives of pharmacies drive proactive health decisions in the community.

To shape the developments mentioned above, Kotler's social marketing model offers interesting insights. The marketing mix, or the 4 Ps (Product, Price, Place, and Promotion), can be mapped onto the context of pharmacy as well. Various services and medications represent the "product," and insurance mechanisms and cost-effectiveness relate to the price. Community presence of the pharmacies relates to the "place," and various health campaigns, such as the use of digital tools for pharmacy engagement, represent the "promotion." This mapping shows how pharmacies employ various marketing strategies not only to influence the behavior of consumers but also to enhance public health outcomes [1]. Additionally, behavior change frameworks—such as the Health Belief Model and Theory of Planned Behavior—provide insight into how pharmacy-led initiatives can drive behaviors like medication adherence and vaccine uptake [2].

METHOD

This study performed a scientometric analysis using Biblioshiny [11]. A total of 120 documents were fetched from the Scopus database during January 2024. The keywords used in the research were "Pharmacy" OR "Social pharmacy" AND "Social marketing." The research was limited to the documents published between 1980 to 2023. Peer-reviewed journal articles, reviews, and conference papers were included in the study. Editorials, book chapters, letters, and non-English publications

were excluded from the study. Before data analysis, the data were subjected to a cleaning process. Duplicates were identified and removed. Further, keywords were standardized, such as harmonizing variants such as "pharmacies" and "pharmacy." This helped to consolidate the related terms and improve the coherence of the co-word and thematic analysis. The results were interpreted using conceptual, intellectual, and social structures. The collaboration network used in this research consisted of approximately 50 authors and 70 edges. The average degree centrality was 2.8, and the network density of 0.058. The modularity score was 0.68. For the keyword co-occurrence network, the average edge weight was 3.1, and the clustering coefficient of 0.42.

RESULTS

The study reported documents over 43 years (1980-2023). The annual growth rate of the chosen theme was 1.63. Average citations per year were maximum in the year 2020. Australian Journal of Pharmacy hosted the maximum number of articles on the chosen theme, followed by Social Marketing Update and Social Marketing Forum. Na Na was the author who had the highest publication frequency (n=6) followed by followed by Prominent authors were Annabel (n=2), Bailey (n=2) and so on (Figure 1). As per Lotka's law of authors' productivity, 302 authors wrote at least one document on the theme used in this research, followed by 10 authors who had written 2 papers. As per Bradford's Law, seven journals were in zone 1 (highly relevant), 28 in zone 2 (mediocre relevant), and 85 in zone 3 (less relevant). The University of California was the major contributor to the theme of the study. The USA contributed the most to this field of research (Table 1), followed by Canada and the UK. The top-cited paper in the world was written by Beradi [12] and team, published in the International Journal of Pharmaceuticals. Other top-cited papers were authored by Bustreo and his team [13], and A thematic map analysis indicated the formation of four quadrants. Motor, niche, basic, and declining themes. Health promotion, attitude, and practices fell into basic themes. These themes have low relevance but a high degree of development. Healthcare delivery in the South African context fell into motor themes (high relevance and development degree). Drug marketing and controlled studies fell into niche themes (High relevance but low development degree). Hospital pharmacies, medical waste disposal, etc, were in a declining theme (low relevance and development degree). The USA was the highest collaborator (Figure 2), mainly collaborating with India, Canada, and so on. The most commonly used words were social marketing, family planning, contraception, etc. A concurrence network revealed the formation of 3 major clusters (Figure: 3). The first clusters were predominated by social marketing by pharmacists encouraging the use of condoms. The second cluster focused on the promotion of various healthcare planning schemes by pharmacists.

FIGURE 1: YEARLY TREND OF AUTHORS' RESEARCH OUTPUT, SHOWING HOW PUBLICATION ACTIVITY IN THE FIELD HAS EVOLVED AND INTENSIFIED ACROSS DIFFERENT YEARS

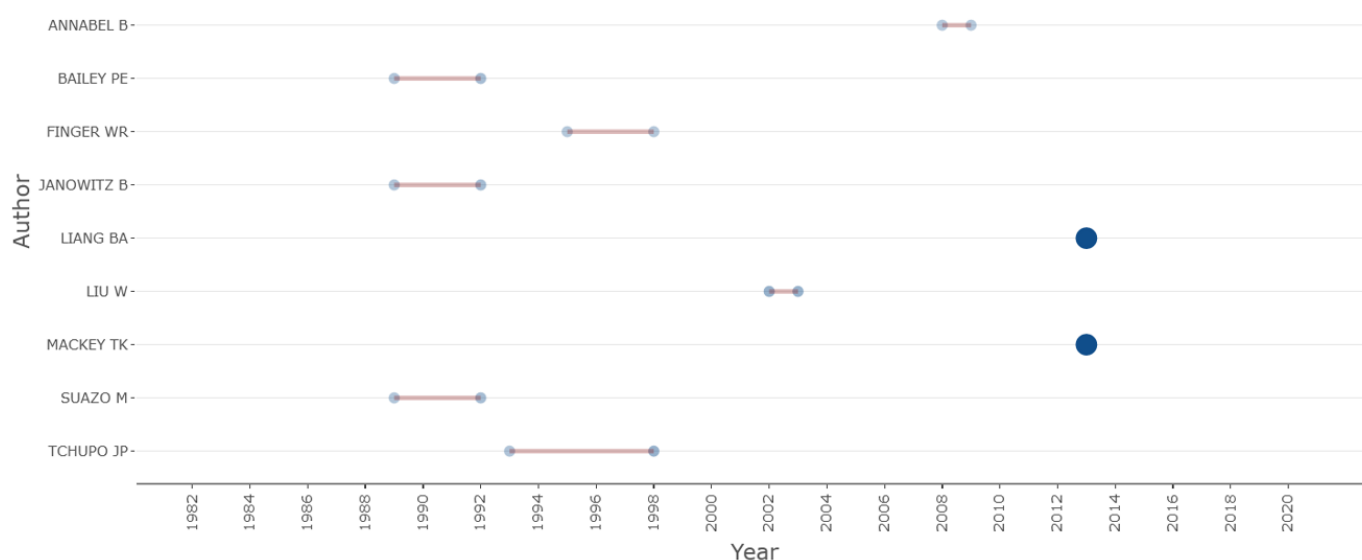


TABLE 1: GLOBAL DISTRIBUTION OF RESEARCH OUTPUT, HIGHLIGHTING THE MOST PRODUCTIVE COUNTRIES IN THE FIELD

Country	Frequency
USA	58
CANADA	19
UK	12
CHINA	7
GERMANY	7
INDIA	7
AUSTRALIA	6
FRANCE	4
NEW ZEALAND	4
SWITZERLAND	4

FIGURE 2: COLLABORATIVE RELATIONSHIPS AMONG AUTHORS ACROSS COUNTRIES, HIGHLIGHTING INTERNATIONAL RESEARCH PARTNERSHIPS AND KNOWLEDGE EXCHANGE

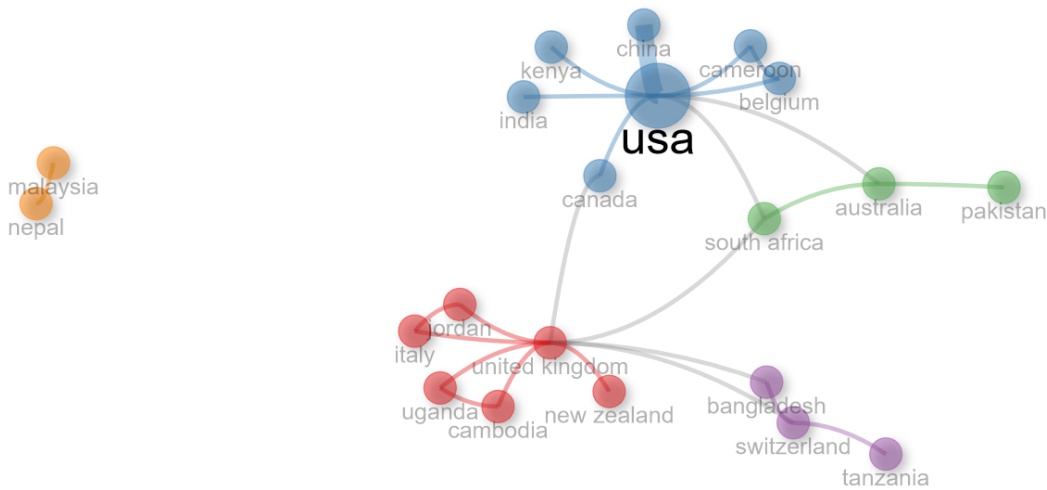
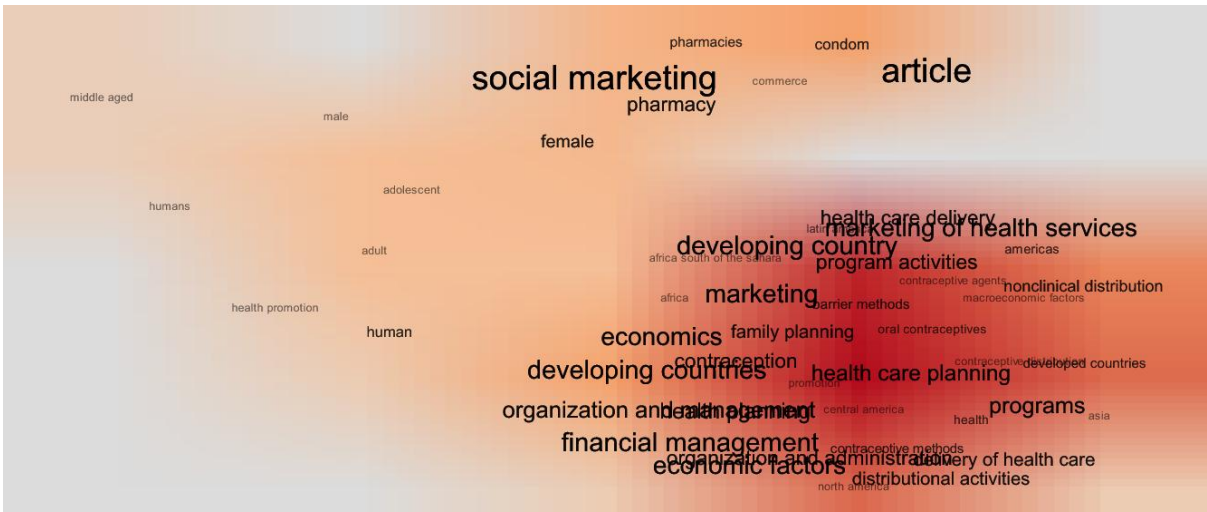


FIGURE 3: CO-OCCURRENCE NETWORK ILLUSTRATING THE INTERRELATIONSHIPS AMONG FREQUENTLY USED KEYWORDS, REVEALING MAJOR RESEARCH THEMES AND CONCEPTUAL LINKAGES WITHIN THE FIELD.



DISCUSSION

Based on the findings of the 43-year study that spans from 1980 to 2023, theoretical implications have been uncovered that provide light on the dynamic character of the topic that was investigated. A theoretical framework for analysing the decline and flow of research themes is suggested by the cyclic pattern that was identified in the motor, niche, basic, and declining quadrants. This framework may be a reflection of variations in societal requirements, technological breakthroughs, or policy objectives. This highlights the worldwide nature of scientific research and prompts theoretical inquiries into the elements that shape international leadership and partnership dynamics. The supremacy of the United States of America and the University of California highlight the global nature of scientific research. The prominence of particular writers and journals, most notably Na Na and the Australian Journal of Pharmacy, presents an opportunity for theoretical investigation into the influence that individual scholars and publication outlets have on the formation of research agendas. The co-occurrence network analysis provides theoretical insights into the interconnection of research issues and the diffusion of innovations. It does this by highlighting clusters such as condom social marketing and financial planning, among other examples. In addition, the identification of developing difficulties and worldwide partnerships by the study, in particular with India and Canada, may give rise to theoretical considerations regarding the adaptability of research to modern challenges and the role that international collaboration plays in the advancement of scientific inquiry. Researchers are encouraged to explore emergent issues, address relevance and development gaps, and collaborate globally to improve their work's impact and application. The most regularly used words suggest that studying social marketing, family planning, and contraception in more detail may enhance knowledge. Active engagement in the community holds similar importance. Pharmacies may employ social media platforms to promote health lectures, seminars, and immunization campaigns[8]. Online forums and groups enable the sharing of stories, seeking of advice, and discussion of health issues, promoting unity and friendship among community members [14]. Pharmacies may partner with public health organisations to execute focused health initiatives to enhance awareness, address health issues, and encourage proactive actions. To increase their reach and interaction, pharmacies may establish partnerships with influencers and generate interactive content like quizzes and polls. This strategy improves the accessibility and comprehensibility of health information. Pharmacies are efficient in responding to social media evaluations and feedback. This exemplifies a commitment to guaranteeing client satisfaction and cultivating confidence throughout the community. Pharmacies may expand their range of services beyond simply dispensing medicines by adopting new trends and employing social marketing tactics [15]. These health clinics may function as central hubs in the community, utilising innovative approaches to improve health outcomes, includeincluding the community, and cater to the diverse health needs of their patients.

CONCLUSION

Pharmacists play a major role within social pharmacy by addressing various social concerns related to health promotion, family planning, and contraception while actively contributing to public health initiatives such as infectious disease control and immunization. Their active involvement in research, social marketing, and healthcare delivery at both national and global levels shows their commitment to advancing the well-being of the community. By organizing various campaigns such as health screenings, educational workshops, and awareness campaigns, pharmacists disseminate major information on vaccination schedules, illness prevention, and healthy living. This collaborative and evolving role highlights their position as trusted healthcare advisors, dedicated to empowering individuals, fostering preventive health behavior, and shaping the future of pharmaceutical practice and research.

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