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REIMAGINING HEALTHCARE DELIVERY: A COMPARATIVE ANALYSIS OF TRADITIONAL HEALTHCARE AND AI-ENABLED SMART HOSPITALS

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ABSTRACT

OBJECTIVE

This study aims to comparatively analyse traditional healthcare and AI-enabled smart hospitals across key dimensions of operational efficiency, clinical outcomes, and accessibility, with a focus on how institutional readiness influences the effectiveness of digital healthcare transformation.

DESIGN

The study conducted a comparative narrative review using WHO's Digital Health Reports from 2019 and 2023. In addition, a total of 23 peer-reviewed articles published between 2016 and 2026 have been synthesised thematically across key dimensions of Operational Efficiency (OE), Resource Optimisation (RO), Clinical Decision Making (CDM), Accessibility (AC), Diagnostic Accuracy (DA), and Healthcare Digital Transformations (HDT), along with the global trends in digital health maturity, infrastructure, and workforce readiness.

RESULTS/OUTCOMES

Findings indicated that AI-enabled smart hospitals showed efficiency in DA, OE, and patient management through predictive analytics and automation. Nevertheless, it has been found that these advantages are highly contingent upon institutional preparedness, workforce capacity, and online infrastructure. Traditional healthcare models, on the other hand, are dependent on human interventions, with limited physical capacity and workforce.

CONCLUSION

The study highlighted that healthcare transformation does not solely rely on technological advancement. A hybrid model integrating traditional healthcare with digital innovation is essential to ensure sustainable, equitable, and scalable healthcare delivery.

KEYWORDS

Artificial Intelligence; Healthcare; Smart Hospitals; Technology; Digital Health

INTRODUCTION

Emerging technologies such as Artificial Intelligence (AI), Information Technology (IoT), and data-centric medical technology have transformed patient care through early interventions, disease diagnosis, real-time monitoring, and personalised care. As hospitals face an ever-increasing patient population and a subsequent rise in healthcare expenditure costs, there is a strain being put on traditional healthcare facilities to meet such real-time needs. Nevertheless, new technologies in smart hospitals can offer the opportunity to automate the medical process and provide healthcare professionals with better data management capabilities to improve clinical decision-making [1]. Digital systems like telemedicine and Electronic Health Records (EHRs) enhance coordination, increase access and support the continuity of care [2]. However, the potential of these systems not only depends on technological capability but also on their adoption and integration by both patients and healthcare providers. For instance, AI-enabled smart hospitals are showing improvements in their operational performance, emergency response time and diagnostic accuracy [3], [4]. These developing technologies highlight the need to critically examine their integration, influencing efficiency, accessibility, and quality of care across healthcare systems.

RESEARCH QUESTIONS

RQ1: How do AI-enabled smart hospitals differ from traditional healthcare systems in terms of operational efficiency, accessibility, and clinical outcomes across varying levels of institutional readiness?

RQ2: How do institutional factors such as governance, infrastructure, and workforce capacity influence the effectiveness of AI-enabled healthcare systems?

LITERATURE REVIEW

The evolution of digital technology has significantly transformed healthcare delivery through emerging AI-enabled smart hospitals based on advanced tools like AI, IoT, and other intelligent information systems. These technologies not only improve the efficiency and patient outcomes but also enable real-time data sharing, clinical coordination, and the delivery of personalised care through EHR, telemedicine platforms, and predictive analytics [2, 5].

Empirical studies emphasise the importance of user acceptance and engagement in the successful implementation of smart hospital technologies [6]. Research based on the Technology Acceptance Model (TAM) shows that perceived usefulness, trust, and convenience are key factors in determining whether patients will adopt smart healthcare services [7, 8]. Moreover, evidence indicates that integration of AI, robotics and automated systems in hospitals can enhance service quality and improve patient satisfaction compared to the traditional healthcare model [3, 9, 10]. However, these benefits are tagged with challenges, including data privacy concerns, high implementation costs, and workforce capacity. Therefore, strategic planning and institutional readiness are critical to facilitate the successful implementation of smart hospital systems. The key findings in Table 1 are synthesised to chalk out thematic codes for analysis.

Abbreviations used in Table 1-
AC- Accessibility
CDM- Clinical Decision Making
DA- Diagnostic Accuracy
HDT- Healthcare Digital Transformation
OE- Operational Efficiency
RO- Resource Optimisation

TABLE 1. KEY FINDINGS SYNTHESISED FROM LITERATURE

Author(s)	Study Focus	Methodology	Key Findings	Thematic Coding
[1]	Intelligent speech technology in smart hospitals	AI model using federated learning	98.6% accuracy in medical transcription and diagnosis	DA, HDT
[3]	Smart emergency hospital technologies	Comparative case study	Emergency response time reduced by 75% and costs by 33%	OE, RO
[4]	Smart technologies and patient satisfaction	Survey study	Smart healthcare technologies improve quality and satisfaction	AC, HDT, RO
[5]	AI-based stroke prediction platform	Deep learning model	Achieved up to 99% accuracy in stroke prediction	DA, CDM
[6]	Telehealth and AI during COVID-19	Analytical study	Telehealth improved healthcare accessibility during the pandemic	AC
[7]	Patient acceptance of smart hospital services	Survey (202) respondents	Trust, usefulness, and convenience influence the adoption of smart services	DA, HDT, AC
[8]	Voice-based smart ward systems	Pilot survey	Perceived usefulness significantly influences patient adoption	OE, CDM, RO
[10]	Advanced medical technologies in healthcare	Analytical study	AI diagnostics improve healthcare efficiency and accuracy	DA, OE
[11]	Integrating 6G technology in smart hospitals	Comprehensive review and analysis	6G-based smart hospital model enhances patient care, real-time monitoring, and hospital operational efficiency	OE, RO, DA
[12]	Digital transformation in hospitals	Mixed methods	Leadership and digital readiness drive hospital digitization	HDT, OE, CDM
[13]	Enablers of AI adoption in hospitals	ISM-MICMAC analysis	Infrastructure, policy, and collaboration drive AI adoption	AC, DA, OE, RO

[15]	Digital twin technologies in healthcare	Technology analysis	Enables real-time monitoring and improved emergency response	CDM, OE, RO
[16]	AI megaprojects in healthcare systems	Case study	AI improves efficiency but raises privacy concerns	OE, CDM, AC
[17]	IoT-enabled virtual hospital systems	Machine Learning Framework	Improves healthcare data processing and diagnostic efficiency	DA, OE
[18]	AI in hospital information systems	Literature review	AI enhances imaging, telemedicine, and patient management	OE, RO, HDT
[19]	AI in hospital administration	Conceptual analysis	AI enhances scheduling and resource allocation	RO, HDT
[20]	Digital twin governance in hospitals	Simulation-based empirical study	AI auditing improves compliance monitoring	CDM
[21]	Digital hospital evaluation scale	Psychometric survey study	Developed a reliable scale for digital hospital performance	OE
[22]	Future development of smart hospitals	Delphi study	Smart hospitals emphasise personalised and digital healthcare	HDT
[23]	Smart hospitals in neurosurgery	Scoping review	AI enables precise diagnostics and personalized treatment	DA, CDM
[26]	Digitalisation and financing of smart hospitals	Case study analysis	Digital healthcare platforms enhance partnership and patient-centred services	RO, HDT
[27]	Wearables technologies in healthcare	Analytical study	IoMT devices enable continuous health monitoring	HDT
[28]	Digital transformation in radiology	Policy and literature analysis	Infrastructure and training support digital healthcare adoption	HDT, AC, OE

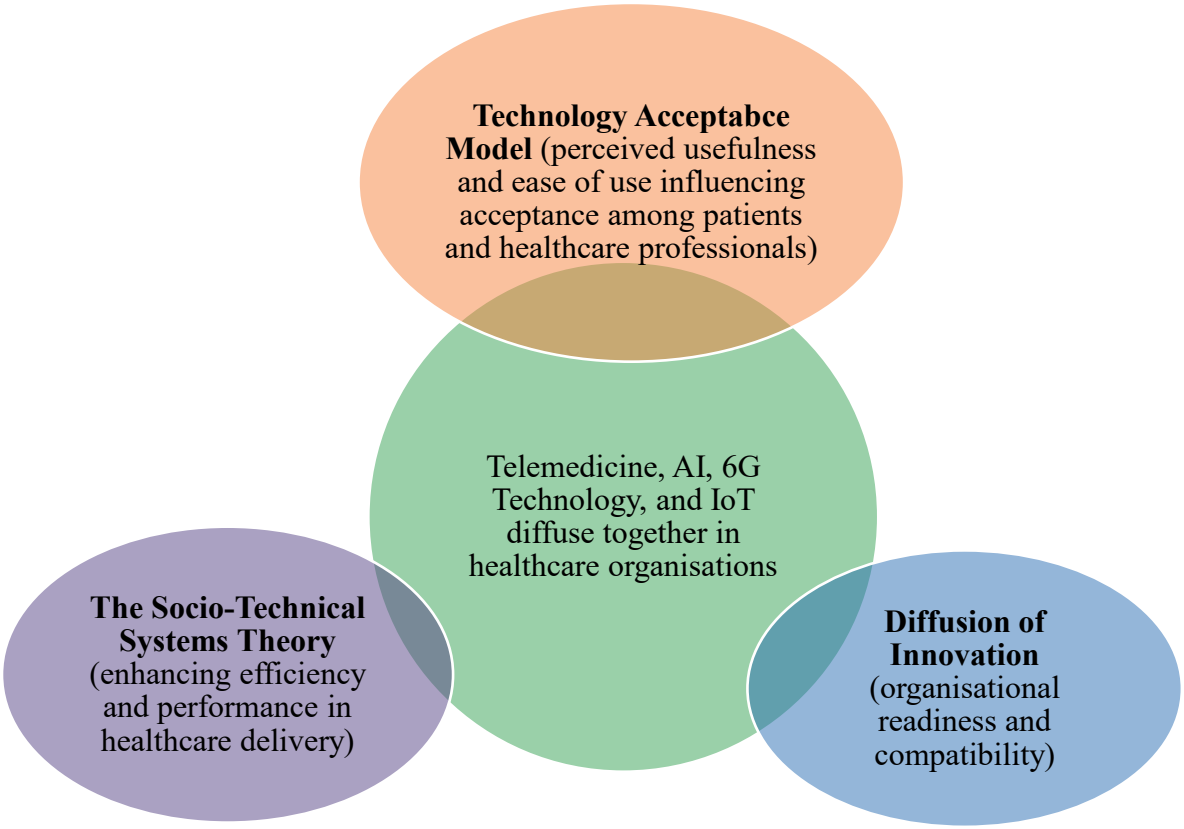
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THEORETICAL FRAMEWORK

This study is underpinned by the TAM, Diffusion of Innovation (DOI) Theory, and Socio-Technical Systems Theory, as represented in Figure 1, to account for the change from traditional healthcare services to AI-based smart hospitals. The

TAM argues that the adoption behaviour is a function of perceived usefulness and ease of use as key determinants influence acceptance among patients and healthcare professionals [7]. DOI Theory supports this by explaining how innovations like telemedicine, AI, 6G Technology, and IoT diffuse together in healthcare organisations driven by organisational readiness and compatibility [11, 12, 13]. The Socio-Technical Systems Theory, in parallel, focuses on the relationship between healthcare practitioners and technological systems to enhance efficiency and performance in healthcare delivery [2].

FIGURE 1. THEORETICAL FRAMEWORKS INTEGRATION



Source: Constructed by Authors

METHODS

A literature search was conducted using academic databases, including Google Scholar, PubMed, MDPI, and open-access journal databases. A total of 23 peer-reviewed academic publications between 2016 and 2026 were selected based on their focus on AI in healthcare, smart hospital systems, or digital healthcare delivery. The search strategy included combinations of keywords such as "artificial intelligence," "smart hospitals," "digital healthcare," "telemedicine," and "healthcare efficiency." Non-relevant and duplicate studies were excluded. Secondary data from the World Health Organization (WHO) digital health reports was utilised to identify technological and operational differences between the two healthcare models. The thematic narrative synthesis was applied to the selected studies, identifying patterns in the most important dimensions such as OE, RO, DA, CDM, AC, and HDT. Each dimension was then mapped to enable comparative interpretation of the study findings. The analysis of secondary data, WHO Digital Health Reports (2019, 2023), was performed to comprehend global trends in digital health maturity, infrastructure, and workforce capacity into perspective. Digital health maturing levels were analytically mapped to each dimension to integrate findings and understand differences between the two healthcare models. This allowed the connection of the literature understanding at the micro level (individual model) with the trends in the global system at the macro level (combination of both models).

RESULTS AND DISCUSSION

The findings of the study indicate that the integration of AI and digital technologies is fundamentally transforming healthcare delivery systems. However, the extent and effectiveness of this transformation vary significantly across contexts, depending on technological, organisational, and institutional factors.

THEMATIC ANALYSIS: RQ1 ANSWERED

Theme 1: Operational Efficiency (OE) and Resource Optimisation (RO)

Machine learning, IoT, and 6G technology, predictive analytics are some of the technologies that are used in smart hospitals to improve the performance of operations and their resource utilisation [11]. Smart hospitals can also enhance their OE with the introduction of automated logistics systems and AI-based technology for imaging and real-time data analytics [14-18]. The emergency response time of 75% reduction is achieved at emergency hospitals that adopt smart technology solutions, with their processes of RO being made 20% more efficient when compared to traditional healthcare models [3], [15]. Nevertheless, their efficacy depends on the integration of systems and the preparedness of infrastructure. The improvement of OE is restricted by a decentralised system that is not prominent in traditional settings. This is in conformity with the ideas of the Socio-Technical Systems Theory, which points out that alignment between the technical systems and the organisational processes is the key to technological effectiveness.

Theme 2: Diagnostic Accuracy (DA) and Clinical Decision Making (CDM)

Systems that are based on AI exhibit high DA in disease prediction and CDM. As an example, federated neural networks have demonstrated intelligent speech technology, with 98.6% DA and transcription accuracy showing potential of AI systems in CDM and minimising medical errors [1]. In addition, unlike traditional healthcare models, smart hospitals can rely on AI and deep learning-based prediction systems, demonstrating a level of DA up to 99% in disease detection systems [5]. These results suggest that AI can greatly improve CDM by minimising human error and enhancing data interpretation. But, within the frame of TAM, the adoption of AI systems can only be validated by governance and policymakers, as it is done in traditional healthcare systems. Results are governed by data quality, algorithm stability, contextual flexibility, biased or inaccurate datasets, making it necessary for the governing bodies to evaluate their perceived usefulness and trust between healthcare professionals.

Theme 3: Accessibility (AC) and Healthcare Delivery Transformation (HDT)

Digital technologies, e.g. telemedicine and remote monitoring, have increased access to health services and continuity of care. The role of digital infrastructure and the application of Management Information Systems (MIS) have played a pivotal role in the development and utilisation of traditional hospitals and the transition towards HDT [2]. These digital systems also ensure the use of remote patient monitoring and telemedicine, which have been critical in the development of HDT and the need to ensure the decongestion of hospitals. The perception and acceptance of HDT by patients are also factors of concern. Studies on patient perception of smart hospital services have revealed that patients are more likely to use smart hospital services when they think that the use of technology is trustworthy, convenient and beneficial to their healthcare needs [7], [19-23]. But the gains of AC are not evenly distributed over regions. The infrastructure and digital literacy levels are limited in many low and middle-income countries, limiting the efficacy of these solutions.

These three themes indicate that smart hospitals should adopt digitalisation and HDT because of the higher OE, RO, DA, and AC. In turn, it enables continuous flexibility in attending to patient needs. However, the implementation and CDM are still limited to governance and policymaking bodies due to their validated perceived usefulness and coordination among healthcare professionals.

WHO DATA ANALYSIS: RQ2 ANSWERED

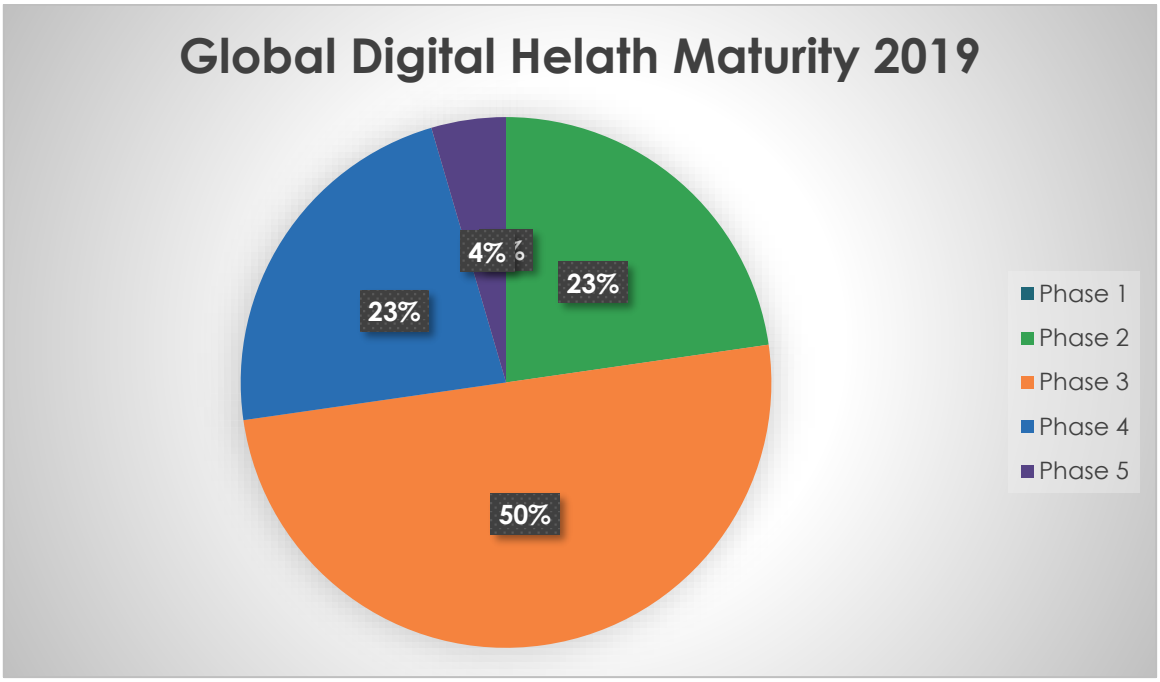
Institutional Readiness and Global Health System Context

The World Health Organization's (2019 and 2023) Digital Health reports show how the world is transforming from conventional health systems to digitally enabled health infrastructure. In the State of Digital Health 2019 report [24], which assessed 22 early adopter countries using the Global Digital Health Index (GDHI), it was established that the digital health ecosystem across the globe had reached an average level of maturity, which is referred to as Phase 3, indicating that it

is still at the developing stage. The most advanced component of the digital health ecosystem was leadership and governance, which had reached an average level of Phase 4, indicating that most countries had already adopted digital health strategies into their healthcare policies. However, other core components, such as standards and interoperability, are still at the developing stage. In addition, there was limited financial commitment and investment in digital health technologies.

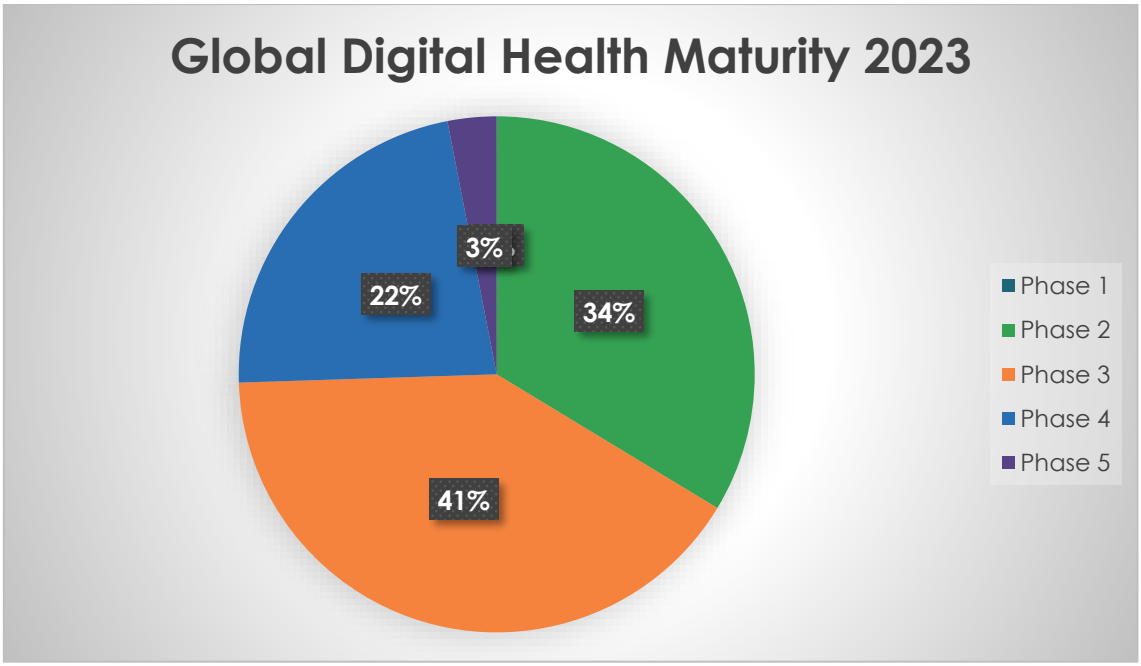
The report titled "The State of Digital Health 2023" [25] evaluates and compares the status of digital health within 67 different nations, serving as an indicator of the progressive, albeit somewhat uneven, advancement of the state of global digital health adoption. The majority of the countries are still at a Phase 3 maturity level, and the 22 countries that have already moved to Phase 4 maturity are experiencing a growing rate of national digital health infrastructure connectivity.

FIGURE 2. GLOBAL DIGITAL HEALTH MATURITY DISTRIBUTION FOR THE YEAR 2019



Source: Compiled by Authors from WHO Digital Health Reports

FIGURE 3. GLOBAL DIGITAL HEALTH MATURITY DISTRIBUTION FOR THE YEAR 2023

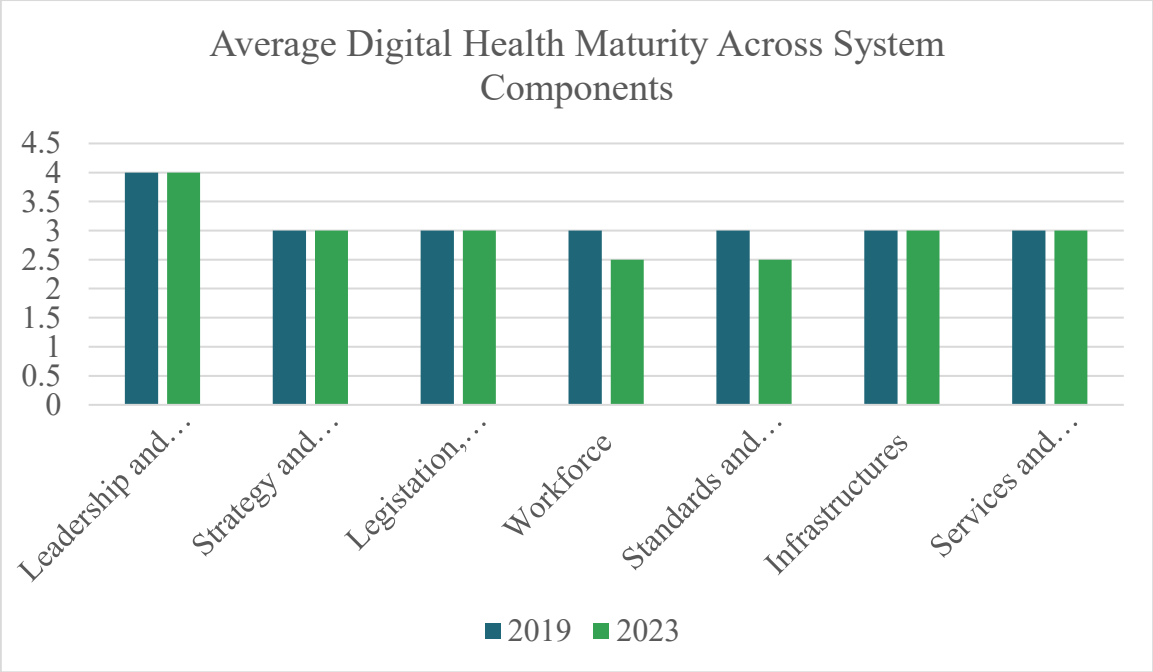


Source: Compiled by Authors from WHO Digital Health Reports

The global digital health maturity (Figures 2 and 3) indicates that most countries are still in Phase 3, which implies partial implementation of the digital health systems. Although the change towards higher maturity levels has been made, it is limited and unequal. Notably, those countries with higher levels of digital maturity (Phase 4 and above) are more inclined to successfully implement AI-enabled healthcare systems due to their improved infrastructure, governance, and workforce capacity. Conversely, less developed countries have structural limitations, which restrict the perceived usefulness of digital health interventions. Even from a TAM perspective, improvements in CDM and DA enhance perceived usefulness, while interoperability challenges reduce perceived ease of use, limiting adoption in Phase 3 systems. This indicates that despite the rising digital health adoption, institutional readiness is still immature, especially in such areas as interoperability, workforce capacity, and funding. Consequently, AI-enabled smart hospitals can only be as effective as they are technologically enabled but not limited by systemic or organisational constraints.

WHO data shows that countries at Phase 3 digital maturity are partially integrating digital innovations that directly impact RO and OE. In turn, such fragmented data infrastructures are showing limited real-time coordination and preventing DA and CDM, further reducing the effectiveness of automation and predictive systems. Uneven digital infrastructure and workforce capacity, as shown by the WHO report, directly impact the AC of telemedicine and remote monitoring in expanding HDT. However, countries at the higher maturity level of Phase 4 are showing better alignment between governance and workforce capabilities, moving towards AI-enabled smart systems.

FIGURE 4. AVERAGE DIGITAL HEALTH MATURITY ACROSS SYSTEM COMPONENTS BASED ON VARIOUS PHASES



Source: Compiled by Authors from WHO Digital Health Reports

Leadership and governance show a rather high level of maturity, whereas workforce capacity and interoperability are not yet at a high level of development (Figure 4). As the combination of leadership and governance shows great maturity (Phase 4), indicating that there are strong policy and strategic commitment, the use of systems to build workforce capacity and support the functions of standards/interoperability indicates only a moderate level of development (Phase 2.5). Hence, there is a significant loss in the capacity to develop digital health talent and connect to other health systems since there is still no development in these areas. According to the WHO reports, digital technology has experienced significant advances in providing AC to healthcare services and in delivering RO. Because of this, the healthcare industry is shifting from traditional systems to digital systems. Workforce capacity limitations further restrict the scalability of AI-enabled healthcare systems, as their effective implementation requires skilled personnel, interoperable systems, and long-term investment. The finding relates to the DOI theory that highlights the fact that adoption is based on organisational preparedness and systemic compatibility.

Moreover, the adoption of smart hospitals with AI-driven solutions is governed by challenges like high costs, data privacy issues, and cybersecurity threats [16]. These hurdles underscore the fact that digital transformation is not technological in nature, but institutional and socio-economic (The Socio-Technical Systems Theory) in nature. Also, the digital divide can contribute to disparities in healthcare access, especially in areas with a low level of infrastructure.

COMPARATIVE SYNTHESIS AND INTEGRATED INTERPRETATION

Based on the themes from 23 studies (Table 1) and WHO reports, the comparison is operationalised across OE, RO, CDM, DA, AC, and HDT between traditional and smart hospitals (Table 2).

TABLE 2. COMPARATIVE ANALYSIS OF TRADITIONAL HEALTHCARE SYSTEMS AND AI-ENABLED SMART HOSPITALS

Dimension	Traditional Healthcare Systems vs. AI-Enabled Smart Hospitals (RQ1)		Analytical Interpretation (RQ2)
	Traditional Healthcare Systems	AI-Enabled Smart Hospitals	
Decision-Making	Clinician-driven, experience-based	Data-driven, AI-assisted	Improves accuracy but depends on trust and perceived usefulness (TAM)
Operational Efficiency	Manual workflows, delays in processes	Automated systems, optimised resource allocation	Efficiency gains depend on infrastructure integration and system interoperability.
Diagnostic Accuracy	Dependent on human expertise	Enhanced through machine learning and predictive models	Reduces human error but introduces risks of algorithmic bias and data dependency
Data Management	Fragmented and siloed systems	Integrated, real-time data ecosystems	Effectiveness depends on interoperability and data governance (WHO findings)
Accessibility	Limited by physical infrastructure and location	Expanded through telemedicine and remote monitoring	Improves reach but varies across regions with differing digital maturity levels
Patient Engagement	Episodic, visit-based interactions	Continuous monitoring and digital engagement	Enhances adherence and satisfaction through sustained interaction
Workforce Capacity	Limited by physical capacity and workforce	High scalability through digital platforms	Enables population-level healthcare delivery with lower marginal expansion costs
Institutional Readiness	Established structures with lower digital dependency	Requires strong governance, workforce skills, and infrastructure	Primary determinant of success (DOI theory and WHO maturity data)
Cost Structure	Lower initial investment, but operational inefficiencies	High initial investment with potential long-term optimisation	Financial barriers may limit adoption in resource-constrained settings
Error and Risk Profile	Higher probability of human error	Reduced human error but increased cyber and ethical risks	Reflects the trade-off between automation efficiency and system vulnerabilities
Equity Impact	More accessible in low-resource settings	Risk of widening digital divide	Unequal digital infrastructure may exacerbate healthcare disparities

Source: Compiled by Authors

The comparison conducted in Table 2 indicates that the performance of AI-enabled smart hospitals is better than that of traditional systems in most aspects, primarily performance in terms of OE, workforce capacity, and DA. Based on the

comparative synthesis, the results indicate that the efficacy of AI-enabled smart hospitals is relative to their applicability and effectiveness in different contexts. High rates of improvement in the performance of the operation process and patient outcomes in high-resource settings with high rates of digital maturity characterise smart hospitals. On the other hand, the traditional healthcare systems are still essential in the context of resource-constrained settings since they are more available, versatile, and less dependent on the digital infrastructure. It implies that the future of healthcare lies in the development of hybrid models that would combine the advantages of the traditional healthcare system with the benefits of digital technologies. Such an approach will assist healthcare systems in accepting innovation without undermining inclusivity and resilience.

RESEARCH GAP AND FUTURE IMPLICATIONS

The literature on the AI-enabled healthcare systems identifies the transformative role of digital technologies, including AI, IoT, telemedicine, and wearable technology, in improving efficiencies in hospitals through better diagnosis and monitoring of patients [6, 26, 27, 5, 15]. However, the research was largely technology-focused and emphasised less on infrastructure preparedness, low data protection, the non-existence of interoperability among systems, and the lack of workforce capacity [16, 28]. Moreover, an integrated comparative analysis of digital health innovations in traditional healthcare systems and AI-enabled smart hospitals has not been done, as most studies examine digital health innovations separately. Limited evidence that exists in low and middle-income environments can also be found despite the large disparities in digital health maturity. Finally, policymakers and healthcare administrators must enhance digital infrastructure, governance, and workforce training that will help healthcare managers to adopt smart hospital systems [29-32].

POLICY AND MANAGERIAL IMPLICATIONS

The findings highlight that successful adoption of AI-enabled smart hospitals depends on strengthening institutional readiness, infrastructure, and workforce capacity. Table 3 summarises key policy and managerial implications derived from the comparative analysis and global digital health trends.

TABLE 3. POLICY AND MANAGERIAL IMPLICATIONS FOR AI-ENABLED HEALTHCARE SYSTEMS

Domain	Key Implication	Action Focus
Policy-Infrastructure	Strengthen digital infrastructure and interoperability	Invest in integrated health information systems and standardised data frameworks
Policy-Governance	Enhance data protection and regulatory frameworks	Establish clear policies for data privacy, cybersecurity, and ethical AI use
Policy-Workforce	Build digital health workforce capacity	Develop training programs and formal roles in health informatics and AI
Policy-Equity	Address uneven digital health maturity	Expand digital access and support underserved regions
Managerial-Implementation	Adopt phased technology integration	Prioritise high-impact areas (diagnostics, monitoring, admin automation)
Managerial-Alignment	Align technology with workflows	Integrate AI systems with existing clinical and operational processes
Managerial- Capability Building	Invest in staff training and change management	Enhance digital literacy and manage adoption resistance
Managerial-Data Utilisation	Leverage data for decision-making	Use analytics to improve efficiency and patient outcomes
Managerial-Risk Management	Strengthen cybersecurity and system resilience	Implement robust data protection and risk mitigation strategies

Source: Compiled by Authors

The implications indicate that digital transformation in healthcare is not solely technology-driven but requires coordinated action across policy and organisational levels. Although the enabling infrastructure, governance, and equity are important issues that should be considered by policymakers, the healthcare managers play an important role in

implementation, readiness of the workforce, and operational integration. This supports the main finding of the study that institutional readiness is the most significant factor of successful smart hospital adoption.

CONCLUSION

This study compared traditional healthcare systems with AI-enabled smart hospitals to examine differences in operational efficiency, accessibility, and overall healthcare digital transformations. The findings show that the performance of smart hospitals can greatly improve their diagnostic accuracy, operational efficiency, and scalability; however, they strongly depend on the institutional readiness. The importance of factors such as governance, infrastructure, and workforce capacity is more essential than technological solutions alone. The lack of digital maturity within the global population, as indicated by WHO statistics, also means that smart healthcare systems cannot be universal. The risks related to data privacy, cybersecurity, and digital inequality are also defined in the analysis. Overall, the study shows that hybrid models that incorporate technological innovation and the merits of the traditional systems are needed so as to sustain healthcare transformation and make it competent and just.

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