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RESEARCH ARTICLE

ANTECEDENTS FOR THE ADOPTION OF TELEMEDICINE IN INDIA: SCALE DEVELOPMENT AND VALIDATION

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ABSTRACT

BACKGROUND:

Telemedicine is increasingly recognized as a promising solution to healthcare challenges in India, particularly in remote areas. However, the country's vast population and geographic diversity present significant obstacles to providing accessible and high-quality healthcare services to all citizens. By leveraging technology, telemedicine has the potential to bridge this gap and enable remote delivery of medical services.

OBJECTIVE:

This study aims to develop and validate a scale that assesses the factors influencing the adoption of telemedicine in the Indian context. Understanding these factors is crucial for identifying key drivers and barriers to telemedicine adoption in India.

DESIGN:

Quantitative methods were employed for scale development. The instrument development process involved several stages: factor identification, item generation, pre-testing, pilot testing, and scale validation. A structured questionnaire was administered to healthcare professionals, industry experts, and patients who have used or intend to use telemedicine.

SETTING:

Confirmatory factor analysis and subsequent tests, such as reliability and validity tests were conducted to establish the internal consistency of the scales. These statistical analyses aimed to identify underlying factors and ensure accurate measurement of latent variables that affect the adoption of telemedicine.

RESULTS:

The study established a robust scale to assess the five key factors, which are the vital explanatory variables in telemedicine adoption in India. These meticulously validated scales, encompassing technology, government policy, user attitudes, societal demand, and healthcare professional perspectives, demonstrate high reliability and validity in understanding the adoption dynamics of telemedicine in the context of India.

CONCLUSION:

This research offers a validated scale for assessing telemedicine adoption in India, crucial for healthcare service providers, policy makers, and researchers in this field. It enables informed decisions in implementing telemedicine, addressing unique

challenges and opportunities, and significantly contributing to optimizing healthcare delivery across India's diverse socio-economic and geographical landscape.

KEYWORDS

Telemedicine adoption, scale development, construct reliability, discriminant validity, latent variables, item generation, remote healthcare

INTRODUCTION

Telemedicine, a healthcare service for remote diagnosis and treatment of patients through telecommunications technology, has become increasingly essential in contemporary healthcare, as the global response to the COVID-19 pandemic and thereafter.

As telemedicine continues to expand, there is a critical need for reliable and valid scales to measure various aspects such as user attitude, effectiveness, and technology usability. These measurements are vital for improving service quality and patient outcomes. The development of our scale is grounded in one key theoretical framework, the technology acceptance model (TAM) by Davis (1989) which provides insights into how users come to accept and use technology for service effectiveness [1].

Existing scales such as the telehealth usability questionnaire (TUQ) and the service user technology acceptability questionnaire (SUTAQ) provide valuable insights, but they often lack comprehensive coverage of user experience, the role of practitioners, the role of policymakers, and effective clinical outcomes in diverse telemedicine settings. This gap underscores the need for a more holistic and robust scale [2, 3]. Given the limitations of existing measurement tools, our study aims to develop a comprehensive scale that addresses these gaps. By incorporating elements from the existing theoretical models, our scale will provide a practically more useful and effective measure of telemedicine services.

This research aims to answer the following questions: 1) what are the key dimensions of effective telemedicine adoption and 2) how can these dimensions be reliably and validly measured? The primary objective is to develop and validate a scale that accurately captures these dimensions, ensuring it is both practical for healthcare providers and meaningful for patients.

BACKGROUND

This research is rooted in the pressing healthcare challenges faced in India. India, renowned for its vastness and diversity, is home to over a billion people. This immense population faces significant challenges in delivering equitable healthcare, particularly in remote and underserved regions. These challenges include inadequate healthcare infrastructure, a scarcity of healthcare professionals, geographical barriers, and socioeconomic disparities. These issues contribute to limited access to both quantum and quality healthcare services, especially in rural and remote areas [4]. In this complex landscape, telemedicine emerges as a promising and transformative solution. By leveraging technology, telemedicine bridges the gap between healthcare providers and patients, irrespective of their physical locations, by offering remote consultations, diagnosis, treatment, and health monitoring. This innovation not only addresses the pressing need for healthcare accessibility but also paves the way for a more inclusive and efficient healthcare system [5]. However, there is a significant gap in understanding the factors influencing the successful adoption of telemedicine in India.

This study aims to address this gap by developing and validating a scale that assesses the factors influencing the adoption of telemedicine in the country. This study builds on prior research in e-health management, telemedicine's practical implications, healthcare emergencies, and the role of technology-based healthcare management.

LITERATURE REVIEW

Some previous research studies have outlined the processes of scale development and validation. The studies utilized guidelines proposed by Churchill in 1979 and Hensley in 1999 for scale development and validation, specifically in telemedicine [6, 7]. Shaarani, in 2023, developed a telemedicine acceptance model based on TAM during the Pandemic (TeAM) [8]. The model was developed considering the associations between

constructs affecting the physicians' attitudes about telemedicine use. TeAM is a tool assessing telemedicine acceptance based on the TAM. It has additional constructs covering the perceived risks of telemedicine use, the perceived need for policies, the perceived need for training, and the perceived usefulness of telemedicine during a pandemic. The adoption and acceptance of telemedicine require the application of a technology acceptance model which could be used to predict patient behaviour [9]. Validated telehealth surveys have proven useful tools for measuring patient satisfaction with telehealth services [10]. Such surveys generate valuable information on patient's experience with telehealth services, which could also be used to predict patient's behaviour.

A literature review of some recent articles was conducted to analyze the findings and identify the gaps, which led to the identification of five independent variables that may impact the adoption of telemedicine in India. These variables include 'societal factors,' 'government policies,' 'perception of patients/users,' 'perception of doctors', and 'technology availability.' The study measures the impact of these independent variables on the adoption of telemedicine through research outcomes identified in the literature survey.

TECHNOLOGY FACTORS

In India, the success of telemedicine hinges on robust technology infrastructure, essential for facilitating remote healthcare interactions. Despite urban advancements, rural areas face significant disparities in accessing this technology [11]. Telemedicine, supplementing rather than replacing face-to-face care, demands video-enabled, user-friendly platforms accessible across locations [12]. Key to its implementation is the availability of compatible, secure, and interoperable systems, addressing challenges like the digital divide, technological literacy, and maintaining patient confidentiality [13].

SOCIETAL FACTORS

Societal factors refer to the influence of social norms, beliefs, attitudes, and expectations of members of society toward adopting telemedicine [14]. Social factors can impact the willingness of individuals and communities to adopt telemedicine due to their longstanding preference for face-to-face consultations [15]. Some patients, particularly females, may feel embarrassed to disclose personal details to unknown people on the other end. Moreover, a perception that telemedicine is less effective and offers lower quality care than traditional healthcare may discourage patients and doctors from using it. Despite these challenges, societal factors can also facilitate technology adoption, especially after pandemics like COVID-19 [16].

USER ATTITUDE TOWARDS THE ADOPTION OF TELEMEDICINE

The user's attitude influences the degree of positive or negative feelings toward using telemedicine. Individual beliefs on the positive and negative consequences influence telemedicine usage. The COVID-19 pandemic has increased the awareness and demand for telemedicine services in India and opportunities for its adoption. The pandemic has also exposed the lacunae and barriers in India's telemedicine infrastructure, policy, regulation, and education [17].

IDENTIFICATION OF CONSTRUCTS

The constructs or factors have been identified based on the literature review. As mentioned above, stakeholders' theory and technology adoption theories were used, a new framework was created, and five independent factors were determined. While the contexts are based on the technology adoption and stakeholder's framework, many of the factors are different when compared to past literature on technology adoption, and they are specific to the needs of the adoption of telemedicine in India. The following factors have been determined based on past research on telemedicine adoption in India and feedback from industry experts, doctors, and users [18].

SOCIETAL ACCEPTANCE (SA)

In India, societal and cultural factors critically influence telemedicine's adoption. While telemedicine's potential to revolutionize healthcare in underserved areas is significant, it faces barriers like cultural beliefs, which may view physical presence as essential in healing [19]. Awareness and trust issues also hinder acceptance; many are unaware of telemedicine's workings, leading to scepticism [20]. Building trust is essential, as physical absence in consultations raises concerns. Addressing these challenges is key to unleashing telemedicine's transformative potential, particularly in rural regions [21]

TECHNOLOGY AVAILABILITY (TA)

Technology availability influences the implementation of telemedicine in India, implying that the access and quality of the telecommunication and information technology infrastructure affect the adoption and effectiveness of telemedicine services in the country. Technology availability is a major challenge and opportunity for telemedicine in India, a large and diverse country with a huge population and a wide gap between urban and rural areas regarding healthcare resources and outcomes. According to some studies, technology availability is a key factor that affects the intention to use telemedicine among doctors and patients in India, as well as the quality and satisfaction of telemedicine services [22]. Some aspects of technology that influence telemedicine implementation are the availability of telecommunication bandwidth, which enables medical expertise to reach underserved rural markets through telemedicine and teleconsulting programs delivered over mobile phones. Reliable and affordable internet connectivity facilitates the transmission of data, images, and videos between remote locations and healthcare centres, which is crucial to telemedicine implementation [17].

GOVERNMENT POLICIES ON TELEMEDICINE (GP)

Telemedicine delivers health care services using information and communication technologies (ICT) such as telephone, mobile, internet, etc., to provide remote consultation, diagnosis, treatment, and follow-up. The Ministry of Health and Family Welfare (MHFW) issued the first guidelines for telemedicine practice in India on March 25, 2020. The guidelines provide information on various aspects of telemedicine practice, such as definitions, types, modalities, processes, technology platforms, ethical principles, fees, data privacy and security, documentation and record keeping, etc. The guidelines also specify the roles and responsibilities of registered medical practitioners (RMPs) who provide telemedicine services, such as obtaining consent, verifying identity, establishing rapport, maintaining confidentiality, prescribing medicines, and issuing digital certificates. The guidelines apply to all RMPs enrolled in the State Medical Register or the Indian Medical Register under the Indian Medical Council Act 1956 [23].

TABLE 1. LATENT CONSTRUCTS (FACTORS) AND THEIR DESCRIPTION

Factor Name	Description
Societal Acceptance (SA)	The influence of societal acceptance on telemedicine adoption.
Technology availability (TA)	The influence of technology availability on telemedicine adoption.
Govt. policies and guidelines (GP)	The extent of influence of clear policies and guidelines on the use of telemedicine in India
User's behavior and attitude (UB)	The extent of influence of patients' attitudes and behavior on the use of telemedicine in India,
Doctor's role (DR)	The extent of influence of doctors' acceptance on the use of telemedicine in India,

PATIENT/USER'S ATTITUDE TO USE TELEMEDICINE IN INDIA (UB)

Telemedicine is revolutionizing Indian healthcare, offering patients the ease of consulting with doctors remotely, and reducing the need for long travels and clinic waits, a significant benefit in a country where distances and traffic often impede medical access [24]. Especially beneficial for remote areas with limited medical facilities, telemedicine connects residents to urban specialists, ensuring quicker, more effective treatment options [25].

DOCTOR'S ROLE IN TELEMEDICINE USAGE (DR)

The importance of telemedicine in India is evident because it can help address some of the major challenges faced by the Indian healthcare system. It can mitigate the high burden of communicable and non-communicable diseases like COVID-19. Doctors must address the need for more awareness and education among patients and providers about preventive and primary health care [26]. Doctors' endorsement of telemedicine has helped build trust and acceptance among patients. As doctors have

advocated for telemedicine's safety, reliability, and convenience, patients have become more receptive to virtual consultations. Doctors' positive patient experiences have further encouraged patients to seek telemedicine services. [27]

The latent constructs (factors) and their descriptions are summarised in Table 1.

GENERATION OF ITEMS

While studies on the adoption of telemedicine in India are limited, items have been adopted from the sources mentioned in the Table 2. The items are suitably adapted and contextualized for the adoption of telemedicine from validated instruments across areas, such as mHealth, telehealth, remote health, and online health consultation, supported by a literature review.

In the context of telemedicine, technology availability is a well-established factor in adoption studies and has primarily been measured using reflective indicators in past research [27]. A new factor, societal acceptance, has been modelled with reflective items within this context. Additionally, factors related to government policy have been developed as reflective indicators [28]. From the doctor's perspective, factors such as the doctor's role, and from the patient's perspective, factors like patient behavior and attitude, have been historically measured in the literature through reflective items.

TABLE 2. PUBLICATION REFERENCE

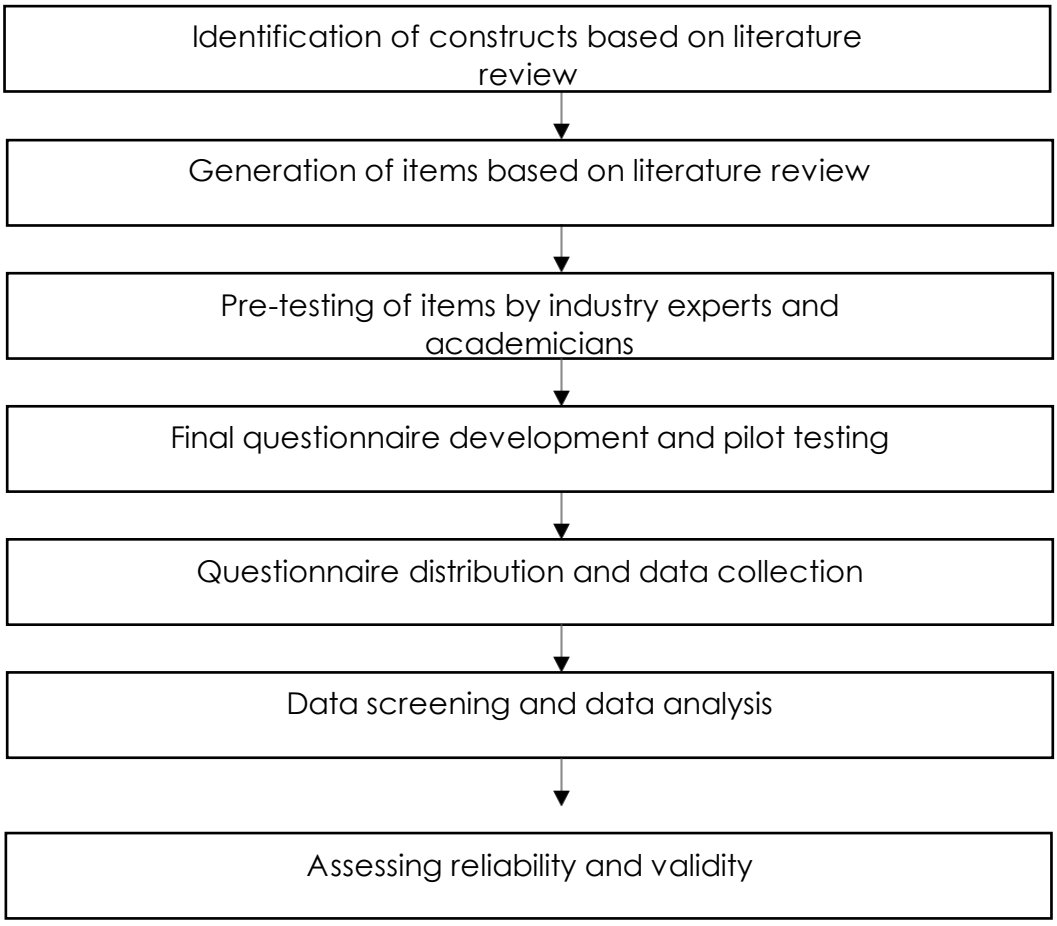
Factor Name	Items	Item Reference
Technology availability (TA)	Improved internet speed and access, along with the widespread availability of connected devices, are key for effective telemedicine.	[11, 12, 13, 17, 22]
	Incorporating AI, ML, VR, Blockchain, and IoT into telemedicine can significantly improve its adoption and effectiveness.	
	Seamlessly combining existing patient data with new technological methods is crucial for comprehensive and efficient telemedicine.	
	Utilizing Blockchain and Cloud computing to secure patient records ensures privacy and data integrity in telemedicine.	
	Leveraging platforms like Zoom, Google Meet, and WhatsApp video enhances doctor-patient interactions, boosting satisfaction in telemedicine.	
	Tailored applications developed by clinics and hospitals can significantly enhance telemedicine services and user experience.	
	Providing diverse online payment methods enhances convenience for telemedicine users.	
Societal acceptance (SA)	Societal pressure to provide healthcare to every citizen in India has intensified, especially following the heightened awareness and urgency due to emergencies and pandemics.	[14, 16, 19, 20, 21]
	There is a societal expectation for the cost of medical treatment to be reduced, making it affordable for the average person.	
	Societal pressure plays a crucial role in urging policymakers in the Health Ministry to establish and maintain a robust healthcare data security system, ensuring patient privacy and trust.	
	Society recognizes the importance of insurance in alleviating and supporting healthcare expenses, underlining its role in a comprehensive healthcare system.	
	How society views and manages its healthcare impacts the nation's image both domestically and internationally, influencing media portrayal and the perception of the international community towards the Indian Healthcare System.	

Government policies (GP)	Government mandates for remote working during the pandemic have significantly accelerated the adoption and usage of Telemedicine services as an essential healthcare tool.	[23, 26]
	Travel restrictions and lockdowns imposed by the government during the COVID-19 crisis led to an increased reliance on telemedicine as an alternative to traditional in-person medical consultations.	
	The Government has provided clear and supportive regulations regarding the use of Telemedicine, aiding in its effective implementation and public acceptance.	
User behaviour (UB)	Patients prioritize their medical needs, and doctors are professionally and morally obligated to provide the best care possible, adhering to their medical oath.	[17, 24, 25]
	In health-related emergencies, patients expect and require a prompt response from healthcare providers like doctors, emphasizing the need for efficient telemedicine services.	
	The cost of telemedicine consultations should be accessible and affordable for the average patient, making it a viable healthcare option for a broader population.	
	Patients expect their consultations and medical records to be kept confidential, underlining the importance of privacy in telemedicine services.	
	Telemedicine consultations should strive to provide an experience that closely resembles traditional in-person consultations, meeting patient expectations for quality and interaction.	
Doctor's role (DR)	Doctors must foster the same level of relationship and rapport in online consultations as they would in offline, face-to-face interactions to ensure continuity in patient care and trust.	[26, 27, 29]
	Doctors can leverage the advantage of prescribing medications online or through applications, offering a seamless, paperless experience for patients.	
	Doctors can use telemedicine platforms not just for consultations, but also for ongoing messaging and engagement with patients, enhancing the continuity of care.	
	With the availability of various online payment modes like Paytm, doctors can conduct their services without concerns about payment, ensuring a smooth financial transaction process.	
Successful adoption of telemedicine (SAT)	A key factor in the successful adoption of telemedicine is its ability to improve patient adherence to prescribed treatments, facilitated by ease of access and continuous engagement.	[4, 5, 9, 10]
	Telemedicine is expected to lead to cost efficiencies, reducing expenses for both patients and healthcare providers by minimizing the need for physical infrastructure and travel.	
	The transition to telemedicine includes the digitization of patient data, which enhances data security and maintenance, ensuring patient confidentiality and efficient health record management.	
	The successful implementation of telemedicine is anticipated to significantly improve healthcare delivery in India, positively influencing the nation's image in terms of healthcare innovation and accessibility.	

METHODOLOGY

This study aims to develop and test a measurement scale to study the adoption of telemedicine in India. The development of the scale has been done in stages, covering factor identification, item generation, pre-testing, pilot testing, and scale validation [30, 31] as shown in Figure 1.

FIGURE 1. RESEARCH METHOD



PRE-TESTING

Pre-testing covers the items, sentence construction, question quality, and identifying biases and errors [32]. The pilot study involved pre-testing the questionnaire on a select pilot sample of 40+ individuals, a small subset of the target population, who fulfilled the demographic criteria for potential respondents in the main survey. These individuals, who were experts in academia and technology, were contacted through the author's personal networks.

QUESTIONNAIRE DESIGN

This study used a structured questionnaire, validated by existing research, to gather first-hand data to test the conceptual model. The questionnaire, essential for both pilot and main studies, comprised four sections: introduction and rationale of the study, respondent demographics, crucial multi-segment questions on independent and dependent variables using a five-point Likert scale, and a closing thank-you note. Open-ended questions were included in the pilot but omitted in the main study for consistency. Google Forms was the chosen platform for its ease of use and effective data management, featuring 33 questions.

DATA COLLECTION

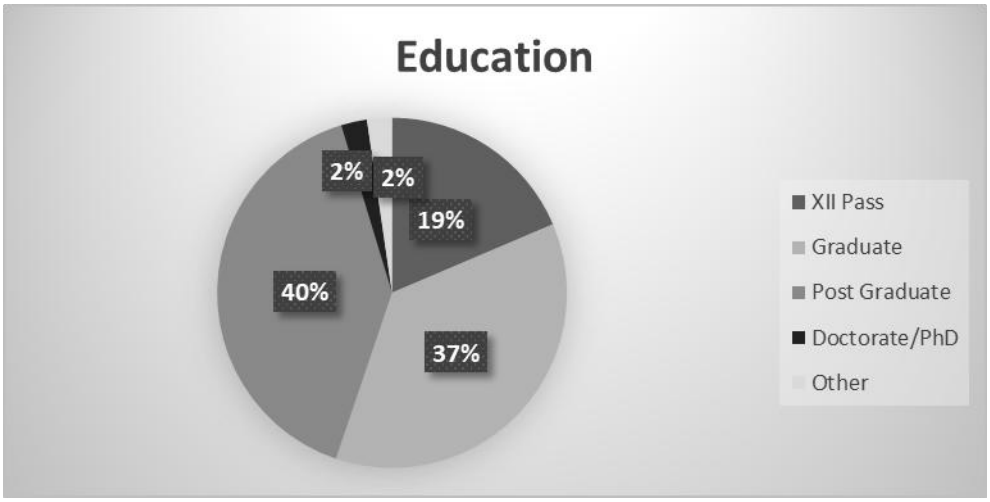
After integrating inputs from the pilot study, the final questionnaire was created for the survey. For the research survey, prospective respondents were selected using the purposive sampling method. Respondents were contacted via LinkedIn or email. The questionnaire was distributed through Google Forms. The survey questionnaire was shared with approximately 1,400 people who are users as well as probable users of telemedicine in India. These prospective respondents were found through purposive sampling (mainly through the professional and Linkedin connections of the first author. Some were also found through the Linkedin searches and recommendations by practitioners). The selection of 1,400 individuals were determined, keeping

in mind the required sample size by balancing the resource constraints and the need for a representative sample. From the responses received, 377 sample cases were found to be complete in all respects which also met the adequacy requirement for this research.

RESPONDENTS' PROFILE

The respondents comprised industry experts, CEOs and business heads, doctors, human resource professionals, and telemedicine users. Of all the survey respondents, 69.2% were males, and 30.8% were females. The survey saw respondents from all age groups. There was no upper limit on the age of the respondents. However, the minimum age limit was set at 18 years. As set out in Figure 2, the data distribution shows that the research survey saw responses from all educational backgrounds.

FIGURE 2. DISTRIBUTION OF RESPONDENTS AS PER EDUCATION



RESULTS AND DISCUSSION

The scale has been assessed for reliability and validity using the licensed version of ADANCO 2.3.2 software. The following statistical tests were done to examine the internal consistency of the scales.

TEST OF RELIABILITY

First, the construct's internal consistency/reliability was measured to test the scale's reliability. Cronbach's α-value and composite reliability (CR) were used to check the reliability. The values presented in Table 3 below reveal that all six constructs exhibit a Dijkstra-Henseler's rho exceeding 0.7, indicating excellent reliability. Furthermore, two constructs achieved a Jöreskog's rho score above 0.9, with another two nearing 0.9 and another surpassing 0.8. Hence, according to Jöreskog's rho, the reliability of the constructs can be considered above the threshold for good reliability. A minimum acceptable value for Cronbach's alpha is 0.60, while values exceeding 0.70 are considered highly reliable. Most of Cronbach's alpha (α) values are 0.7 or higher, with some approaching 0.9, which signifies good to excellent reliability. Based on the established criteria for Dijkstra-Henseler's rho (ρA), Jöreskog's rho (ρc), and Cronbach's alpha (α), it can be concluded that the reliability levels of the constructs in this study are generally classified as good or excellent. Reliability and validity results of the constructs, (defined in Table 1) are presented in Tables 3 and 4 below.

TABLE 3. CONSTRUCT RELIABILITY

Construct	Dijkstra– Henseler's rho (ρA)	Jöreskog's rho (ρc)	Cronbach's alpha (α)	Number of items
SA	0,7819	0.8502	0.7802	5
GP	0.7749	0.8380	0.7185	3
UB	0.8462	0.8876	0.8414	5
DR	0.8249	0.8832	0.8236	4

TA	0.9092	0.9267	0.9074	7
SAT	0.8572	0.9025	0.8560	4

Note: SA – Societal acceptance, GP – Government policy, UB – User behaviour, DR – Doctor's role, TA – Technology availability, SAT – Successful adoption of telemedicine

TEST OF VALIDITY

Discriminant validity serves as a parameter to determine the extent to which constructs that are expected to be unrelated demonstrate a lack of relationship. This implies that two conceptually distinct constructs must also exhibit statistical differences. According to this criterion, a construct's average variance extracted (AVE) should exceed the squared correlations it shares with all other constructs in the model, which are shown in Table 4 below.

TABLE 4. DISCRIMINANT VALIDITY

Construct	SA	GP	UB	DR	TA	SAT
SA	0.5317					
GP	0.3974	0.6365				
UB	0.3377	0.2656	0.6129			
DR	0.3106	0.2276	0.4752	0.6542		
TA	0.3804	0.3104	0.4846	0.5445	0.6441	
SAT	0.3455	0.3272	0.3517	0.3893	0.5562	0.6983

Note: Figures in cells are squared correlations; AVE values are in the main diagonal.

Discriminant validity is established when the highest absolute value in each column and row of the matrix is located on the main diagonal. In other words, the diagonal values (AVEs) should be greater than the non-diagonal values (squared correlations) in their respective rows and columns. This confirms the presence of discriminant validity in all the scales we have used.

COMMON METHOD VARIANCE

Common method variance (CMV) has been identified as a significant source of systematic error in survey research. As an ex-ante pre-cautionary measure, we employed the suggested approach proposed by Podsakoff et al. (2003), to minimize the potential for common method bias [32]. The questions related to the outcome variable were randomly placed in the questionnaire. Additionally, precautions were taken to ensure that respondents had no clue to identify which questions were assessing the outcomes. Besides this, procedural remedies, including the anonymization of responses and the clarity of questionnaire design, were incorporated to minimize response biases. All these suggest that CMV is unlikely to introduce bias in this study.

CONCLUSION

This research study delves into the determinants of telemedicine adoption in India, a country facing significant healthcare delivery challenges, particularly in underserved and remote areas. The core achievement of this study is the development and validation of a scale designed to accurately measure the factors influencing telemedicine adoption, offering valuable insights for healthcare executives, policymakers, and researchers.

Employing a robust quantitative methodology, the study involved several key stages: factor identification, item generation, pre-testing, pilot testing, and scale validation. A diverse group of healthcare professionals, industry experts, and telemedicine users were engaged through a structured questionnaire, contributing to a comprehensive understanding of the telemedicine landscape in India. The study utilized statistical analyses, including confirmatory factor analysis and reliability analysis, which confirmed the validity and reliability of the developed scale. This resulted in the identification of five latent variables as critical factors, significantly enriching the existing body of knowledge on telemedicine adoption in the Indian context.

The study's findings have substantial implications for health and aged care service managers and policymakers in India. The validated scale is a critical tool for understanding the nuances of telemedicine adoption, aiding in strategic decision-making, and policy formulation aimed at enhancing the accessibility and quality of healthcare services across India's diverse regions.

However, the study is not without limitations. Its primary focus on the Indian context and reliance on self-reported data may limit the generalizability of the findings. Future research should aim to expand the scope of this study, exploring the scalability and sustainability of telemedicine adoption in varied settings. Incorporating qualitative research methods could also provide a richer, more contextual understanding of the barriers and facilitators influencing telemedicine adoption. Such future endeavors could build upon the current study's foundation, further contributing to the optimization and customization of telemedicine services to meet the diverse healthcare needs of populations in other geographical regions, similar to India. This research, therefore, not only adds to the academic discourse but also serves as a practical guide for ongoing and future telemedicine initiatives in regions with similar healthcare challenges and demographics.

ETHICAL APPROVAL

The survey procedure conducted for the study involved human participants and conformed to ethical standards. The procedure was duly approved by the Research Ethics Committee of the S P Jain School of Global Management on 12 April 2022 (REC 03335G/202203) where the study was initiated.

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No funding was received for this study.

AUTHOR DISCLOSURE STATEMENT

No competing financial interests exist.

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