

E-HEALTH READINESS IN PAKISTAN: A PRISMA GUIDED SYSTEMATIC REVIEW AND FRAMEWORK SYNTHESIS

OSSAM CHOCHAN¹, SITI FALINDAH PADLEE^{2*}, SYAHIDA ABDULLAH³, BAKHTIAR MUHAMMAD⁴, LAILA BIBI⁵

- ¹. FACULTY OF BUSINESS, ECONOMICS AND SOCIAL DEVELOPMENT UNIVERSITI MALAYSIA TERENGGANU, MALAYSIA; ossam@cuiatd.edu.pk
- ². FACULTY OF BUSINESS, ECONOMICS AND SOCIAL DEVELOPMENT UNIVERSITI MALAYSIA TERENGGANU, MALAYSIA; siti.falindah@umt.edu.my
- ³. SENIOR LECTURER, CENTRE FOR FUNDAMENTAL AND CONTINUING EDUCATION, UNIVERSITI MALAYSIA TERENGGANU, MALAYSIA; syahida.abdullah@umt.edu.my
- ⁴. DEMONSTRATOR, MEDICAL EDUCATION PAK-AUSTRIA FACHHOCHSCHULE INSTITUTE OF APPLIED SCIENCES & TECHNOLOGY HARIPUR, PAKISTAN; bakhtiar.muhammad@paf-iast.edu.pk
- ⁵. FACULTY OF STATISTICS, COMSATS UNIVERSITY ISLAMABAD, ABBOTTABAD CAMPUS, PAKISTAN; laila@cuiatd.edu.pk

Submission Date: March 20, 2025

Acceptance Date: August 15, 2025

Publishing Date: October 23, 2025

Abstract

Background: E-health technologies offer major opportunities to improve access, efficiency, and quality of healthcare in low- and middle-income countries, but their success depends on readiness across technological, organizational, and social domains. Pakistan—with growing mobile and internet penetration but fragmented health systems—lacks a standardized, country-specific tool to assess e-health readiness.

Methods: A systematic literature review was conducted across PubMed, Scopus, Web of Science, and Google Scholar for studies up to 2024. Following PRISMA-guided screening and eligibility checks, 38 studies were retained for thematic synthesis. Extracted constructs were mapped against established readiness frameworks (Khoja et al., 2007; Ntseme et al., 2021; Yusuf et al., 2017).

Results: Five dominant readiness constructs emerged consistently: ICT readiness, infrastructure readiness, patient readiness, digital literacy, and trust. Most existing studies emphasize technical and organizational factors, while few explicitly model behavioral mediators. To address this gap, we propose a conceptual E-Health Readiness Framework for Pakistan that links these structural readiness constructs to Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) from the Technology Acceptance Model, which then influence attitude and behavioral intention toward e-health adoption.

Conclusion: The proposed framework provides a country-specific roadmap to assess and strengthen e-health readiness in Pakistan by bridging structural enablers with behavioral adoption pathways. Empirical validation across diverse healthcare settings and development of standardized measurement instruments are recommended to operationalize the framework and inform policy interventions.

KEYWORDS: e-health readiness; Pakistan; digital health; ICT readiness; Technology Acceptance Model; perceived usefulness; perceived ease of use.

1. INTRODUCTION

Digital health innovations such as telemedicine, electronic health records, and mobile health applications are increasingly recognized as transformative tools to improve healthcare delivery in resource-constrained settings. In low- and middle-income countries (LMICs), these technologies hold the potential to expand access, reduce inequalities, and strengthen health systems. However, evidence consistently shows that the success of such initiatives depends not only on technology availability but also on the readiness of institutions, providers, and patients to adopt and sustain them (Khoja et al., 2007; Yusuf et al., 2017).

Pakistan is showing an interesting phenomena as the digital appliances has shown significant penetration due to increasing internet facilities in terms of service and infrastructure, this change has no significant impact on healthcare system particularly the difference between geographical differentiation between rural and urban healthcare standards, the availability of healthcare infrastructure and above skilled human resources (Qureshi et al., 2021). Multiple healthcare initiatives have been taken through locally available resources and with INGOs like World Health Organization (WHO), mostly taken during COVID19 pandemic and continued after that, still the poor organizational infrastructure, lack of digital literacy among most of the population and above people trust in digital health care are prominent barriers to achieve the expected results from digital healthcare systems. Most of the developing countries (LMICs) have established unified framework to keep track of systematic evaluation of consumers readiness towards e-health adoption but Pakistan I still lacking in designing such framework.

Previous studies in same domain of e-health readiness established strong foundations on these directions. (Mauco et al., 2020) established an e-health framework for validation of results in developing countries, whereas (Yusif et al., 2017) conducted detailed review on readiness tools, where technological, organizational and human aspects were studied. Another contribution was made by (Khoja et al., 2007) where they initially proposed tools for assessment particularly for developing countries including Pakistan as well. Still, these established frameworks do not fully cover the behavioral intentions mechanism which is primarily based on perceived usefulness (PU) and perceived ease of use (PEOU), which according to TAM strongly influence adoption behaviors, and these framework do not really reflect the diverse and unique healthcare challenges for Pakistani healthcare systems.

This proposed SLR addresses this gap by conducting a systematic literature review (SLR) to point out important key readiness determinants relevant to Pakistan, then comparing these determinats against established frameworks discussed above and finally propose conceptual framework that is based on TAM approach by integrating behavioral mediators with novel independent constructs (Davis, 1989). The gap bridging in structural readiness with behavioral intentions in adoption pathway, the proposed framework offers practical foundations for policy and implementations in digital healthcare sectors.

1.1 Research Gaps and Contributions

Despite the multiple and tested e-health readiness framework across multiple low- and middle-income countries (LMICs), significant gaps remain exist in the literature that makes them impractical to the Pakistani context. Most importantly, majority of the existing studies focus on technological and organizational readiness (Khoja et al., 2007; Mauco et al., 2020), whereas healthcare consumers and their behavioral patterns got relative less attention. In particular, constructs such as digital literacy, user trust, and socio-cultural perceptions are often treated as peripheral, despite being critical determinants of adoption in LMICs (Al-Kahtani, 2022; Yusif et al., 2017).

Second, prior research has generally conceptualized readiness as a static, structural condition, focusing on whether ICT infrastructure, policies, or resources exist (Syed et al., 2021). However, there has been limited exploration of how these readiness factors translate into actual adoption behavior through mediating perceptions like perceived usefulness (PU) and perceived ease of use (PEOU). This missing link between readiness and behavior limits both the explanatory power of existing models and their practical value for policymakers.

Third, the majority of studies that include Pakistan are either project-specific evaluations or descriptive accounts of implementation challenges (Goy et al., 2019; Qureshi et al., 2021), rather than comprehensive, systematic assessments of readiness across multiple dimensions. Consequently, there is no standardized framework tailored to the unique healthcare landscape of Pakistan, which is characterized by rural-urban disparities, fragmented service delivery, and evolving ICT ecosystems.

In response to these gaps, this study makes three key contributions:

1. **Comprehensive synthesis:** It systematically reviews evidence from 48 studies, covering both structural and behavioral dimensions of readiness, and consolidates insights from diverse LMIC contexts while focusing on Pakistan.
2. **Integration with behavioral theory:** It extends existing readiness frameworks by embedding constructs from the Technology Acceptance Model (TAM), thereby linking readiness conditions with user adoption pathways (PU → PEOU → attitude → behavioral intention).
3. **Contextual relevance:** It proposes a country-specific conceptual framework that captures the technological, organizational, patient, and trust-related aspects of e-health readiness in Pakistan, offering policymakers a practical tool for assessment and intervention.

Through these contributions, the study addresses both a theoretical gap by bridging readiness and behavioral adoption and a practical gap by offering a tailored framework for Pakistan's healthcare system.

2. METHODS

This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and replicability.

2.1 Search Strategy

A systematic search was conducted across four major databases: PubMed, Scopus, Web of Science, and Google Scholar. The search covered studies published between 2010 and 2024. The following keywords and Boolean combinations were applied: “*e-health readiness*” OR “*digital health adoption*” OR “*e-health readiness framework*” OR “*health ICT Pakistan*” OR “*digital literacy health.*” Reference lists of included studies were also screened to identify additional relevant articles.

2.2 Inclusion and Exclusion Criteria

Studies were eligible if they: (i) focused on e-health or digital health readiness in LMICs, (ii) explicitly discussed frameworks, constructs, or determinants of readiness, and (iii) were peer-reviewed empirical studies, reviews, or conceptual papers. Studies were excluded if they: (i) did not focus on healthcare, (ii) lacked clear readiness constructs, or (iii) were not in English.

2.3 Screening and Selection Process

The search initially yielded 6,828 articles. After removing duplicates, 6,790 remained. Screening of titles and abstracts excluded 6,549 articles due to irrelevance, leaving 241 for full-text review. Of these, 203 were excluded because they did not explicitly address readiness constructs, resulting in a final sample of 38 studies for synthesis.

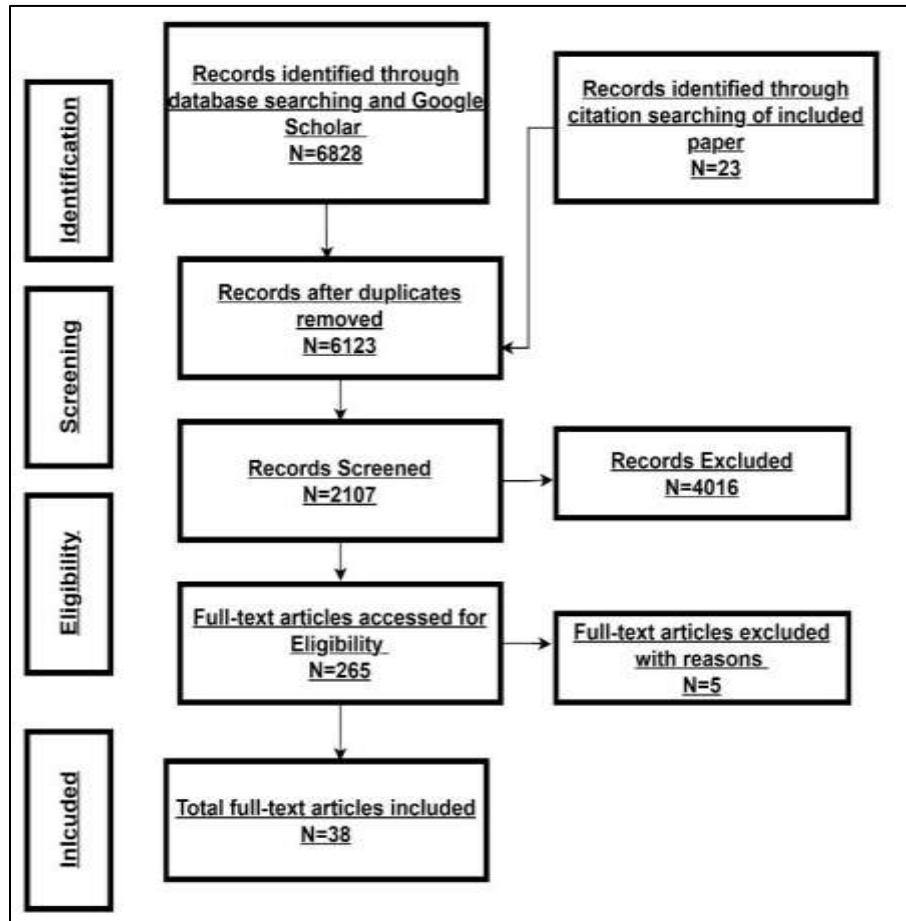


Figure-1: PRISMA Flow Diagram

Figure 1 illustrates the PRISMA flow diagram for the systematic review process. Out of the initially identified records, duplicates were removed, and eligibility screening excluded irrelevant or non-health ICT studies. The final set of articles included in the review provides a robust basis for synthesizing determinants of e-health readiness.

2.4 Data Extraction and Synthesis

From each included study, we extracted key information including author, year, country, readiness constructs, framework/model used, and whether behavioral mediators (e.g., PU, PEOU) were incorporated.

Thematic synthesis was conducted to identify recurring constructs across studies. These were grouped into five dominant categories: ICT readiness, infrastructure readiness, patient readiness, digital literacy, and trust. Each

construct was then mapped against established frameworks (Khoja et al., 2007; Mauco et al., 2020; Yusif et al., 2017) to highlight similarities, differences, and gaps.

Study (Author, Year)	Country	ICT Readiness	Infrastructure Readiness	Patient Readiness	Digital Literacy	Trust	Behavioral Mediators (PU/PEOU)	Measurement Instrument Used
(Farooq et al., 2024)	Pakistan	✓	✓	✓	✓	✓	✗	Digital Health Literacy Index (DHLI)
(Farooq et al., 2024)	Pakistan	✓	✓	✗	✓	✓	✗	Adapted DHLI
(Qureshi et al., 2021)	Pakistan	✓	✓	✓	✗	✓	✗	User readiness survey
(Mauco et al., 2020)	South Africa	✓	✓	✓	✓	✓	✓	Validated readiness scale
(Yusif et al., 2017)	Ghana	✓	✓	✓	✓	✓	✗	Mixed methods
(Al-Kahtani, 2022)	Saudi Arabia	✓	✓	✓	✓	✓	✗	Survey & qualitative interviews
(Asgar et al., 2021)	Pakistan	✓	✓	✓	✓	✗	✗	Structured questionnaires
World Bank Report, 2023	Pakistan	✓	✓	✓	✓	✓	✗	Secondary data analysis

Table-1: Summary of Readiness Constructs Across Reviewed Studies

Table-1 presents a review of eight studies and reports spanning from 2017 to 2024, primarily focused on low- and middle-income countries (LMICs), highlights key dimensions of digital health readiness. Majority of these studies were based upon data taken from Pakistan, with additional insights taken from Saudi Arabia, Ghana and South Africa. The studies examined different readiness dimensions like ICT infrastructure readiness, consumers' preparedness, e-health and digital literacy, trust and confidentiality, and behavioral mediators such as perceived usefulness (PU) and perceived ease of use (PEOU).

ICT infrastructure readiness in particular and other infrastructure readiness were consistently a major focused point in all studies, making it strongly contributing concern for establishing environments. Healthcare consumers readiness and digital literacy were also got huge attention, evaluated in most cases, whereas very few studies ignored one or the other (Qureshi et al., 2021). After the concept of digitalization, e-Trust or Trust, got prominent place as a common but not universal component, with most of the studies relied to include it in examining digital health adoption.

Interestingly, only (Mauco et al., 2020) categorically taken behavioral mediators (PU/PEOU) into account, showing a limited application of theoretical technology adoption models like the Technology Acceptance Model (TAM) within the reviewed literature (Davis, 1989). This potential gap motivates researchers in understanding and examine how user perceptions impacts adoption behaviors.

Different measurement scales were adopted to study digital health literacy (although very few are available which best fits for Pakistani healthcare system) like the Digital Health Literacy Index (DHLI) and its adaptations were employed in some of Pakistan based studies (Farooq et al., 2024), whereas other studies heavily relied on readiness scales validation, structured or mixed methods approaches. On the other The World Bank (2023) report relied on secondary data approach and analysis to examine system-level readiness.

Overall, the literature reflects a growing emphasis on multidimensional readiness for digital health, yet highlights the need for more standardized measurement frameworks and theoretical integration to better capture user-centric adoption factors.

3. RESULTS

3.1 Summary of Included Studies

The final sample consisted of 38 studies spanning diverse LMIC contexts, with several directly focused on Pakistan. Most studies emphasized technological and organizational readiness, while fewer addressed user-level factors such as patient readiness, digital literacy, or trust. Importantly, only a small number of studies explicitly incorporated behavioral mediators such as Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Summary of included studies is provided in Table-2

CONSTRUCTS	Key Measures / Indicators	REFERENCES
Patient Readiness	Health literacy (HL) and e-health literacy (e-HL) Sociodemographic characteristics (e.g., age, education, digital exposure) Prior experience with e-health services Trust in technology and digital systems Digital knowledge and internet access Access to online systems and devices Availability of educational programs for digitally illiterate populations	(Borda et al., 2022; Hamidzadeh et al., 2019; Lee et al., 2022; Li et al., 2020; Mauco et al., 2020; Mengiste et al., 2023)
Core Readiness	Awareness and perceived need for e-health systems Dissatisfaction with the current healthcare system Familiarity with and perceived ease of using technology	(Leon et al., 2012; Ojo et al., 2007; Pujani et al., 2019)
ICT Readiness	Trust in ICT systems and policies E-health planning and integration with health institutions Information sharing capacity ICT policy and regulatory environment Network reliability and internet availability Hardware/software compatibility Institutional support and training access Organizational culture and willingness Staff capability and optimism toward ICT use Professional ICT support availability	(Beebeejaun & Chittoo, 2017; Lee et al., 2022)
Digital Literacy	User knowledge, confidence, and digital skills Self-efficacy in using digital tools Language and cultural compatibility of e-health platforms Interventions aimed at digital skill development	(Aldosari et al., 2023; Dong et al., 2023)
Infrastructure Readiness	Stakeholder engagement and infrastructure implementation Availability and affordability of internet connectivity Installation of e-health devices in hospitals and clinics	(Badr et al., 2021; Mengiste et al., 2023; Rajapaksha & Wickramasinghe, 2021; Ramdani et al., 2020)
Trust	User trust in e-health services' usability and fairness Protection of privacy and data sharing Awareness of privacy laws and user rights Willingness to adopt EHR systems Perceived system security and confidentiality	(Afzal & Yusuf, 2013; Ruotsalainen & Blobel, 2022; Savitz et al., 2020)

Table 2: Summary Table of Included Studies

Table-2 outlines the key constructs used to assess digital health readiness, along with their associated indicators and supporting references. **Patient readiness** is typically measured through health and e-health literacy, sociodemographic characteristics, prior digital exposure, and access to digital tools and services (Borda et al., 2022; Mauco et al., 2020). **Core readiness** refers to the perceived need for digital health solutions, often driven by dissatisfaction with existing services and familiarity with technology (Leon et al., 2012; Ojo et al., 2007). **ICT readiness** encompasses the broader technological and organizational environment, including infrastructure, policy, and staff capability (Beebeejaun & Chittoo, 2017; Lee et al., 2022). **Digital literacy** focuses on users' digital skills, confidence, and the cultural or

linguistic usability of platforms (Aldosari et al., 2023; Dong et al., 2023). ICT infrastructure readiness broadly refers to the availability of internet services and connectivity, hardware and software, and respective stakeholder support for e-health implementation (Badr et al., 2021; Rajapaksha & Wickramasinghe, 2021). Whereas, trust refers to the user perceptions on data privacy, electronic system security, and willingness to utilize digital health platforms (Afzal & Arshad, 2021; Ruotsalainen & Blobel, 2022).

3.2 Identified Readiness Constructs

Thematic synthesis identified five prominent and focused constructs of e-health readiness across the reviewed literature:

1. ICT readiness refers to the availability and accessibility of ICT infrastructure, internet connectivity, technical support in system interoperability (Mauco et al., 2020).
2. Organizational readiness for change refers to the organizational policies on digital healthcare, resources, leadership skills and commitment, and institutional systems (Khoja et al., 2007).
3. Consumers/ patient readiness refers to the awareness and consumers' willingness towards digital exposure and intentions towards e-health services adoption (Yusif et al., 2017).
4. Digital literacy broadly refers to the consumers skills and competency of both consumers and healthcare providers to adopt digital tools effectively (Yusif et al., 2020).
5. Trust refers to the users' perception about security, privacy and confidentiality, fairness, and overall confidence in electronic healthcare systems (Qureshi et al., 2021).
- 6.

3.3 Theoretical Framework

Based on these defined constructs, this study proposes a novel theoretical e-health readiness framework for Pakistan. This framework defines ICT readiness, digital literacy and organizational readiness for change and e-trust as structural constructs with PU and PEOU and attitude as mediators and behavioral intentions as dependent variable (Davis, 1989). This novel integration of constructs defines a pathway between readiness determinants and behavioral intentions towards e-health services in Pakistan and bridges the gaps in earlier model.

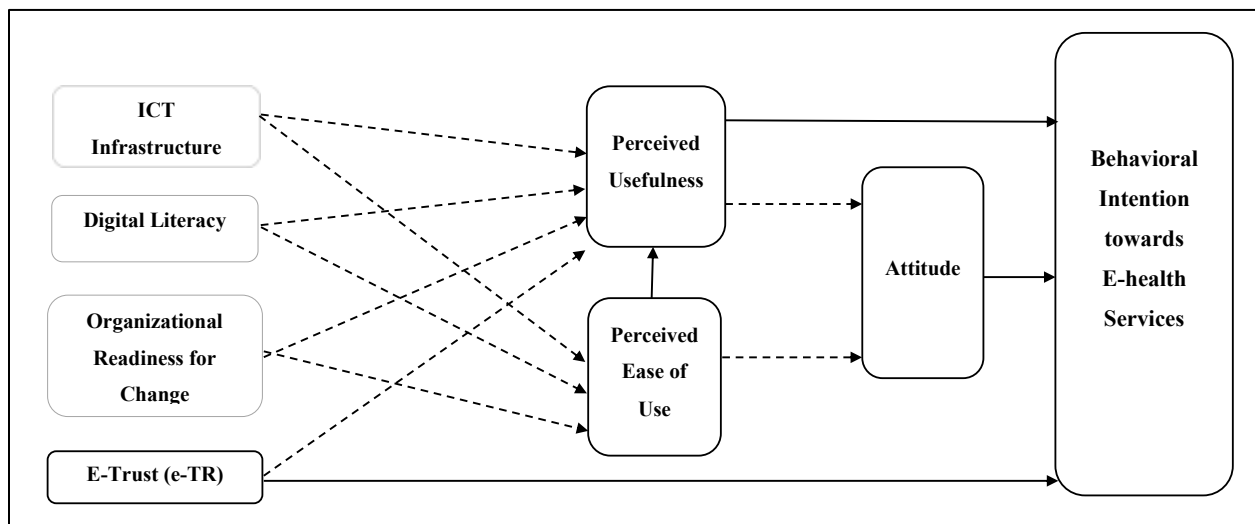


Figure-2: Theoretical Framework diagram

Figure-2 explains the proposed novel theoretical framework for e-health readiness in Pakistan. It integrates ICT infrastructure, digital literacy, organizational readiness, and e-trust as independent constructs influencing the perception in the form of perceived ease of use (PEOU) and perceived usefulness (PU), which in turn impacts attitudes and finally shapes behavioral intentions toward e-health services in Pakistan.

3.4 Comparison with Existing Frameworks

A comparative analysis presented in Table-2 provides a detailed comparison between previous studies. (Khoja et al., 2007; Mauco et al., 2020; Yusif et al., 2017), all emphasized technological and organizational readiness, but lacks in integrating behavioral mediators from famous Technology Acceptance Model (TAM). Our framework addresses this gap by showing how readiness translates into behavioral adoption pathways.

Construct (Proposed Framework: Pakistan)	(Mauco et al., 2020) Validated Framework for Developing Countries	(Yusif et al., 2017) Systematic Review of Readiness Tools	(Ojo et al., 2007) Formal Readiness Model
ICT Readiness (technology infrastructure, internet connectivity, system availability)	<i>Technological readiness</i> (availability of ICT, infrastructure, technical resources)	<i>Technological readiness</i> (ICT infrastructure, interoperability, system support)	<i>Technological dimension</i> (ICT infrastructure, system quality)
Patient Readiness (awareness, willingness to use, acceptance)	<i>Societal/individual readiness</i> (patient awareness, acceptance, participation)	<i>Core readiness</i> (awareness of need, dissatisfaction with status quo)	<i>Social readiness</i> (end-user engagement, cultural acceptance)
Digital Literacy (knowledge, skills, competencies)	<i>Human resource readiness</i> (skills, competencies, training availability)	<i>Human readiness</i> (knowledge, literacy, willingness to use technology)	<i>Human resource readiness</i> (training, skills of health workers)
Infrastructure Readiness (resources, facilities, organizational systems)	<i>Organizational readiness</i> (policies, leadership, management support, resources)	<i>Organizational readiness</i> (policies, culture, leadership, budget)	<i>Organizational readiness</i> (management support, institutional resources)
Trust (privacy, security, reliability, confidence in system)	<i>Socio-cultural readiness</i> (trust, cultural fit, confidentiality concerns)	<i>Engagement & governance readiness</i> (trust, ethical/legal aspects, security)	<i>Social/ethical readiness</i> (trust, data security, ethical norms)
Mediators: PU & PEOU (Technology Acceptance Model link)	Not explicitly included, though “perceived benefit” is implicit in societal readiness	Not explicitly included; highlighted need for standardized instruments to capture perceptions	Not explicitly included in formal model (focus on readiness dimensions, not behavioral mediators)

Table-3: Comparison Table

In this study, we systematically reviewed e-health readiness literature and proposed a framework tailored to Pakistan that integrates structural readiness constructs with behavioral mediators from the Technology Acceptance Model (TAM). Below we interpret our findings, compare with existing literature, discuss implications, limitations, and highlight pathways for future research and policy.

3.5 Pakistan Specific Findings

Pakistani studies show:

- Students and health professionals generally have moderate to high digital literacy in certain domains (operational skills, privacy protection), but weaker in assessing reliability, content contribution, navigating complex health information (Farooq et al., 2024).
- Health care professionals at a tertiary hospital in Lahore scored well in several DHLI domains (Farooq et al., 2024).
- Readiness tools tested in Pakistan (e.g. by Telemedicine & e-Health study from 2006) had many structural items and institutional focus, but lacked behavioral mediation and user-level patient readiness in many dimensions (Khoja et al., 2007).
- Public sector user readiness (surveyed in Qureshi et al. 2023) shows positive attitudes, but implementation tends to lag due to infrastructural, regulatory, and literacy/trust issues.

3.6 Interpretation of Findings

Structural readiness remains foundational but uneven and results confirm that ICT readiness (connectivity, hardware/software, and network reliability), infrastructure readiness (organizational policies, leadership, and resource allocation), patient readiness, digital literacy, and trust are dominant readiness constructs. In alignment with previous studies (e.g., *Current Challenges of Digital Health Interventions in Pakistan*) we found that infrastructure and ICT limitations especially in rural and underserved areas—pose the biggest obstacles (Kazi et al., 2020).

3.6.1 Digital Literacy as Both Enabler and Bottleneck

Digital literacy emerged as a recurring theme, especially for patients and providers. Our framework includes it explicitly as a core construct, consistent with recent evidence. For instance, the study *Digital Health Literacy: A systematic review* showed that interventions improve literacy and contribute to healthcare access in marginalized

populations in Pakistan (Mukhtar et al., 2025). However, gaps remain in how such literacy is measured, the domains assessed (privacy, navigation, critical evaluation), and in tailoring interventions to those with low baseline digital skills.

3.6.2 Trust, Privacy, and Behavioral Mediators are Under Assessed

Trust in digital systems covering data privacy, system security, and fairness—is often mentioned but less frequently measured quantitatively. Our finding that behavioral mediators such as Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) are rarely included aligns with gaps identified elsewhere. For example, in *Current Challenges... in Pakistan*, privacy concerns and cost are noted barriers but not fully operationalized into behavioral models (Kazi et al., 2020). Integrating mediators like PU and PEOU (from TAM) helps in understanding not just whether readiness exists, but *why or how* readiness translates into adoption behavior.

3.6.3 Socio-cultural, Equity, and Economic Barriers are Critical

Beyond technical or organizational factors, socio-cultural norms, gender, socioeconomic status, and access disparities emerge as significant. The *Bridging the digital divide for diabetes care: affordability and adoptability...* study emphasizes that in Pakistan, women in rural areas face cultural barriers and low digital literacy, which restrict digital health uptake. Cost (both direct and indirect), regulatory gaps, and variations in institutional capacity are also prominent (Fayez et al., 2025).

3.6.4 Comparative Alignment with Global Studies

The study's proposed framework resonates with findings from other LMICs. Global scoping reviews of national e-health implementation cite trust of users, legal and ethical frameworks, interoperable systems, and user acceptance as essential success factors (Wilson et al., 2021). Similar obstacles like lack of high-speed internet in remote zones, variable digital literacy, concerns about privacy/security are seen in many countries. What is distinctive for Pakistan is the magnitude of disparities between rural vs urban areas, between provinces, and between public vs private sectors, as well as urgent need for policy coordination across federal and provincial levels.

4. DISCUSSIONS

The findings confirm that technological and organizational readiness remain foundational to e-health adoption in LMICs. In Pakistan, however, barriers such as limited ICT infrastructure in rural areas, weak institutional support, and low digital literacy amplify the challenge. Trust in digital systems, especially regarding privacy and security, emerged as a particularly sensitive factor in the Pakistani context (Qureshi et al., 2021).

By integrating PU and PEOU as mediators, the proposed framework extends prior models. Earlier frameworks, while comprehensive, largely treated readiness as a static condition. Our model instead demonstrates how readiness factors translate into behavioral adoption pathways, thereby enhancing both explanatory power and policy relevance.

For policymakers, the framework highlights the need for interventions at multiple levels: strengthening ICT infrastructure, investing in digital literacy training, ensuring robust legal frameworks for privacy and security, and promoting awareness campaigns to build trust. For researchers, it offers a foundation for empirical testing through survey instruments and structural equation modeling (e.g., SmartPLS). The implications with respect to theory, practice and policy are discussed in the following section

4.2 Implications for Theory, Practice, and Policy

4.2.1 Theory

- Integrating TAM mediators helps to move beyond readiness as a static checklist toward understanding dynamic adoption behavior (Amin et al., 2022).
- A multi-construct framework (ICT, infrastructure, digital literacy, trust, patient readiness) aligned with behavioral models enriches explanatory power and may better predict adoption in empirical studies (Tan et al., 2023).

4.2.2 Practice

- Digital literacy programs: Training for both healthcare providers and end-users will be crucial. For example, medical and student populations in Lahore show varying levels of digital health literacy; targeting weaker domains (searching reliability, assessing trust) may improve readiness (Farooq et al., 2024).
- Infrastructure investment should prioritize rural/underserved areas: connectivity, hardware, affordable internet, device access are foundational (Valentín-Sívico et al., 2023).
- Trust-building: Transparent policies on data security & privacy; clear communication to users; legal/regulatory frameworks; and user involvement in design may help (Shandilya et al., 2024).

4.2.3 Policy

- The government of Pakistan must develop unified regulatory frameworks for digital health, including data privacy, telemedicine licensing, national standards, and interoperability. Some studies (e.g., *Digital Health and Telemedicine in Pakistan*) point out missing laws/regulations around telemedicine (Bilal et al., 2022)
- Equity considerations: Policies should include strategies to reduce digital divides, including for women, rural populations, low-literacy groups. Subsidies or low-cost technologies could help.

- Standardization of measurement tools: For sufficient comparison and tracking, readiness constructs need standardized instruments (scales for digital literacy, trust, etc.).

4.3 Limitations

- Language and publication bias: Like many SLRs, this review included only English-language studies; local studies in Urdu or regional languages may have been omitted.
- Temporal variation: Studies cover a span of years (2010-2024); the rapid pace of ICT change (internet penetration, mobile devices) means that some older findings about infrastructure or digital literacy may now be less applicable.
- Lack of empirical validation: The proposed framework remains conceptual; without empirical testing (surveys, case studies), its predictive power is untested.
- Measurement heterogeneity: Different studies use different scales/measures for similar constructs (digital literacy, trust, readiness), which complicates comparison.

4.4 Future Research Directions

1. Empirical validation of the proposed framework in Pakistan: Use quantitative methods (e.g., structural equation modeling) across representative sample of institutions (rural vs urban, public vs private) to test the relationships among readiness constructs, PU/PEOU, attitude, and adoption.
2. Development and validation of standardized measurement instruments: For readiness constructs (especially trust, digital literacy), so results across studies can be compared and meta-analyzed.
3. Intervention studies targeting weakest constructs: For example, interventions aimed at improving trust (through privacy/data security assurance), digital literacy, or patient awareness, and then measuring impact on adoption.
4. Policy and regulatory analysis: Research focused on how existing legal, ethical, and institutional frameworks in Pakistan support or hinder e-health readiness; evaluation of policy reforms, regulatory gaps.
5. Equity-focused studies: Investigating readiness among marginalized or vulnerable populations (rural, women, low literacy) to ensure framework applicability across the full socio-economic spectrum.

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