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CHALLENGES FACED BY HEALTHCARE WORKERS IN ADOPTING TELEMEDICINE TECHNOLOGIES – UNDERSTANDING BARRIERS TO DIGITAL HEALTH INTEGRATION IN CLINICAL PRACTICE

Original Research

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ABSTRACT

Background: Despite the rapid global expansion of telemedicine, its effective integration into routine clinical practice in low- and middle-income countries like Pakistan remains limited. Multiple barriers hinder adoption at various levels, posing a challenge to sustainable digital health implementation.

Objective: To explore and understand the key challenges faced by healthcare workers in adopting telemedicine technologies, with an emphasis on identifying systemic, technological, organizational, and personal-level barriers in Pakistan's clinical settings.

Methods: A qualitative study was conducted over eight months in public and private healthcare facilities across Lahore, Karachi, and Islamabad. A purposive sample of 34 healthcare professionals, including physicians, nurses, and allied health staff, was recruited. Data were collected through semi-structured, in-depth interviews. Thematic analysis was applied using Braun and Clarke's framework with NVivo 12 software for data management. Ethical approval was obtained, and informed consent was ensured.

Results: Four primary themes emerged: systemic (policy ambiguity, inconsistent funding), technological (usability issues, lack of interoperability), organizational (insufficient training, weak administrative support), and personal (digital illiteracy, emotional resistance). Interconnected barriers revealed that infrastructural deficits and unclear institutional strategies often reinforced individual resistance and workflow disruption. Participant narratives emphasized the need for practical training and supportive leadership in fostering telemedicine acceptance.

Conclusion: This study underscores the multifactorial nature of barriers to telemedicine adoption in Pakistan. Practical implications include the urgent need for cohesive national policy, infrastructure enhancement, and provider-centric digital training to facilitate effective and sustained telemedicine integration.

Keywords: Clinical Workflow, Digital Health, Health Personnel Attitudes, Pakistan, Qualitative Research, Telemedicine, Technology Adoption.

INTRODUCTION

The global healthcare landscape has undergone a rapid and profound transformation with the accelerated adoption of digital health technologies, particularly telemedicine. Initially catalyzed by the COVID-19 pandemic, this shift has not only reshaped how care is delivered but also revealed deep-rooted systemic and structural challenges. Telemedicine—encompassing virtual consultations, remote monitoring, and digital diagnostics—has emerged as a vital modality in ensuring continuity of care (1). However, as the world adjusts to a post-pandemic reality, it has become increasingly clear that integrating these technologies into routine clinical workflows remains far from seamless. Understanding the barriers healthcare workers face in adopting telemedicine is not only timely but also crucial for shaping sustainable digital health ecosystems (2,3). Despite the promise of telemedicine to enhance access, reduce costs, and improve health outcomes, healthcare professionals often encounter a complex web of challenges that hinder its integration into everyday practice. Several studies have documented that the transition to digital platforms is not merely a matter of infrastructure or training, but involves multifaceted concerns including technological limitations, workflow disruption, digital literacy, and concerns around patient safety and data privacy (4,5). For many clinicians, especially those in resource-constrained settings, the adoption of telemedicine introduces additional burdens rather than alleviating existing pressures. In such contexts, the very tools designed to streamline care can inadvertently become sources of frustration and fatigue.

A recurring theme in the literature is the perceived lack of institutional support and strategic guidance for implementing telehealth solutions. Healthcare workers often find themselves at the crossroads of technological change and clinical responsibility, without sufficient input into decision-making processes regarding digital integration (6,7). This disconnects fosters resistance and contributes to suboptimal utilization. Organizational readiness, or the absence thereof, further compounds the issue. When systems are introduced without alignment to existing clinical workflows or without adequate time for training and adaptation, they are less likely to be embraced and effectively used. At a more personal level, healthcare providers express anxiety over the erosion of the human touch in medicine—a cornerstone of the patient-provider relationship (8). Virtual care, while convenient, is often seen as impersonal and less nuanced, raising concerns about diagnostic accuracy and patient rapport. In addition, the lack of digital confidence among some practitioners, particularly older clinicians, creates a generational divide in adoption rates. This gap is exacerbated by uneven access to technical support and ongoing education, leaving many clinicians to navigate digital tools in isolation (9,10). Technological barriers are also a significant concern, particularly when digital tools are not interoperable with existing systems or are plagued by usability issues. Fragmented health information systems often require clinicians to duplicate tasks or work across multiple platforms, increasing cognitive load and reducing time for patient care (10). Moreover, inconsistent internet connectivity, especially in rural or underserved areas, presents a tangible limitation for both providers and patients, threatening equity in care delivery (11).

There is also a cultural dimension to consider. The rapid digitization of healthcare is met with varied acceptance across different specialties, institutions, and even countries. While some environments foster innovation and flexibility, others are anchored in tradition, where skepticism about technology prevails. Without a cultural shift that normalizes digital health as an essential component of care, efforts to scale telemedicine may continue to face inertia. Building trust in telemedicine, both among providers and patients, requires transparent communication, reliable performance, and demonstrable value in clinical outcomes (12,13). The current body of research, while rich in identifying technical and operational issues, often overlooks the lived experiences of healthcare workers on the front lines of digital transformation. These perspectives are essential in designing practical, inclusive solutions that go beyond policy and platform. Therefore, there is a critical need to capture the voices of clinicians who are not just users of telemedicine, but co-creators of its implementation and evolution. Against this backdrop, the present qualitative study seeks to explore and understand the key challenges faced by healthcare workers in adopting telemedicine technologies. Through in-depth engagement with clinicians, this research aims to identify systemic, technological, organizational, and personal barriers that impede the effective integration of digital health into clinical practice, thereby contributing to a more grounded and human-centered approach to digital transformation in healthcare.

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METHODS

This qualitative study was conducted over an eight-month period, from September 2024 to April 2025, in various public and private healthcare settings across three major metropolitan cities in Pakistan: Lahore, Karachi, and Islamabad. These cities were selected to ensure a diverse sample in terms of institutional policies, technological infrastructure, and socio-economic conditions, thereby enriching the breadth of perspectives gathered. The study was designed to explore and understand the multifaceted challenges healthcare professionals face in integrating telemedicine into their daily clinical workflows, with a focus on identifying barriers at systemic, technological, organizational, and personal levels. A purposive sampling strategy was employed to recruit participants, targeting individuals actively involved in clinical care delivery who had experience using or were expected to use telemedicine technologies (3,4). This included general practitioners, specialists, nurses, and allied health professionals working in tertiary care hospitals, outpatient clinics, and telehealth units. Inclusion criteria required participants to have a minimum of one year of clinical experience and at least six months of exposure to any form of telemedicine—whether synchronous video consultations, asynchronous digital communications, or remote patient monitoring. Participants who had no direct interaction with telemedicine systems or who had only administrative roles without clinical responsibility were excluded to maintain the relevance and focus of the data collected.

To determine an adequate sample size for thematic saturation, the study adopted a flexible, iterative sampling approach as commonly recommended in qualitative research. Based on literature suggesting thematic saturation typically occurs within 12–20 interviews for homogeneous groups, an initial target of 30 participants was set. The final sample included 34 healthcare professionals, ensuring saturation was achieved with no new themes emerging in the final interviews. Data collection was carried out using semi-structured, in-depth interviews, designed to elicit detailed personal experiences and perceptions of telemedicine integration. An interview guide was developed based on the study objective and informed by relevant literature, ensuring alignment with systemic, technological, organizational, and individual domains. Questions probed participants' experiences with digital platforms, institutional support, technological limitations, patient interactions, and perceptions of the changing nature of clinical care in a digital environment. Interviews were conducted in either English or Urdu, depending on participant preference, and each lasted approximately 45–60 minutes. All interviews were audio-recorded with prior informed consent and transcribed verbatim. For Urdu interviews, transcripts were translated into English and then back-translated to ensure linguistic and conceptual fidelity.

To enhance credibility, triangulation was employed through field notes and memos maintained during and after interviews to capture contextual details and researcher reflections. An inductive thematic analysis approach was adopted, using Braun and Clarke's six-phase framework. This included familiarization with data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report (14). Two researchers independently coded a subset of transcripts, and discrepancies were resolved through discussion to refine the coding framework. NVivo 12 software was used to manage and organize the data, facilitating efficient coding and theme development. Outcome measurement was centered on identifying and categorizing the barriers experienced by healthcare workers, organized across four domains: systemic (e.g., policy constraints, infrastructure limitations), technological (e.g., platform usability, interoperability), organizational (e.g., leadership support, workflow integration), and personal (e.g., digital literacy, attitudes toward change). These thematic domains guided both the interview design and the analytic framework, ensuring consistency and alignment with the study objective. Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the relevant institute. Written informed consent was obtained from all participants prior to data collection, and anonymity was maintained through de-identification of transcripts and secure storage of data. Participants were informed of their right to withdraw at any stage without any repercussions, and the study complied with the ethical principles outlined in the Declaration of Helsinki. By employing a robust qualitative methodology rooted in empirical rigor and ethical sensitivity, this study aimed to yield rich, nuanced insights into the lived experiences of healthcare professionals navigating the integration of telemedicine technologies in the evolving Pakistani healthcare system.

RESULTS

The study revealed four overarching themes characterizing the barriers to telemedicine adoption among healthcare professionals: systemic, technological, organizational, and personal. These themes encompassed multiple interrelated subthemes that illustrated the complexity of digital health integration in clinical environments across Pakistan. Systemic barriers were most commonly described in relation to policy and governance deficits. Participants expressed concern over the lack of clear national guidelines and standardized frameworks for telemedicine deployment. One senior consultant noted, *"We are navigating in the dark. There's no unified policy, just*

fragmented decisions at hospital level." Another subtheme under systemic challenges was financial inconsistency, where clinicians highlighted how unreliable or inadequate funding limited institutional readiness. Regulatory ambiguity, especially around patient data privacy and professional accountability in virtual settings, was also noted as a deterrent. Technological barriers emerged as particularly dominant. The most cited subtheme was the difficulty in using telemedicine platforms, especially those with unintuitive interfaces or frequent technical glitches. As one clinician shared, *"Sometimes we spend more time troubleshooting the system than attending to the patient—it just breaks the flow."* Internet reliability was also a significant issue, especially for those serving rural populations, creating uneven access and disruptions in virtual care delivery. Interoperability limitations further hindered efficiency, as systems often failed to sync with hospital electronic health records or lab platforms, resulting in redundant data entry and reduced workflow continuity.

Organizational-level challenges were also prominent. Many participants emphasized a lack of structured training programs tailored to the practical demands of digital care. One nurse reported, *"We were expected to just start using it with no formal orientation—it was stressful and confusing."* Lack of administrative backing, in terms of IT support and clinical workflow redesign, compounded the difficulty. Disruptions in traditional patient flow, unclear telemedicine appointment protocols, and limited scheduling flexibility were cited as contributing to clinician burnout. On the personal front, barriers related to knowledge, attitude, and perception of technology played a crucial role. Digital illiteracy, particularly among older professionals or those with limited prior exposure to information technology, was frequently mentioned. Another participant commented, *"This whole system feels like it belongs to a younger generation—I'm just not comfortable."* Emotional resistance, stemming from a belief that telemedicine undermines the humanistic aspect of care, also surfaced repeatedly. Concerns over diminishing therapeutic relationships and a perceived erosion of trust in remote consultations were notable. The cumulative findings reflect that these barriers do not exist in isolation but interact dynamically, amplifying the complexity of telemedicine adoption. Systemic inertia fuels organizational inadequacies; technological frustrations reinforce personal resistance. These interconnections suggest the need for comprehensive, multi-level interventions to address the layered nature of digital health integration challenges.

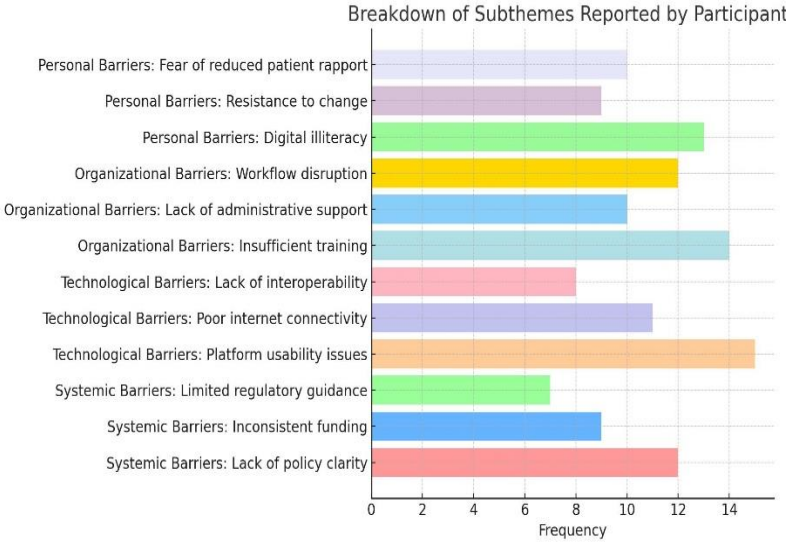

Figure 1 Breakdown of Subthemes Reported by Participant

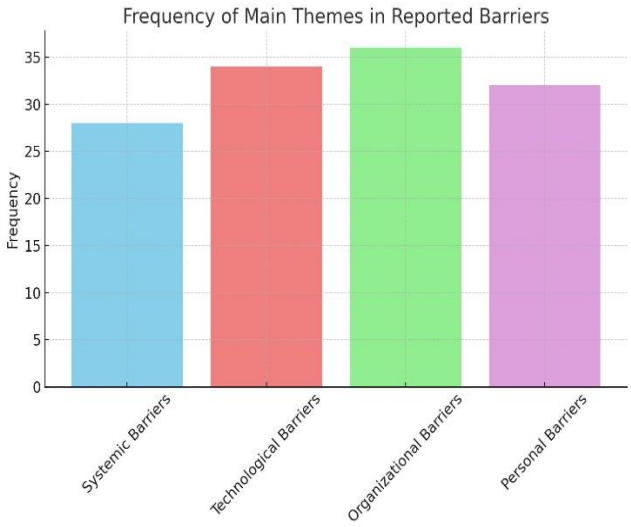

Figure 2 Frequency of Main Themes in Reported Barriers

DISCUSSION

The findings of this study contribute significantly to the growing body of evidence surrounding the practical realities of telemedicine implementation in clinical practice, particularly within the context of low- and middle-income countries like Pakistan. The insights derived from this qualitative investigation are consistent with prior research, reinforcing the notion that systemic, technological, organizational, and personal-level barriers interact to shape healthcare providers' experiences with telemedicine adoption. Systemic challenges such as unclear policy directives and inconsistent funding mechanisms were consistent with the conclusions drawn in several recent reviews. A study underscored how ambiguity in regulatory frameworks and underinvestment in digital infrastructure often create

uncertainty among healthcare workers regarding accountability, legal implications, and long-term viability of telemedicine systems (15,16). Similar concerns have been echoed in the Indian context, where integration barriers were amplified by the lack of standardized protocols and uneven policy support across states (17). These findings indicate that without a cohesive, top-down policy infrastructure, digital health implementation remains fragmented and vulnerable to institutional inertia. Technological limitations emerged as a dominant theme, particularly the issues of poor usability and unreliable connectivity. The literature strongly supports this; research identified user unfriendliness of virtual platforms and weak ICT infrastructure as key deterrents to sustained adoption (18,19). The frequent complaint among participants that technological failures disrupt clinical flow aligns with prior analyses that advocate for better user-centered design in telehealth systems (20). The persistence of these problems suggests that while hardware and software tools continue to evolve, real-world usability and accessibility concerns remain under-addressed.

Organizational resistance was another major barrier, with participants citing lack of training, poor administrative support, and misaligned workflows. These organizational dynamics mirror earlier findings by a study, who emphasized that a shortage of formal telemedicine training programs and the absence of methodological guidelines greatly hinder clinician engagement (21). Furthermore, the issue of workflow disruption—often ignored in high-level policy discourse—highlights the critical need for adaptive organizational models that account for time management, staffing, and clinical coordination in hybrid care environments. On a personal level, barriers such as low digital literacy and skepticism toward virtual care were echoed across interviews. These concerns reflect broader global patterns. According to a study, providers' unfamiliarity with technology and concerns about depersonalized care reduce their willingness to adopt telemedicine even when infrastructure is available. This attitudinal resistance often stems from cultural perceptions of what constitutes “real” or “effective” clinical care, as well as a fear of being replaced or diminished in the clinical process (20,21). A study further emphasized that younger healthcare workers were more adaptable to change, suggesting the need for generationally sensitive digital education strategies (22).

One of the strengths of this study is its methodological rigor, incorporating diverse healthcare settings and perspectives to ensure comprehensive coverage of the barriers to telemedicine adoption in Pakistan. Thematic saturation was achieved, and triangulation strategies added depth to the analysis. However, certain limitations must be acknowledged. The study was geographically limited to urban centers, potentially excluding the experiences of rural healthcare workers who may face different or more acute technological and infrastructural barriers. Furthermore, the qualitative nature of the study, while rich in depth, restricts the generalizability of findings. Future research should consider longitudinal mixed-methods designs that track the impact of specific interventions—such as digital training programs or infrastructure investments—on adoption outcomes. Implications of these findings suggest the need for multilevel strategies. At the policy level, standardized national guidelines and sustainable funding structures are imperative. At the institutional level, integration of telemedicine into existing workflows through staff engagement, training, and resource support is essential. On a personal level, fostering digital confidence and addressing emotional concerns around virtual care can enhance acceptance. Future research should also explore how interprofessional collaboration can facilitate smoother adoption and identify success stories within similar socio-economic environments for comparative insight. In summary, this study reaffirms that successful integration of telemedicine depends not solely on technology, but on a complex interplay of policy, infrastructure, organizational readiness, and human perception. Bridging these gaps requires coordinated effort from stakeholders across all tiers of the healthcare system.

CONCLUSION

This study highlights the complex interplay of systemic, technological, organizational, and personal barriers that hinder the integration of telemedicine into routine clinical practice in Pakistan. By amplifying the lived experiences of healthcare providers, the findings underscore the urgent need for comprehensive policy frameworks, user-centered technology, institutional support, and targeted training. Addressing these challenges holistically is essential to realize the full potential of telemedicine as a sustainable healthcare solution.

AUTHOR CONTRIBUTION

Author	Contribution
Muhammad Abdullah Avais*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Ahmar Iftikhar	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Afeefa Tahira	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Mehwish Mobeen	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Hafzah Shah	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Sohail Nasir	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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