Exploration of Digital Health Technologies

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Open Access Original Article

Knowledge, perception, and willingness of digital psychiatry among psychiatrists in Pakistan: a multicenter cross-sectional study

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Academic Editor: Subho Chakrabarti, Postgraduate Institute of Medical Education and Research (PGIMER), India
Received: May 21, 2025 **Accepted:** November 24, 2025 **Published:** January 7, 2026

Cite this article: Riaz MMA, Abrar T, Hammad M, Tariq H, Fatima R, Siddique I, et al. Knowledge, perception, and willingness of digital psychiatry among psychiatrists in Pakistan: a multicenter cross-sectional study. Explor Digit Health Technol. 2026;4:101179. https://doi.org/10.37349/edht.2026.101179

Abstract

Aim: A comprehensive understanding of current digital literacy and perspectives of the psychiatric workforce is important to introduce appropriate digital psychiatry interventions and implement contextually relevant measures in Pakistan. This study aims to address a gap in the existing literature by assessing psychiatrists' knowledge, attitudes, perceived barriers, and willingness to integrate digital psychiatry into their clinical practice.

Methods: A cross-sectional online survey was conducted from January 2023 to June 2023 across psychiatric departments of 18 public hospitals in Pakistan. The study included psychiatry residents, fellows, and consultants. A 48-item questionnaire, internally and externally validated, assessed knowledge, perceptions, and willingness to adopt digital psychiatry tools—telepsychiatry, artificial intelligence, mental health applications, and virtual reality. Data were analyzed using Statistical Package for the Social Sciences (version 26) for descriptive statistics, correlation, and regression analyses, while thematic analysis of open-ended responses was performed using Quirkos.

Results: A total of 200 participants (56.0% aged 20–30 years, *n* = 112; 55.5% male, *n* = 111) were part of this study. 68.5% (*n* = 137) understood the applications of telepsychiatry, while 72.5% (*n* = 145) agreed that it is time-efficient and cost-effective. Only 39.5% (*n* = 79) of participants had received relevant artificial intelligence training to incorporate it in their psychiatric clinical practice. 62.0% (*n* = 124) of respondents reported unfamiliarity with the use of mental health applications. Regarding virtual reality, 32.5% (*n* = 65) were familiar with the technology, but only 42.5% (*n* = 85) were aware of its applications in psychiatric

care. Thematic reflexive analysis revealed major challenges, including a 'lack of infrastructure/resources' (44.5%, *n* = 89) and a 'lack of education/awareness' (21.5%, *n* = 43).

Conclusions: This study represents the first cross-sectional examination of digital psychiatric literacy in Pakistan's healthcare system, which revealed significant gaps in digital health competencies among psychiatrists. Given the vast potential of emerging technologies in addressing mental health challenges, there is an urgent need for mental health professionals in Pakistan to integrate digitization in psychiatric practice.

Keywords

telepsychiatry, artificial intelligence, mental health apps, virtual reality, digital psychiatry, Pakistan

Introduction

Globally, mental health disorders account for 14.6% of years lived with disability (YLDs) and affect nearly 1 in 8 people (970 million) worldwide, making them one of the leading contributors to the global burden of disease [1]. Despite this high burden, investment remains disproportionately low, with countries allocating on average only 2% of health budgets to mental health, leaving significant treatment gaps [2]. The COVID-19 pandemic further exacerbated these challenges, with the World Health Organization (WHO) reporting a 25% global increase in anxiety and depression during the first year of the pandemic [3].

Low and middle-income countries (LMICs), which host nearly 80% of the world's population, face a disproportionately high burden of untreated mental disorders. More than 75% of individuals with mental health conditions in LMICs receive no treatment, a phenomenon often termed the "treatment gap" [4]. This gap is driven by severe workforce shortages, urban-centric services, and stigma surrounding help-seeking. Digital psychiatry—comprising telepsychiatry, artificial intelligence (AI), smartphone mental health applications (MHAs), and virtual reality (VR) has been highlighted as a potential equalizer, offering scalable, cost-effective, and stigma-reducing pathways to expand access [5].

In South Asia, a meta-analysis of 25 studies reported that around one in six adults experience depression, one in eight experience anxiety, and nearly one in seven suffer from both conditions, with rates varying across countries and assessment tools [6]. Psychiatrist density remains far below global averages; for example, India has 0.75 psychiatrists per 100,000 population, compared to the global median of 9 per 100,000 [7]. In a national survey of psychiatrists (*n* = 340; response rate 6.8%), nearly three-quarters (76.5%) reported using smartphones for teleconsultations, and 73.4% issued digital prescriptions, yet two-thirds (67.1%) still felt in-person consultations were superior, highlighting both growing adoption and persistent hesitancy towards digital tools [8].

Pakistan exemplifies these challenges. A recent systematic review reported a mean prevalence of anxiety and depression at 33.6%, one of the highest in South Asia [9]. Despite the high prevalence of common mental disorders, Pakistan's mental health system remains chronically under-resourced. The country spends only 0.04% of total health expenditure on mental health, and psychiatrist density is just 0.19 per 100,000 population, one of the lowest in the WHO Eastern Mediterranean Region [10]. Overall, mental health workforce availability is limited to 0.56 workers per 100,000, far below the global median, with services heavily concentrated in urban tertiary hospitals. Community-based mental health facilities remain sparse (0.6 per 100,000), and most service users pay out of pocket for both consultations and psychotropic medicines, reflecting minimal financial protection [10]. While Pakistan has a national mental health policy (2001), implementation has been inconsistent, and no updated stand-alone legislation aligned with international human rights standards exists [10]. Moreover, research output in mental health is negligible, constituting only 0.04% of total national research [10].

Early Pakistan-based implementation research demonstrates the feasibility and acceptability of technology-assisted interventions (e.g., Lady Health Worker-delivered mobile health for common mental disorders), suggesting that thoughtfully adapted digital models can extend care beyond hospital walls [11].

Moreover, regional training audits reveal large gaps in formal preparation for telepsychiatry and related competencies (for e.g., 58.8% reporting no theoretical training), implying that clinician readiness, not technology alone, will shape uptake and quality [12]. Against this backdrop of high burden, low investment, and uneven service provision, examining the digital readiness of Pakistani psychiatrists is crucial to inform scalable, cost-efficient, and context-appropriate pathways for mental healthcare delivery.

This study addresses that critical gap. While the global literature identifies clinician hesitancy, lack of training, and infrastructural deficits as barriers to digital psychiatry adoption [5, 8], Pakistan-specific data on psychiatrists' readiness remains scarce. We therefore conducted a multicenter cross-sectional study to evaluate psychiatrists' knowledge, perceptions, and willingness to adopt digital psychiatry tools, while also identifying implementation barriers. By linking systemic pressures (high prevalence, underfunding, workforce shortages, and urban concentration) with clinician-level readiness, our findings aim to inform evidence-based strategies for training, governance, and infrastructure that are essential to building a sustainable digital mental health ecosystem in Pakistan. Specifically, we aimed to address the following research questions:

- What is the level of familiarity among psychiatrists in Pakistan regarding digital psychiatry tools, including telepsychiatry, AI, VR, and MHAs?
- How do Pakistani psychiatrists perceive the feasibility, affordability, and practicality of adopting these tools in the current healthcare system?
- How willing are Pakistani psychiatrists to gain training in and integrate digital psychiatry tools into clinical practice?
- What do Pakistani psychiatrists perceive to be key barriers to the implementation of digital psychiatry tools in the Pakistani healthcare system?

Literature review

In recent decades, digitization has spread into every aspect of society, including healthcare, and the field of psychiatry is no exception. Various innovative technologies have pervaded psychiatric practice, revolutionizing the delivery and accessibility of mental health care services [13]. While this process of digitization began much earlier, it was the widespread enforcement of social distancing measures and shortage of healthcare workers resulting from the COVID-19 pandemic that compelled the healthcare community to realize that conventional methods were inadequate to meet the burden of the pandemic-induced surge in mental health disorders [14]. This drove the rapid development and implementation of digital techniques in mental health care services, marking the inception of what we now know as "digital psychiatry [15]."

Globally, digital psychiatry has emerged as an efficient solution for mental health workforce shortages and access disparities. Evidence from high-income countries demonstrates that telepsychiatry can deliver clinical outcomes comparable to face-to-face care, with advantages in cost efficiency and patient satisfaction [16, 17]. Similarly, AI-driven diagnostic support tools and smartphone-based interventions have shown potential to enhance early detection and self-management of mental disorders [18, 19].

In LMICs, where over 75% of individuals with mental disorders remain untreated, digital platforms have been promoted as potential equalizers [4, 20]. Given that Pakistan reports some of the highest rates of anxiety and depression in South Asia [9], coupled with a critical shortage of mental health professionals, limited healthcare infrastructure, and pervasive stigma [10], integrating digitization into psychiatric practice has become increasingly essential.

Studies in Pakistan have shown favourable results on the implementation of digital mental health interventions. For example, a study conducted in rural Sindh found reductions in anxiety and depression scores after delivery of digital counselling interventions by lay health workers [21]. Further studies showed that technology-based mental health interventions were found to be feasible, acceptable, and appropriate by the community when delivered by community health workers in resource-limited areas of Sindh [11].

Surveys of Pakistani psychiatrists indicate growing, but cautious, engagement with telepsychiatry, with less than half of participants indicating telepsychiatry as being a convenient approach to patient care [22].

Indeed, one of the major barriers to the widespread implementation of these technologies in resource-limited countries, including Pakistan, is a hesitancy to adopt these tools by practitioners, stemming from a lack of familiarity with and training in their applications [12].

Many countries lack curricula-specific training in digital methods of psychiatric diagnosis and interventions [12]. According to a survey conducted among medical students and psychiatric trainees, 58.8% of Pakistani respondents stated that they had not received adequate training in telepsychiatry [12]. This lack of awareness has the potential to fuel misconceptions regarding the capabilities, safety, and benefits of these technologies, impeding their integration into the healthcare system. Therefore, in order to introduce digital psychiatry solutions in Pakistan, it is imperative to examine the current level of knowledge and viewpoint of the psychiatric workforce. To the best of our knowledge, literature assessing digital literacy, perspectives, and attitudes of Pakistani practitioners in the context of psychiatry is scarce. This study aims to bridge that gap by gauging their level of knowledge and perceptions of digital psychiatry and of the barriers to its implementation; their familiarity with its associated tools; and their willingness to adopt these services in practice. In doing so, it hopes to lay the foundation for future recommendations and strategies aimed at increasing access to digital mental healthcare in Pakistan.

Materials and methods

Methods

This cross-sectional study focused on Knowledge, Attitudes, and Practices (KAP) from public academic hospitals across Pakistan to explore the perspectives of psychiatrists concerning their familiarity with, perceptions of, and willingness towards various digital psychiatry tools. Data were collected via an online questionnaire distributed through Google Forms between January 17 and June 24, 2023.

Participants

Participants included psychiatry residents, fellows, and psychiatry consultants employed in Pakistan's public healthcare system. Individuals without formal psychiatric training, such as interns, medical students, non-psychiatric nurses, and other non-psychiatric specialists, were excluded.

Survey design

A multidisciplinary core team of psychiatrists, residents, and medical students developed a 48-item survey divided into four sections and 12 subsections. The survey was disseminated via volunteers using social media platforms (Twitter, WhatsApp, LinkedIn). Experts in digital psychiatry conducted internal validation within the core team, focusing on item clarity, content alignment, and thematic coverage. For external validation, a pilot study was conducted at a local public-sector medical university involving $n = 23$ psychiatrists (consultants and residents). Feedback was obtained through structured debriefing and reviewed for clarity, length, and content relevance. With that, 4 independent experts in digital psychiatry and health education were consulted to assess content validity, leading to minor adjustments in item phrasing and sequencing.

The four sections, telepsychiatry, AI, MHAs, and VR, assessed respondents' knowledge, perceptions, and willingness to engage with digital psychiatry tools. Knowledge was assessed based on familiarity with relevant terminology and its applicability in Pakistan's healthcare context. Perception focused on feasibility, accessibility, sustainability, and affordability. Willingness included readiness to collaborate, integrate, and pursue training in digital psychiatry. Participants were also asked about existing frameworks and training opportunities in their institutions, as well as challenges faced during implementation. To prevent duplicate responses, participants were required to submit their email addresses, which were used solely for authentication and were not linked to individual data responses.

Participant recruitment

Participants were recruited through convenience sampling via the Pakistan Psychiatric Society network; departmental heads helped identify consultants, registrars, residents, and medical officers in public hospitals, and questionnaires were distributed using their official contact details.

Survey dissemination

Volunteers facilitated data collection by distributing the Google Forms survey within their hospital networks via email and conducting on-site visits to public hospitals. Use of Google Forms for survey dissemination and self-reported data collection poses inherent limitations. Recruitment through social media and hospital-based volunteers may have introduced self-selection bias, as individuals with a stronger interest or familiarity with digital psychiatry tools may have been more likely to participate. This could limit the generalizability of the findings to all psychiatrists in the public sector. Moreover, the reliance on self-reported data increases the risk of response bias, including social desirability bias and inaccurate recall. To mitigate duplication, email-based authentication was employed, and survey instructions emphasized honest and independent responses. Nonetheless, these methodological constraints are acknowledged as potential influences on data validity and interpretation. To mitigate these concerns, instructions emphasized confidentiality, honest reporting, and independent completion. Respondents provided demographic data, including age, professional rank, years of service, and area of practice.

Data extraction and analysis

Due to the absence of a centralized national registry, the population of public-sector psychiatrists in Pakistan was estimated to be 400 based on consultations with hospital departments. Using Raosoft's sample size calculator with a 5% margin of error and 95% confidence interval, the required minimum sample size was determined to be 200.

Survey responses were exported from Google Forms to Microsoft Excel 365 and cleaned before statistical analysis in Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics (means, standard deviations, and frequencies) summarized participant characteristics and responses across the four domains. Reliability analysis assessed the internal consistency of the questionnaire, and additional correlational analysis explored relationships among key variables.

Correlation analyses were performed to examine relationships among the key domains of digital psychiatry, telepsychiatry, AI, MHAs, and VR in terms of knowledge, perceptions, and willingness. Before choosing the correlation method, we assessed the statistical assumptions necessary for the use of Pearson correlation. Specifically, the normality of continuous variables was tested using the Shapiro–Wilk test, and visual assessments were made via histograms and Q–Q plots. Linearity between variables was evaluated using scatterplots, and multicollinearity among variables (where relevant for regression) was assessed through the variance inflation factor (VIF). Shapiro–Wilk test for normality indicated that several continuous variables, especially those related to perception and willingness towards AI and VR, significantly deviated from normality ($W = 0.874–0.941$, $p < 0.05$). Hence, Spearman's rho was used instead of Pearson's correlation for these variables. For regression models, multicollinearity was assessed using the VIF, with values ranging from 1.12 to 2.34, well below the cutoff of 5, confirming the absence of problematic collinearity.

Construct validity of the survey was assessed using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity (BTS). The KMO statistic was 0.812, exceeding the recommended threshold of 0.70, indicating sampling adequacy for factor analysis. BTS was statistically significant ($\chi^2 = 2{,}765.43$, df = 1,128, $p < 0.001$), confirming sufficient inter-item correlations. Internal consistency reliability was evaluated with Cronbach's alpha, which ranged from 0.78 to 0.87 across the main domains (telepsychiatry, AI, MHAs, VR), reflecting good reliability.

Results indicated that several variables, particularly those related to perception and willingness in less familiar domains like AI and VR, violated the assumption of normality. Consequently, we used Spearman's

rank-order correlation for these non-normally distributed variables. Pearson correlation was retained only for relationships between variables that met the normality and linearity criteria. This hybrid approach ensured the robustness and validity of the statistical findings. All correlation coefficients (Spearman's ρ and Pearson's r) were reported with corresponding significance levels in the results section. Factors associated with digital psychiatry readiness were further explored using multiple logistic regression models. All significance tests were two-tailed, with $p < 0.05$ considered statistically significant.

For the qualitative component, open-ended responses were analyzed using reflexive thematic analysis following the six-phase framework proposed by Braun and Clarke (2006), using NVivo Version no 15. This approach allowed for a flexible, iterative examination of meaning across the dataset while maintaining sensitivity to context. The analysis was conducted using Quirkos software version 3, which facilitated the coding, comparison, and refinement of themes.

Initially, two independent coders conducted inductive coding, generating codes directly from the data without imposing preconceived categories. Codes were then grouped into broader patterns to develop preliminary themes. The team held regular meetings to discuss coding discrepancies, refine theme definitions, and ensure analytic consistency. Themes were reviewed and finalized based on their internal coherence and relevance to the research questions, particularly around barriers to implementation, institutional readiness, and training gaps in digital psychiatry. Inter-coder reliability between the two independent analysts was calculated on a 20% subsample, yielding a Cohen's kappa of 0.84, which reflects strong agreement. Coding discrepancies were resolved through discussion until consensus was reached. Example codes included: '*Limited institutional support*' → under the theme 'Barriers to Implementation', '*Need for formal training workshops*' → under the theme 'Capacity Building and Training Gaps', '*Concerns about patient confidentiality in telepsychiatry*' → under the theme 'Ethical and Privacy Challenges.' Reflexivity was maintained throughout, with coders documenting their positionality and interpretations during the process. Representative quotes were extracted to illustrate emerging themes. This dual-analyst strategy enhanced the credibility and depth of qualitative findings.

Results

Demographics

We identified 39 psychiatric departments of public hospitals, of which 23 were in Punjab, 6 in Sindh, 9 in Khyber Pakhtunkhwa, and 1 in Balochistan. Data was collected from 18 departments and included departments from all provinces. The sample comprised 55.5% (n = 111) male and 44.5% (n = 89) female participants. Most respondents (56.0%; n = 112) were aged 20–30 years, followed by 36.0% (n = 72) aged 31–40, 6.0% (n = 12) aged 41–50, and 2.0% (n = 4) over 51. A majority (95.0%, n = 190) were Pakistani nationals, while 5.0% (n = 10) were non-Pakistani. In terms of professional rank, 22.5% (n = 45) were consultants, 6.5% (n = 13) registrars, 54.0% (n = 108) residents, and 17.0% (n = 34) medical officers. All participants were Bachelor of Medicine, Bachelor of Surgery (MBBS)-qualified medical doctors. Consultants and registrars had completed the College of Physicians and Surgeons Pakistan (CPSP) postgraduate fellowship in psychiatry (FCPS Psychiatry). Residents were MBBS-qualified doctors currently enrolled in FCPS Psychiatry training, while Medical Officers were MBBS-qualified clinicians providing psychiatric or general services, but not pursuing FCPS Psychiatry. Most participants (95.5%, n = 191) practiced in public hospitals, with only 4.5% (n = 9) in academic or research settings. Regarding participants' demographics, 26.0% (n = 52) served predominantly urban populations, 60.5% (n = 121) suburban or rural, and 13.5% (n = 27) a mix of both. As for experience, 68.0% (n = 136) had under 5 years, 23.5% (n = 47) had 5–10 years, 5.0% (n = 10) had 11–15 years, and 3.5% (n = 7) had over 15 years in psychiatry (Table 1).

Telepsychiatry

A majority of participants reported basic familiarity with telepsychiatry, 68.5% (n = 137), yet only 42.0% (n = 84) understood its practical applications. Notably, institutional exposure was limited as most respondents 67% (n = 134) stated they had not received any formal training, and nearly half (47.5%; n = 95) indicated that telepsychiatry-related meetings or conferences were not held at their workplace. Over 72.5% viewed it

Table 1. Demographics of the participants.

Variables		Frequency (*n*)	Percentage (%)	*p*-value
Gender	Male	111	55.5	0.002
	Female	89	44.5	
Age (years)	20–30	112	56.0	0.024
	31–40	72	36.0	
	41–50	12	6.0	
	≥ 51	4	2.0	
Nationality	Pakistan	190	95.0	0.001
	Non-Pakistani	10	5.0	
Professional ranking	Consultant	45	22.5	0.004
	Registrar	13	6.5	
	Resident	108	54.0	
	Medical officer	34	17.0	
Type of practice	Public hospital	191	95.5	0.330
	Academic hospital or primarily research	9	4.5	
Type of area your patients are from	Urban	52	26.0	0.045
	Suburban or rural	121	60.5	
	Mixture of both	27	13.5	
Years of experience in the field of psychiatry	Less than 5	136	68.0	0.001
	5–10	47	23.5	
	11–15	10	5.0	
	Above 15	7	3.5	

as time-efficient (*n* = 145), and 75.5% regarded it as a viable option for patient care (*n* = 151). A large majority (79.0%; *n* = 158) expressed willingness to consult with larger telepsychiatry centers, and 64.0% (*n* = 128) were open to using telepsychiatry for real-time observation of procedures like electroconvulsive therapy (ECT).

However, resistance to integration within current health systems was evident: 53.5% (*n* = 107) disagreed with incorporating telepsychiatry into existing psychiatric services, and only 37.0% (*n* = 74) supported integration (Table S1).

Statistical associations

Significant associations were observed between:

- Training in telepsychiatry and awareness of its applications (β = 0.408, *p* = 0.0038)
- Perception of national digital infrastructure and willingness to use telepsychiatry (β = 0.657, *p* = 0.007)
- Belief in telepsychiatry replacing in-person care and openness to its adoption (β = 0.121, *p* = 0.017)

AI

A majority (68.5%, *n* = 137) of participants reported unfamiliarity with AI applications in psychiatry. Similarly, 60.5% (*n* = 121) had not received institutional training on AI usage at their institution, while 39.5% (*n* = 79) had received some level of AI training. Perceptions were mixed: 46.5% (*n* = 93) were neutral on AI's viability in psychiatric services, and 77.5% (*n* = 155) disagreed with its cost and time-saving potential. Over half (53.5%, *n* = 107) disagreed that AI could replace conventional psychiatry practices. A significant portion (63.5%, *n* = 127) reported a lack of understanding of AI algorithm outcomes, though 55.0% (*n* = 110) showed interest in AI-psychiatry collaborations. While 31.5% (*n* = 63) were neutral about AI integration into psychiatric care, 43.5% (*n* = 87) agreed that building trust between clinicians and AI technologies is essential for future development (Table S2).

MHAs

Most respondents (62.0%; n = 124) were unfamiliar with MHA for psychiatric care, and 40.5% (n = 81) disagreed with their clinical utility. More than half (53.0%; n = 106) strongly disagreed that these apps could reduce time and costs within psychiatric systems. Awareness among psychiatrists regarding app recommendations was reported by only 30.0% (n = 60). Willingness to integrate such apps was noted in 35.5% (n = 71), while 53.0% (n = 106) expressed interest in learning about new MHA. However, only 24.5% (n = 49) agreed on the possibility of their integration within Pakistan's psychiatric care framework (Table S3).

VR

About 32.5% (n = 65) of respondents were familiar with VR, and only 25.0% (n = 50) reported having received institutional training. Only 27.0% (n = 54) agreed that VR could save time and money in psychiatric care. The majority (79.5%; n = 159) cited insufficient digital infrastructure for VR adoption. While 37.5% (n = 75) disagreed with the possibility of VR integration. Over half (51.0%; n = 102) did not view VR as a viable replacement for in-person services. A promising 55.5% (n = 111) expressed willingness to learn about VR, but 85.0% (n = 170) disagreed with their willingness to use it in practice. Furthermore, 40.5% (n = 81) were unwilling to view live procedures such as ECT via VR (Table S4).

Reliability analysis

Reliability analysis showed strong internal consistency for telepsychiatry (Cronbach's alpha = 0.847) and VR (Cronbach's alpha = 0.866), suggesting these domains are robust in clinical settings. AI (Cronbach's alpha = 0.756) showed commendable stability, while MHA exhibited moderate reliability (Cronbach's alpha = 0.614) (refer to Table 2).

Table 2. Results for reliability analysis.

Variable name	Mean	Cronbach's alpha
Telepsychiatry	58.18	0.847
MHAs	44.84	0.614
VR	47.15	0.866
AI	60.55	0.756

AI: artificial intelligence; MHAs: mental health applications; VR: virtual reality.

Correlation analysis

Correlation analysis results revealed significant positive correlations between telepsychiatry and AI (r = 0.493), as well as MHA (r = 0.429), indicating their synergistic potential in transforming psychiatric care. Additionally, the significant positive correlations between AI and MHA (r = 0.497) and VR (r = 0.390) highlight the interconnectedness of these innovative technologies in mental health. Notably, VR demonstrates positive correlations across all variables (refer to Table 3).

Table 3. Results of correlation analysis.

Variables	Telepsychiatry	AI	MHAs	VR
Telepsychiatry	1	—	—	—
AI	0.493* (ρ)	1	—	—
MHAs	0.429* (r)	0.497* (ρ)	1	—
VR	0.293* (ρ)	0.390* (ρ)	0.392* (ρ)	1

Spearman's ρ was used for correlations involving variables that violated normality assumptions, while Pearson's r was used for normally distributed variables. —: indicates cells not shown (matrix is symmetric). *: $p < 0.01$. AI: artificial intelligence; MHAs: mental health applications; VR: virtual reality.

Qualitative findings

Thematic analysis of the open-ended responses revealed five major themes: lack of infrastructure/resources, lack of education/awareness, unwillingness to adapt, complexity of technology, and confidentiality concerns. Frequencies are presented in Table 4, while illustrative quotations provide context.

Table 4. Thematic analysis of qualitative responses.

Theme	Frequency (*n*)	Percentage (%)
Lack of infrastructure/resources	89	44.5
Lack of education/awareness	43	21.5
Unwillingness to adapt	28	14.0
Complexity	18	9.0
Confidentiality concerns	13	6.5
N/A	9	4.5

Inter-coder agreement was high (Cohen's kappa = 0.84), confirming the strong reliability of thematic coding.

Theme 1: Lack of infrastructure and resources (44.5%)

The most dominant theme was the absence of basic digital infrastructure, hindering the adoption of digital psychiatry in public-sector hospitals. Participants frequently described the absence of fundamental tools, including unreliable internet, outdated hardware, and limited institutional investment, as a major barrier to implementation.

Respondents highlighted the lack of basic digital equipment and hardware. Lack of reliable internet access was described as being stark indicator of the ground realities limiting digital interventions:

- "*Most of our psychiatry units don't even have computers, let alone video consultation facilities.*" (Response 17)
- "*Even Wi-Fi is a luxury in many departments. This is the ground reality.*" (Response 44)
- "*We can't even rely on uninterrupted power. Expecting high-tech tools is unrealistic without structural change.*" (Response 60)

Participants also linked these infrastructural challenges to broader system-level neglect of telemedicine. The absence of institutional support was perceived as a key barrier to implementing digital psychiatry initiatives:

- "*There is no provision of telemedicine in our setup. How can we talk about AI or VR?*" (Response 102)

Overall, these responses emphasise the need for investment in digital and technological infrastructure, without which digital psychiatry solutions cannot be introduced meaningfully into the Pakistani healthcare system.

Theme 2: Lack of education and awareness (21.5%)

The second major theme centered on participants' limited exposure to digital psychiatry and the absence of structured training programs. Participants frequently reported insufficient training, limited exposure to digital psychiatry, and the absence of structured curricula. This lack of training has created uncertainty about how to incorporate new technologies into clinical practice.

One respondent underscored the novelty of digital psychiatry use in the healthcare context:

- "*I have never heard of mental health apps being used professionally in our country.*" (Response 21)

This also revealed a consistent gap in postgraduate training. Psychiatry residents reported that digital psychiatry topics are not integrated into residency curricula. Participants emphasized the importance of structured continuing medical education (CME) to bridge these deficiencies:

- "*We have never received formal education on digital psychiatry in our residency.*" (Response 85)
- "*There is a significant knowledge gap. Most of us don't know how to use these tools effectively.*" (Response 38)
- "*Workshops or CME sessions are needed to help us keep up with digital innovation.*" (Response 97)

These responses demonstrate the importance of educating and training providers on the use of contemporary digital psychiatry tools via structured curricula.

Theme 3: Unwillingness to adapt (14.0%)

This theme reflected cultural resistance toward digital psychiatry, particularly among senior clinicians who preferred conventional, in-person approaches to psychiatric care. Participants described a generational divide in the acceptance of digital tools, with younger psychiatrists generally more open to innovation, while senior professionals often expressed skepticism or discomfort with technology-mediated care:

- "*Senior colleagues are not comfortable with digital platforms. They think psychiatry should be face-to-face only.*" (Response 56)
- "*Change is hard in our system. Many think these tools are unnecessary or too futuristic.*" (Response 31)

Beyond individual preferences, some participants expressed fears that digital psychiatry might devalue or replace traditional clinical methods:

- "*There's a fear among some staff that digital psychiatry may undermine traditional clinical roles.*" (Response 73)
- "*Adoption will be slow unless mindsets change.*" (Response 111)

Theme 4: Complexity of technology (9.0%)

Participants expressed apprehension regarding the perceived complexity of digital psychiatry tools, particularly AI and VR. Many respondents highlighted that psychiatrists often lack the technical expertise needed to navigate complex software.

Several participants emphasized the need for user-friendly interfaces and simplified platforms. Without this, these tools become impractical for routine psychiatric use:

- "*We are not IT experts. The interfaces need to be simple for doctors to use them effectively.*" (Response 93)
- "*Introducing VR sounds good, but who will train us? It seems complicated.*" (Response 40)
- "*Even electronic prescribing is a challenge. Adding AI sounds overwhelming.*" (Response 76)
- "*If it takes too long to learn, most people will just ignore it.*" (Response 112)

Theme 5: Confidentiality and ethical concerns (6.5%)

Although cited less frequently, ethical concerns were strongly expressed regarding patient privacy, data security, and medico-legal responsibility. Respondents emphasized that the ethical and legal implications of digital psychiatry remain ambiguous in Pakistan.

Participants expressed a lack of trust in third-party digital platforms to safeguard patient information, and guarantee confidentiality, highlighting fears about unauthorized access and potential misuse of data:

- "*I don't trust third-party apps with sensitive patient information.*" (Response 29)
- "*If confidentiality isn't guaranteed, then digital consultations can be dangerous.*" (Response 50)

Questions of accountability also emerged as a critical concern. Participants noted that the absence of clear legal frameworks for data protection creates ambiguity over responsibility in the event of data leaks or adverse outcomes:

- "*Who is responsible if a patient's data gets leaked from an AI platform?*" (Response 116)
- "*There are no clear guidelines on data protection. This makes us hesitant.*" (Response 88)

Overall, these insights indicate that ethical and legal safeguards are foundational prerequisites for the safe and effective implementation of digital psychiatry.

Discussion

Telepsychiatry

Our findings denote that 68.5% (*n* = 137) of participants were familiar with telepsychiatry. This reflects the significant gap in the understanding of digital psychiatry in Pakistan, where conventional treatment methods dominate. These results echo international concerns. In the U.S., despite its advanced healthcare infrastructure, many psychiatry residents lack hands-on experience with telepsychiatry [23]. Regionally, a study in Saudi Arabia found moderate familiarity (44.6%) but inadequate practical exposure, expert availability, and workplace integration, paralleling the Pakistani context [24]. Similarly, a broader Asia-Pacific study noted that 58.8% of Pakistani respondents lacked theoretical training, with even less practical experience, reflecting a regional pattern [12].

Only 16.5% (*n* = 33) of participants had received formal training in telepsychiatry, while 25.5% (*n* = 51) reported unfamiliarity with guidelines or telepsychiatry practice, highlighting the urgent need for capacity-building and national policy implementation. International literature further supports these findings. In Poland, only 15% of psychiatrists had telepsychiatry knowledge [25], whereas in Italy, basic familiarity was offset by limited academic coverage and training [26]. It has been noted that clinicians and patients have shown concerns about ensuring privacy during telepsychiatry sessions. Given the limited digital infrastructure to protect patient information, it is likely that telepsychiatry is not seen as part of common practice with higher risks to patient safety, thereby limiting its exposure and familiarity for Pakistani psychiatrists [27].

Encouragingly, Pakistani practitioners recognize the potential of telepsychiatry: 75.5% (*n* = 151) agreed it is a viable care model, and 72.5% (*n* = 145) believed it could reduce costs and save time. As mobile phone penetration increases, telepsychiatry offers a practical solution to reach underserved populations, particularly in the wake of climate-induced disasters in remote settings.

Most (75.0%; *n* = 150) of the participants confirmed the presence of Information and Communication Technologies (ICT) in their workplaces. Similar findings were reported in the Asian-Pacific region (82.3%) [12] and Saudi Arabia [24]. However, only 37.0% (*n* = 74) of participants expressed confidence in Pakistan's digital infrastructure, a concern echoed in Egypt [28]. Additionally, 43.0% (*n* =86) did not see telepsychiatry replacing in-person services, mirroring findings from India (62%) [27] and the Netherlands, where face-to-face care remains preferred with limited online augmentation [29]. This hesitancy in Pakistan may stem from technological constraints, cultural preferences favoring traditional care models, and system-level unpreparedness due to limited formal training and infrastructure. Furthermore, connecting with patients in their homes through a stable internet connection has its own cultural barriers, particularly in conservative communities where family and religious commitments coupled with societal stigma can potentially limit the therapeutic alliance from being established [27].

Despite infrastructural and cultural barriers, a strong willingness to adopt telepsychiatry emerged: 79.0% (*n* = 158) were open to collaboration with larger centers via telepsychiatry. This contrasts with Saudi Arabia, where higher readiness was reported: 88% for consultation use, 85.7% for peer adoption, and 84.8% for system readiness [24]. Addressing these challenges within the Pakistani context will require investments in digital infrastructure, enacting supportive policy reforms, clear operational guidelines, and delivering widespread training to educate and familiarize psychiatrists with telepsychiatry's benefits and implementation strategies.

AI

In our study, only 11.0% (*n* = 22) knew about its applications in psychiatry. Only 34.0% (*n* = 68) were aware of AI-based management procedures being used at their workplaces. These findings highlight a significant gap in AI literacy and implementation in Pakistan's mental health system. A similar Pakistani study found that only 39.0% of postgraduate doctors were familiar with AI, 72.6% were unaware of its practical applications, and 92.9% had no formal AI education during training [30]. In contrast, healthcare professionals in Bahrain reported higher AI knowledge [31], suggesting Pakistan's gaps stem from outdated curricula, limited resources for AI education, and poor clinical integration of AI. Addressing these issues is crucial to empowering psychiatrists with the skills needed to leverage AI for enhanced diagnostic and therapeutic outcomes in mental health care.

In our study, only 23.5% (*n* = 47) of participants viewed AI as a viable tool for psychiatric services, but only 13.0% (*n* = 26) believed it could save time and money. This contrasts with another Pakistani study where 74.4% acknowledged AI's role in diagnostics [30], and a Bahraini study where 70% believed AI would reduce diagnostic time [31]. Challenges with integrating AI-based solutions as part of reimbursements in patient care continue to be a global challenge, with no clear direction within mental health settings in Pakistan for billing purposes. Cultural and religious influences in Pakistan may contribute to skepticism toward AI in mental health. In Pakistani society, where cultural norms and religious beliefs play significant roles in daily life, concerns about privacy, confidentiality, and the perceived impersonality of digital platforms and AI could deter individuals from their use [32, 33]. Additionally, cultural preferences for face-to-face interactions and traditional healing methods might prioritize in-person consultations over digital alternatives [34].

Only 27.5% of our participants believed the digital infrastructure was adequate for AI services, similar to the 25.6% in Bahrain [31]. Concerns about AI replacing traditional psychiatric practice were expressed by 40.5% of respondents, compared to 75% in Bahrain who feared AI impacting mental healthcare employment [31]. Additionally, 81% in Bahrain doubted AI could deliver empathetic care, echoing global skepticism where most psychiatrists believe AI could augment specific tasks but not replace them [31, 35]. In Pakistan, 53.4% of doctors disagreed with AI's potential to replace physicians [32]. The lack of confidence in AI integration reflects concerns about job security and infrastructure readiness.

Our study identified challenges in AI implementation, including the complexity of AI algorithms in psychiatric practice. However, financial and technical limitations, insufficiently trained health professionals, absence of data on public perceptions, fear of replacement, societal barriers, confidentiality concerns, and ethical considerations were highlighted as broader challenges in other studies [36–38].

Still, 55.0% (*n* = 110) of participants were interested in developing AI-based solutions in healthcare and supported integrating AI into the current health infrastructure. These findings align with a systematic review where over 60% favored clinical AI integration [39]. This may indicate a broad openness among healthcare professionals, including Pakistani psychiatrists, towards AI technologies and a potential for successful AI integration in psychiatric healthcare. Respondents emphasized the importance of fostering trust between humans and AI, establishing ethical, legal, and infrastructural frameworks, especially critical in Pakistan, where awareness remains low [12]. A study on AI in LMICs emphasized training and retaining local experts, establishing monitoring systems, system-based implementation, and responsible local leadership, offering broader strategic contrasts to Pakistan's psychiatry-specific challenges [39].

MHAs

As per our data, MHAs among the psychiatric workforce in Pakistan are markedly low, with only 4.0% (*n* = 8) reporting familiarity with their usage. In comparison, studies from Germany, Portugal, and France show moderate levels of familiarity and usage of MHAs [40–42]. The lack of standardized guidelines in Pakistan may contribute to this gap, reinforcing the need for independent certification to ensure app quality and reliability [30]. Our findings highlight a significant knowledge gap in MHA use for psychiatric care in Pakistan, calling for targeted educational initiatives and the development of institutional protocols.

Addressing these deficits could promote better integration of digital tools, enhancing accessibility and support in mental health services.

Despite low awareness, 30.0% (n = 60) of participants recognized the value of MHA in psychiatric care, and 24.5% (n = 49) considered it time- and resource-saving. In contrast, a German study reported that 68.3% saw the potential for MHA to lower psychotherapy barriers [42], and in Portugal, 70% believed in their efficiency, with 45.5% considering them cost-effective [40]. Additionally, 35.5% (n = 71) of our participants were ready to use MHA for patient care. In Germany, 68.3% were willing to use treatment apps [42], while in Portugal, 22% of psychiatrists and 48% of psychologists were likely to prescribe digital MHA within the year [43]. An important reason for the lack of acceptance for MHA could also be its lack of cultural and language adaptation to local models of care. Such apps are often validated and built on Western datasets without involving psychiatrists from LMICs in the development process. This may widen the digital literacy gap and create further challenges for adoption in Pakistani mental health systems.

These insights reflect a cautiously optimistic outlook on MHAs effectiveness and cost-efficiency in psychiatric care. However, the relatively lower percentages in our study suggest the need for further exploration, awareness, and training to realize the potential of MHA in psychiatric care.

VR

Our findings show moderate awareness and familiarity with VR and its applications within Pakistan's psychiatric care. Only 32.5% (n = 65) of respondents were familiar with VR. In contrast, studies from Australia and the U.S. show significantly higher exposure, likely due to better funding and earlier adoption of digital tools in mental health care [44, 45]. Bridging this gap through targeted education and training initiatives could facilitate VR integration into psychiatric care, potentially improving treatment outcomes and patient engagement.

Only 24.0% (n = 48) of respondents deemed VR as a viable approach to psychiatric care. Trust in existing infrastructure was strikingly low, with only 4.0% (n = 8) expressing confidence. Comparatively, a survey from the Asia-Pacific region shows that 82.3% of respondents believed digital health could reduce costs, and 68.2% expected digital psychiatry might replace in-person care [12]. Interestingly, a Norwegian study noted improved clinician attitudes toward VR after direct exposure [46], suggesting that hands-on experience can foster acceptance in Pakistani practitioners.

Our findings indicate significant skepticism about VR in Pakistani psychiatry, with doubts about its viability and infrastructure. Although 55.5% (n = 111) of respondents were open to learning about VR, only 12.5% (n = 25) felt ready to apply it in practice—highlighting a critical gap between interest and preparedness. Comparatively, the Asia-Pacific study linked positive attitudes to digital psychiatry with theoretical and practical training, underscoring the need for education [12]. An Australian study cited barriers such as cultural resistance, validation time, lack of guidelines, training, and financial constraints [44]. These findings suggest a moderate willingness to explore VR in psychiatric care, with more enthusiasm for learning than active application. There is also a lack of culturally validated research on VR implementation in Pakistani psychiatric settings, which may possibly decrease the confidence in its uptake and efficacy by psychiatrists. Addressing these barriers and expanding training opportunities could pave the way for broader acceptance and integration of VR in mental health care.

Challenges

The study identified several challenges hindering the adoption of digital psychiatry in Pakistan. Key barriers included the "lack of infrastructure/resources" (44.5%), followed by "lack of education/awareness." Other concerns included "unwillingness to adapt," "complexity," and "confidentiality" issues. These findings highlight the pressing need for infrastructure development and comprehensive education initiatives to support the transition to digital psychiatry in Pakistan.

A parallel study on digital health interventions in Pakistan echoed similar barriers, including limited internet access and phone ownership, network coverage, absence of regulatory frameworks, data security

issues, affordability, and reliance on paper-based health records [47]. Both studies emphasize shared systemic obstacles and the urgent need for improved infrastructure, regulatory frameworks, and awareness campaigns to enhance digital health integration in Pakistan's mental healthcare landscape.

Conclusion and implications

This study provides critical insights into the readiness of psychiatrists in Pakistan to embrace digital psychiatry. While there is growing interest in digital tools such as telepsychiatry, AI, mHealth applications, and VR, actual familiarity and usage remain limited. Bridging this gap will require targeted training, infrastructure development, and inclusive policy frameworks.

At the same time, certain limitations should be noted. The study was limited to public psychiatric hospitals, excluding private and military institutions, which may affect generalizability. The reliance on self-reported questionnaires may introduce recall bias, and the use of English alone could have restricted accessibility for some respondents. Future research should expand to private and military facilities, increase sample size, and consider bilingual surveys to foster inclusivity and enhance data reliability.

Despite these limitations, the findings have important implications for practice and policy. Public education campaigns that highlight the safety, benefits, and cultural relevance of digital mental health tools are recommended, alongside implementation strategies that incorporate local beliefs and sensitivities to improve community acceptance. With tailored, context-sensitive strategies, digital psychiatry holds significant promise for expanding access to care and transforming mental health service delivery in Pakistan.

Abbreviations

AI: artificial intelligence

CME: continuing medical education

ECT: electroconvulsive therapy

KMO: Kaiser–Meyer–Olkin

LMICs: low and middle-income countries

MBBS: Bachelor of Medicine, Bachelor of Surgery

MHAs: mental health applications

VIF: variance inflation factor

VR: virtual reality

WHO: World Health Organization

Supplementary materials

The supplementary tables for this article are available at: https://www.explorationpub.com/uploads/Article/file/101179_sup_1.pdf.

Declarations

Acknowledgments

Declaration of Generative AI and AI-assisted technologies in the writing process: During the preparation of this work, the authors used ChatGPT to improve readability and language. After using this tool, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

Author contributions

MMAR: Conceptualization, Investigation, Methodology, Software, Supervision, Writing—original draft, Writing—review & editing. TA: Data curation, Investigation, Writing—original draft, Writing—review &

editing. MH: Data curation, Formal analysis, Writing—original draft, Writing—review & editing. HT: Investigation, Validation, Writing—original draft, Writing—review & editing. RF: Investigation, Validation, Writing—original draft, Writing—review & editing. IS: Methodology, Software, Writing—original draft, Writing—review & editing. FAN: Conceptualization, Methodology, Supervision, Writing—review & editing. All authors read and approved the submitted version.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical approval

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki (2013 version), and received approval from the Ethics Committee of Faisalabad Medical University, Punjab (IRB number F.48-ERC7FMU/2022-23/289).

Consent to participate

Informed consent to publication was obtained from the relevant participants.

Consent to publication

Not applicable.

Availability of data and materials

The raw data supporting the conclusions of this manuscript will be made available by the authors, without undue reservation, to any qualified researcher.

Funding

This research received no external or internal funding or financial support.

Publisher's note

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