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PERCEPTION OF ARTIFICIAL INTELLIGENCE AMONG PHYSICAL THERAPISTS OF PAKISTAN ALONG WITH ITS ETHICAL IMPLICATION

Original Research

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ABSTRACT

Background: Artificial intelligence (AI) is increasingly transforming rehabilitation practices by enhancing diagnostic accuracy, optimizing treatment planning, and reducing the workload of physiotherapists (PTs). In Pakistan, limited research has explored PTs' awareness and perceptions of AI applications in rehabilitation. Understanding these perspectives is crucial for guiding integration strategies and addressing educational gaps in this evolving field.

Objective: To evaluate the knowledge, attitudes, and perceptions of physiotherapists in Pakistan regarding the use of AI in rehabilitation, and to identify associated factors influencing awareness and acceptance.

Methods: A cross-sectional study was conducted between June and September 2023 using a validated four-part questionnaire (content validity index: 0.8) distributed via Google Forms and in paper format. The minimum sample size of 213 was calculated using G*Power (version 3.1.9.7), with a logistic regression model assuming an odds ratio of 1.5, $\alpha = 0.05$, and 80% power. Inclusion criteria were licensed physiotherapists with ≥6 months of clinical or academic experience in Pakistan. Chiropractors, other healthcare professionals, and those unwilling to participate were excluded. Purposive sampling yielded 259 respondents. Data were analyzed using IBM SPSS version 25.0, applying descriptive statistics (frequency, percentage, mean ± SD) with $p \leq 0.05$ considered significant.

Results: Among respondents, 65% were female and 35% male, with a mean age of 26.61 ± 3.56 years. Awareness of AI in rehabilitation was reported by 62.2%, with higher knowledge in those with <5 years of experience (72%) compared to >5 years (58%). Only 22% had used AI tools in clinical practice, while 78% had only heard of them. Most agreed AI could reduce workload (64%) and improve patient care (70%), yet 29% cited difficulty understanding its complexity. Importantly, 89.6% expressed willingness to learn more about AI, and 64% supported its inclusion in rehabilitation curricula.

Conclusion: Physiotherapists in Pakistan generally demonstrated positive perceptions toward AI in rehabilitation, though practical exposure and understanding remain limited. Targeted training and curriculum integration are recommended to enhance readiness for AI adoption.

Keywords: Artificial Intelligence, Attitude of Health Personnel, Knowledge, Pakistan, Perception, Physical Therapists, Rehabilitation.

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INTRODUCTION

The Fourth Industrial Revolution (4IR) has brought unprecedented integration of advanced digital technologies into diverse sectors, including healthcare, where artificial intelligence (AI), machine learning, smart sensors, robotics, big data analytics, and the Internet of Things (IoT) are transforming clinical practice, operational efficiency, and patient care outcomes (1,2). AI, first termed by John McCarthy, represents a branch of computer science dedicated to replicating human intelligence in computational systems (3,4). Its applications span expert systems, natural language processing, speech recognition, and machine vision, with Marvin Minsky defining AI as the ability of a machine to perform tasks deemed intelligent by human standards (5). Among these, "Intelligent Agents," capable of perceiving, understanding, and responding appropriately to their environment, have demonstrated significant potential in improving diagnostic accuracy and enabling personalized therapies in healthcare (6). The field of physiotherapy (PT) has seen increasing demand due to its central role in injury management, restoration of physical function, and enhancement of overall mobility. With the growing adoption of technology in healthcare, AI is emerging as a valuable adjunct in physiotherapy, streamlining workloads, assisting in treatment delivery, and improving patient outcomes (7,8). These technologies offer physiotherapists the capability to serve larger patient populations while minimizing physical strain, yet their integration has elicited diverse professional opinions, shaped by varying levels of awareness, training, and readiness for change (9,10). In Pakistan, the establishment of the National Centre of Artificial Intelligence in 2018 marked a step towards fostering innovation, research, and skill development in AI-related fields. However, despite emerging local initiatives such as AI-based rehabilitation tools, adoption in physiotherapy remains limited, especially in resource-constrained settings (11).

AI applications in rehabilitation are gaining global traction. Studies have examined AI tools in elderly care (12), emotion detection in children (13), and customized therapy programs for chronic pain (14). Research has also explored AI-assisted physiotherapy for stroke rehabilitation (15) and pain recognition using advanced computational methods (16). These developments suggest that AI can complement traditional physiotherapy, though its adoption requires both technological readiness and practitioner acceptance (17,18). Concerns persist regarding the potential for AI to replace certain professional roles, the ethical implications of its use, and the lack of foundational AI knowledge among healthcare providers (19–21). While some view AI as a paradigm shift towards data-driven healthcare, others caution that rapid technological advancements may disrupt established clinical roles and decision-making autonomy (18). Within this context, it is essential to assess physiotherapists' knowledge, perceptions, and preparedness to integrate AI into clinical practice, as well as their views on its ethical and professional implications (22,23). Understanding these perspectives is vital for ensuring that AI adoption enhances rather than undermines physiotherapy practice, enabling evidence-based integration aligned with patient needs and professional values. Therefore, this study aims to investigate the perceptions of Pakistani physiotherapists regarding AI, evaluate their knowledge of its applications, and explore how they foresee its impact and ethical considerations in healthcare.

METHODS

This cross-sectional observational study was conducted in Pakistan, with all data collected in a single phase using standardized sampling instruments for the variables under investigation. A purposive sampling strategy was employed, selected in accordance with the time frame allocated for the completion and submission of the research report (23). The study was carried out over a six-month period. Participation was voluntary, and all respondents were required to be licensed physiotherapists (PTs) employed in Pakistan, either in clinical or academic roles, with professional experience ranging from six months to ten years. Both male and female PTs were eligible for inclusion. Chiropractors, other healthcare professionals such as nurses and general practitioners, as well as PTs unwilling to participate, were excluded from the study. The minimum sample size required to achieve a statistical power of 0.80 was calculated prior to survey distribution using G*Power software (version 3.1.9.7) (24). A logistic regression test was performed for an a priori power calculation, assuming an odds ratio (OR) of 1.5, a significance level of 0.05, and a 95% confidence interval. The analysis determined that a minimum of 213 participants was necessary. The final study sample comprised 256 respondents, which exceeded the calculated requirement and accounted for an anticipated attrition rate of 20%.

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The survey was developed and distributed electronically via Google Forms on June 3, 2023. The introductory section provided participants with a concise explanation of the study's objectives and assurances of confidentiality and anonymity. Informed consent was obtained electronically at the start of the questionnaire through an explicit agreement question. The questionnaire used in this study was adopted from a similar cross-sectional survey conducted in 2022, with permission obtained from the corresponding author via email. The instrument's content validity index (CVI) for the overall survey was 0.8, with individual items ranging between 0.8 and 1.0, indicating acceptable content validity. The survey link was disseminated through multiple online platforms, including Twitter, WhatsApp, and Facebook groups. Additionally, email invitations were sent directly to PTs, with a request to forward the survey link to colleagues who met the inclusion criteria. Data collection took place from June to September 2023. Upon completion, the data were coded in Microsoft Excel 2013 and analyzed using IBM SPSS Statistics software (version 25.0). Descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed to summarize demographic variables. Statistical significance was set at a p-value ≤ 0.05. Ethical approval for the study was obtained from the Office of Research Innovation and Commercialization (ORIC), University of Management and Technology, Lahore. The research adhered to ethical standards for human subject research, with participants providing informed consent before involvement.

RESULTS

The study included 259 physiotherapists from across Pakistan, representing a diverse range of regions and professional sectors. The mean age of participants was 26.61 ± 3.56 years. Female respondents constituted 65% (n=168) of the sample, while males accounted for 35% (n=91). The majority of participants (82.6%, n=214) were from Punjab, representing 23 cities, followed by Khyber Pakhtunkhwa (8.55%, n=22) with respondents from four cities, Sindh (6.9%, n=18) from three cities, and Balochistan (1.9%, n=5) from two cities. Regarding professional sector, 60.6% (n=157) were employed in non-academic clinical settings, 15.8% (n=41) in academic institutions, and 23.2% (n=60) worked in both academic and clinical roles. In terms of specialization, 34% (n=88) were general physiotherapists, 29.7% (n=77) specialized in musculoskeletal and sports rehabilitation, 16.6% (n=43) in neurorehabilitation, 13.5% (n=35) in cardiorespiratory rehabilitation, 5% (n=13) in pediatric rehabilitation, and 1.2% (n=3) in women's health. Most respondents (62.2%, n=161) reported one to five years of experience, while the remaining 37.8% (n=98) had more than five years to over twenty years of professional experience.

In terms of knowledge of AI in rehabilitation, 44% (n=114) reported having knowledge, 14.3% (n=37) had no knowledge, and 3.9% (n=10) expressed mixed responses. When asked about the advantages of AI in rehabilitation, 76.8% supported its potential to reduce therapists' workload, 70.3% agreed it could make patient care more relaxed, and 61.4% believed it could contribute to disease prevention. Regarding AI applications in rehabilitation, agreement was reported for assistive technology (52.9%), goal setting (48.3%), diagnostic tools (45.9%), educational enhancement (43.6%), and disease prediction (39%). Primary concerns about AI implementation in healthcare included inability to understand its application (41.31%, n=107), unpredictability in clinical situations (29.73%, n=77), and minimal personal experience (28.96%, n=75). The majority (64.1%, n=166) agreed that AI applications should be taught within rehabilitation curricula, while 23.94% (n=62) were neutral and 11.97% (n=31) disagreed. A large proportion of participants (89.6%, n=232) expressed willingness to learn more about AI, while 10.42% (n=27) were not interested.

Table 1: Demographic Characteristics of Respondents (n = 259)

Variable		n (%) or Mean ± SD
Mean Age (years) ± SD		26.61 ± 3.56
Gender	Female	168 (65.0)
	Male	91 (35.0)
Province	Punjab	214 (82.6)
	Khyber Pakhtunkhwa	22 (8.55)
	Sindh	18 (6.9)
	Balochistan	5 (1.9)
Sector	Non-academic Clinical	157 (60.6)
	Academic	41 (15.8)
	Both	60 (23.2)

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Variable		n (%) or Mean ± SD
Specialization	General	88 (34.0)
	Musculoskeletal & Sports	77 (29.7)
	Neurorehabilitation	43 (16.6)
	Cardiorespiratory	35 (13.5)
	Pediatric	13 (5.0)
	Women's Health	3 (1.2)
Experience	1–5 years	161 (62.2)
	>5 years	98 (37.8)

Table 2: Knowledge of Artificial Intelligence in Rehabilitation

Knowledge of AI in Rehabilitation	n (%)
Knowledge	114 (44.0)
No Knowledge	37 (14.3)
Mixed Response	10 (3.9)

Table 3: Perceived Advantages of Artificial Intelligence in Rehabilitation

Perceived Advantages	n (%) Agreement
Reduce workload	199 (76.8)
Make patient care more relaxed	182 (70.3)
Contribute to disease prevention	159 (61.4)

Table 4: Agreement with AI Applications in Rehabilitation

AI Application	n (%) Agreement
Assistive technology	137 (52.9)
Goal setting	125 (48.3)
Diagnostic tools	119 (45.9)
Educational enhancement	113 (43.6)
Disease prediction	101 (39.0)

Table 5: Concerns Regarding AI Implementation in Healthcare

Primary Concern	n (%)
Inability to understand AI	107 (41.31)
Unpredictability in situations	77 (29.73)
Minimal personal experience	75 (28.96)

Table 6: Willingness to Learn More About Artificial Intelligence

Willingness to Learn AI	n (%)
Willing	232 (89.6)
Not Willing	27 (10.42)

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Figure 1 Willingness to Learn More About AI

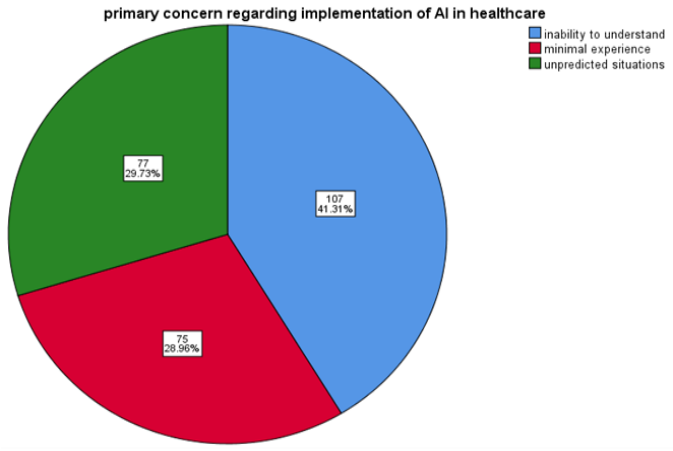
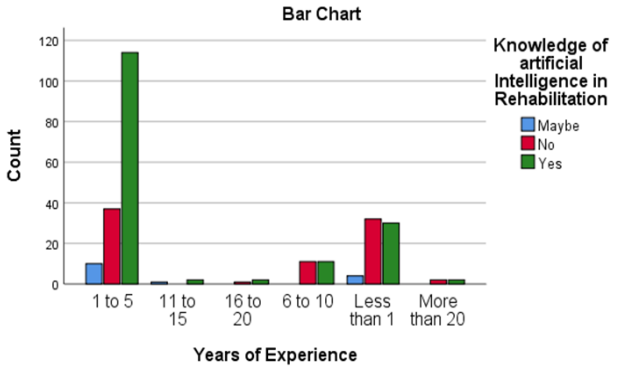
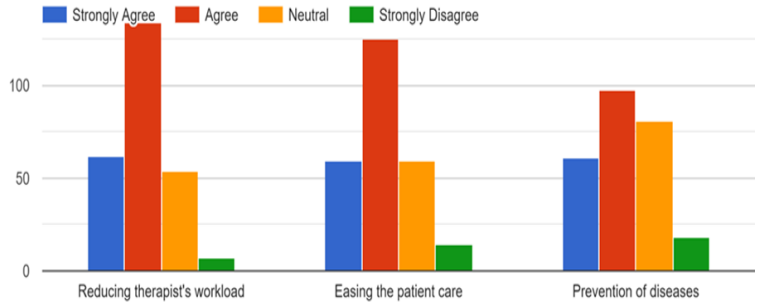
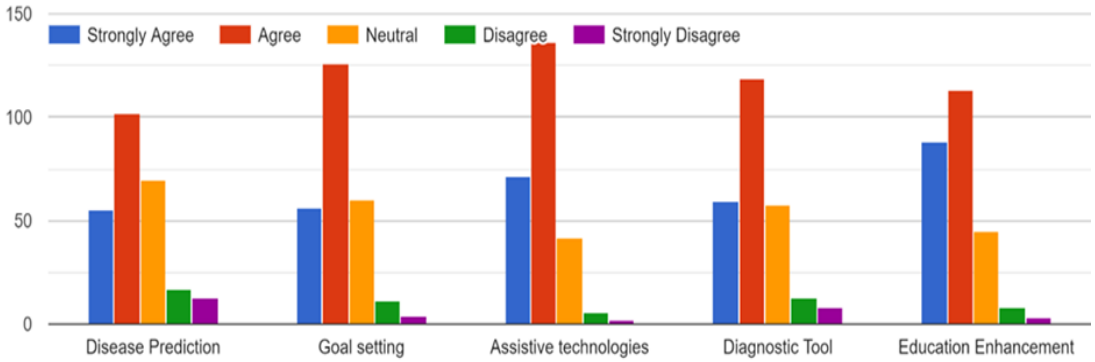


Figure 2 Primary Concern Regarding Implementation of AI in Healthcare







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DISCUSSION

The present study revealed that a substantial proportion of physiotherapists in Pakistan reported awareness of artificial intelligence (AI) applications in rehabilitation, with 62.2% indicating knowledge of such technologies. This finding contrasts with earlier research conducted in Saudi Arabia, where a majority of physiotherapists reported little or no knowledge of AI in rehabilitation (19). The difference may be attributed to variations in regional exposure to emerging technologies, differences in educational integration, or healthcare system dynamics. Notably, despite the higher proportion of respondents in the current study who were aware of AI applications, more than half reported no direct exposure to such technologies in their workplace, which suggests that integration into clinical practice remains limited. This aligns with earlier findings that clinical adoption of AI in rehabilitation is progressing slowly, despite growing global interest (20,21). The analysis further indicated marginal differences in AI awareness between male and female respondents, with slightly higher knowledge levels among males. This pattern is consistent with prior studies in other medical fields, such as dermatology, ophthalmology, radiation oncology, and radiology, where male clinicians demonstrated greater familiarity and confidence in AI technologies (22). However, the narrow gap observed in this study suggests that awareness among female physiotherapists is improving, possibly reflecting broader access to digital resources and professional training opportunities. An inverse relationship between years of experience and AI awareness was also observed, with physiotherapists having less than five years of experience demonstrating higher awareness compared to those with longer professional tenure. This trend mirrors earlier findings (23,24) and likely reflects the greater exposure of recent graduates to digital health concepts during their academic training.

Subspecialty analysis showed that physiotherapists working in general rehabilitation reported the highest awareness of AI applications, with comparatively lower awareness among those in more specialized fields such as neurorehabilitation, cardiorespiratory rehabilitation, pediatric rehabilitation, and women's health. This discrepancy underscores the need for targeted capacity-building initiatives to ensure equitable AI literacy across all subspecialties. A provincial comparison revealed a concentration of AI knowledge in Punjab, with limited awareness in other provinces. This regional disparity may stem from unequal access to technological infrastructure, training programs, and academic initiatives, highlighting the importance of tailored awareness campaigns and professional development opportunities in underserved areas. The study's findings have important implications for AI adoption in rehabilitation. While awareness levels appear promising, the limited workplace exposure and regional disparities indicate that structured implementation strategies are necessary to ensure equitable integration of AI technologies. Furthermore, the finding that most respondents favored the inclusion of AI-related content in rehabilitation curricula reflects readiness for formalized education, which could accelerate adoption and enhance patient care outcomes. However, potential barriers, such as limited technical skills, uncertainty regarding clinical application, and minimal practical exposure, remain challenges that must be addressed through policy development, continuing education programs, and resource allocation.

Strengths of the study include a diverse sample representing multiple provinces, sectors, and specializations, as well as the use of a validated instrument to measure knowledge and perceptions. Nonetheless, certain limitations warrant consideration. The reliance on a self-administered online survey may have introduced response bias, and purposive sampling limits the generalizability of findings. The absence of qualitative data restricts the ability to capture deeper insights into perceptions, experiences, and contextual barriers to AI adoption. Moreover, the study did not explore in detail the types of AI tools used in clinical practice, the challenges encountered during implementation, or patient perspectives—factors that could inform more comprehensive policy recommendations. Future research should aim to incorporate mixed-methods designs to capture both quantitative and qualitative dimensions of AI adoption in rehabilitation (18,19). Comparative studies across regions and healthcare systems could provide valuable insights into contextual differences influencing acceptance and integration. Additionally, longitudinal research could evaluate the impact of AI adoption on clinical efficiency, patient outcomes, and professional satisfaction over time. Investigating patient attitudes toward AI-assisted rehabilitation could further inform strategies for ethical, patient-centered implementation. By addressing these dimensions, future work could contribute to a clearer understanding of how AI can be effectively and sustainably embedded within physiotherapy practice in Pakistan and beyond.

CONCLUSION

The study concluded that physiotherapists demonstrated a generally positive outlook toward the role of artificial intelligence in rehabilitation, with many recognizing its potential to enhance clinical practice and patient care. While awareness was evident across various experience levels, less experienced practitioners appeared more attuned to emerging technologies compared to their senior

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counterparts. The primary challenge identified was difficulty in understanding the complexity of AI applications, yet there was a strong willingness among respondents to expand their knowledge. These findings highlight the importance of structured education and training initiatives, including the integration of AI-related content into physical therapy curricula, to support informed adoption and effective utilization of AI in rehabilitation settings.

AUTHOR CONTRIBUTION

Author	Contribution
Rahila Anis*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Ubaidullah khan	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
Sania Akram	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Maida Mushtaq	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Mahnoor Liaqat	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Nadia Talib	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Fatima Nasir	Contributed to study concept and Data collection Has given Final Approval of the version to be published

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