

Nurses' Attitudes and Readiness Toward the Integration of Artificial Intelligence in Clinical Practice in Pakistan

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Abstract: Artificial Intelligence (AI) is increasingly transforming healthcare delivery, offering opportunities to enhance efficiency, clinical decision-making, and patient safety. However, successful AI implementation in nursing practice depends on nurses' readiness and attitudes toward its integration. Limited data exist on this topic within the Pakistani context. **Objective:** To assess nurses' attitudes and readiness toward the integration of Artificial Intelligence in clinical practice using the Technology Readiness Index 2.0 (TRI 2.0). **Methods:** A descriptive cross-sectional study was conducted at a tertiary care hospital in Pakistan from July to December. A total of 90 registered nurses working in inpatient, outpatient, emergency, and critical care units were recruited using non-probability convenience sampling. Data were collected using an adapted version of the TRI 2.0 scale, comprising four dimensions: optimism, innovativeness, discomfort, and insecurity. Each item was rated on a 5-point Likert scale, and composite readiness scores were computed. Reliability was confirmed with Cronbach's alpha ($\alpha = 0.88$). Statistical analysis was performed using SPSS version 26. Associations between demographic factors and readiness were evaluated using t-tests and a one-way ANOVA, with $p < 0.05$ as the significance level. **Results:** Participants had a mean age of 31.6 ± 5.8 years; 81.1% were female, and 70.0% held a Bachelor of Science in Nursing. The overall AI readiness score was high (mean = 3.91 ± 0.54), with optimism (4.12 ± 0.65) and innovativeness (3.96 ± 0.71) showing strong positivity. Moderate discomfort (2.85 ± 0.78) and insecurity (2.72 ± 0.82) indicated manageable apprehension toward AI technologies. Educational qualifications were significantly associated with AI readiness ($p < 0.01$), whereas gender and experience were not. **Conclusion:** Nurses in Pakistan demonstrated positive attitudes and high readiness toward AI integration in clinical practice. Educational advancement emerged as a key factor enhancing acceptance and preparedness for AI technologies. Targeted educational interventions and structured training programs are essential to address residual concerns and promote effective, ethical, and confident AI adoption in nursing practice.

Keywords: Artificial Intelligence, Nursing, Readiness, Technology Readiness Index, Healthcare Innovation

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Introduction

The integration of artificial intelligence (AI) into clinical nursing practice is rapidly changing healthcare systems worldwide. AI technologies promise numerous benefits, including enhancing clinical decision-making, improving patient outcomes, and streamlining healthcare processes. However, the acceptance and readiness of nursing professionals to embrace these technologies remain critical factors influencing successful implementation. Understanding nurses' attitudes and readiness toward AI integration is therefore essential for a smooth transition and effective utilization in clinical settings.

Recent research indicates a generally positive perception of AI among nursing professionals. For instance, a study by Abuzaid et al. found that over 70% of nurses expressed optimism about AI's potential to support their daily practices (1). Similarly, Al-Olimat et al. found that nursing students in Saudi Arabia demonstrated a moderate level of readiness and acceptance toward AI healthcare technologies, underscoring the need for initiatives that highlight AI's benefits, such as improved patient safety and clinical efficiency (2). Furthermore, studies indicate that educational levels positively correlate with nurses' attitudes toward AI deployment, suggesting that as nursing professionals advance in their education, their acceptance and preparedness to utilize AI technologies also enhance (3). Resistance to change has also been identified as a significant barrier to AI integration in nursing. Amin et al. noted that while many nurses expressed positive attitudes toward AI, concerns about job security and changes to traditional roles pose challenges to embracing this technological advancement (4). This is echoed by Zhang et al., who found that although nursing students generally support AI in clinical practice, they experience

underlying anxiety about potential job displacement (5). Thus, addressing these concerns through education, discussion, and supportive policies is vital for fostering a positive attitude toward AI among nursing staff.

The evolving landscape of nursing education underscores the need to prepare current and future nurses for AI integration. Studies indicate that exposure to AI technologies during training can enhance psychological comfort with their application. Consequently, this could lead to improved patient care and more efficient workflows, as indicated by Paré et al., who highlighted the transformative potential of AI to foster interdisciplinary collaboration and enhance patient-centered care (6). However, nurses' digital literacy can significantly influence their engagement with AI, underscoring the role of educational institutions in this transition (7).

In Pakistan, integrating AI into nursing practice is particularly pertinent given the country's numerous healthcare challenges. The National Center for Artificial Intelligence is advancing AI-driven innovation in healthcare; however, overall exposure to AI technologies in clinical settings remains limited (8). Investigating and addressing Pakistani nurses' attitudes and readiness toward AI integration is, therefore, essential for developing strategies tailored to this unique demographic and for ensuring successful implementation that aligns with local healthcare needs and contexts.

Thus, fostering positive attitudes and readiness toward AI among nurses is fundamental to achieving effective integration of these technologies in clinical practice. This synthesis of current literature highlights the importance of targeted educational initiatives and the exploration of potential barriers that nursing professionals face. By tailoring approaches to the specific context of healthcare in Pakistan, the groundwork can be



laid for successful AI integration, ultimately leading to improved healthcare outcomes.

Methodology

This descriptive cross-sectional study was conducted at a tertiary care hospital in Pakistan from July to December. The study population included registered nurses working in inpatient, outpatient, emergency, and critical care units. A total of 90 participants were recruited through non-probability convenience sampling after obtaining informed consent. Data were collected using the Technology Readiness Index 2.0 (TRI 2.0) developed by Parasuraman and Colby (2015) (16), which was adapted for the healthcare context to assess nurses' attitudes and readiness toward integrating Artificial Intelligence (AI). The adapted questionnaire consisted of 16 items distributed across four domains:

1. Optimism (belief that AI improves efficiency and quality of care),
2. Innovativeness (propensity to embrace new AI tools),
3. Discomfort (perceived difficulty in controlling AI systems), and
4. Insecurity (concern over reliability and ethical implications).

Each item was rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The composite readiness score was calculated as (Optimism + Innovativeness) – (Discomfort + Insecurity), per TRI 2.0 scoring recommendations.

The adapted instrument was reviewed by a panel of nursing and health informatics experts for content validity and pilot-tested on 10 nurses before full implementation. The instrument's reliability in this population was confirmed with a Cronbach's alpha coefficient of 0.88. Ethical approval was obtained from the institutional review board. Participation was voluntary, and confidentiality was ensured throughout the study. Data were analyzed using SPSS version 26.0. Descriptive statistics (frequency, mean, standard deviation) were calculated for demographic and TRI 2.0 variables. The association between demographic factors and readiness was evaluated using t-tests and one-way ANOVA, with $p < 0.05$ considered statistically significant.

Results

A total of 90 registered nurses from various clinical departments participated in the study. The mean age was 31.6 ± 5.8 years (range 22–45). The majority of participants were female (81.1%), consistent with the gender composition of the nursing workforce in Pakistan. Most nurses (62.2%) were staff nurses, 24.4% were charge nurses, and 13.3% were nurse managers. The mean professional experience was 7.3 ± 4.5 years, and the majority (70.0%) held a Bachelor of Science in Nursing (BSN) degree. Most respondents were young-to-middle-aged female nurses with bachelor-level education and 5–10 years of professional experience. This profile reflects a balanced, experienced sample suitable for assessing AI-related readiness and attitudes. (Table 1)

Table 1. Demographic Characteristics of the Participants (n = 90)

Variable	Frequency (n)	Percentage (%)
Age (years)		
22–30	35	38.9
31–40	42	46.7
>40	13	14.4
Gender		
Male	17	18.9
Female	73	81.1
Educational Qualification		
Diploma in Nursing	18	20.0
BSc Nursing	63	70.0
MSc Nursing	9	10.0
Professional Designation		
Staff Nurse	56	62.2
Senior/Charge Nurse	22	24.4
Nurse Manager	12	13.3
Years of Experience		
<5 years	28	31.1
5–10 years	40	44.4
>10 years	22	24.4

Table 2 indicates high optimism and innovativeness scores among nurses, reflecting strong confidence in AI's potential to improve healthcare delivery. Discomfort and insecurity scores were moderate, suggesting some apprehension regarding system errors and ethical

implications, but not strong resistance. The overall readiness score (3.91) demonstrates a positive disposition toward adopting AI-assisted clinical tools. (Table2)

Table 2. Mean Scores of Technology Readiness Index 2.0 (TRI 2.0) Dimensions

TRI 2.0 Dimension	Mean ± SD	Interpretation
Optimism (belief AI improves care efficiency)	4.12 ± 0.65	High
Innovativeness (willingness to experiment with new AI tools)	3.96 ± 0.71	Moderate to High
Discomfort (fear of losing control over AI systems)	2.85 ± 0.78	Moderate
Insecurity (distrust of AI outcomes)	2.72 ± 0.82	Low to Moderate
Overall AI Readiness Score	3.91 ± 0.54	High Readiness

Educational level was significantly associated with readiness ($p < 0.01$), where nurses holding postgraduate qualifications showed the highest TRI 2.0 scores. No significant differences were observed

between genders or years of experience, though readiness slightly increased with seniority. (Table 3)

Table 3. Association Between Demographic Variables and AI Readiness (TRI 2.0 Composite Score)

Variable	Mean Readiness Score ± SD	p-value
Gender		
Male	3.86 ± 0.53	0.41
Female	3.92 ± 0.55	
Educational Qualification		
Diploma	3.54 ± 0.63	<0.01 *
BSc	3.92 ± 0.49	
MSc	4.12 ± 0.37	
Years of Experience		
<5 years	3.76 ± 0.58	0.07
5–10 years	3.88 ± 0.52	
>10 years	3.97 ± 0.48	

Figure 1 shows that 59% of nurses demonstrated high readiness, 31% moderate readiness, and 10% low readiness. This distribution reflects a predominantly positive orientation toward AI-based healthcare technologies. Figure 2 displays the mean scores of the four TRI 2.0

domains, highlighting that optimism and innovativeness were notably higher than discomfort and insecurity, reinforcing nurses' openness to technological transformation in clinical environments.

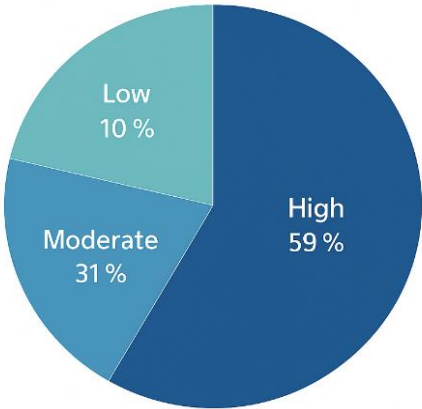


Figure 1. Distribution of Nurses' Overall Readiness Levels Toward AI Integration

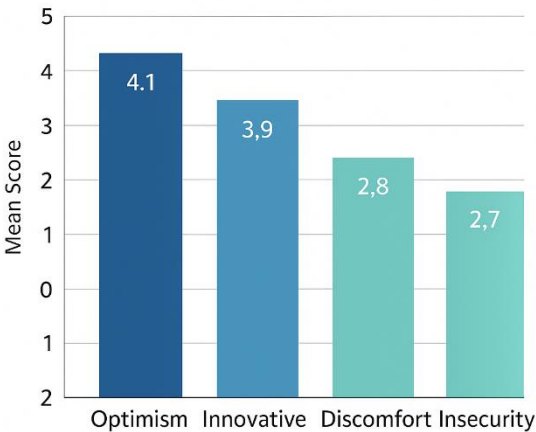


Figure 2. Mean TRI 2.0 Scores Across Dimensions

Discussion

The study aimed to assess registered nurses' attitudes and readiness toward integrating artificial intelligence (AI) into clinical practice in Pakistan. A total of 90 registered nurses from various clinical departments participated, presenting a demographic profile characterized by young-to-middle-aged females with substantial experience. This discussion compares the findings of this study with existing literature, focusing on key dimensions such as demographic characteristics, technology readiness scores, and the relationship between educational qualifications and AI readiness.

The sample consisted predominantly of female participants (81.1%), with an average age of 31.6 years and a mean professional experience of 7.3 years. This gender composition aligns with the traditional workforce distribution in nursing, as noted by Abuzaid et al., who discussed the predominance of female nurses in many countries, including Pakistan (9). Furthermore, the participants' educational qualifications reveal that 70% held a Bachelor's degree in nursing, consistent with trends indicating a push towards higher educational standards within the nursing profession 10. Studies by Alqaissi and Qtait underscore the significance of a well-educated nursing workforce when incorporating new technologies, including AI, into practice (10).

The findings on technology readiness showcased high optimism (4.12 ± 0.65) regarding AI's potential to enhance healthcare delivery. This optimism mirrors the growing recognition of AI's transformative capabilities across various healthcare settings, as highlighted by Dai and Tayur, who asserted that AI can significantly augment healthcare delivery systems when effectively integrated (11). The innovativeness score of 3.96 ± 0.71 also indicates that nurses are willing to experiment with AI tools, consistent with findings by Rony et al., who emphasize the importance of innovative thinking among nursing professionals when engaging with new technologies (12).

Moderate discomfort (2.85 ± 0.78) and insecurity (2.72 ± 0.82) scores indicate some apprehension about using AI systems, reflecting common concerns reported in the literature about potential errors and the ethical implications of AI technologies. Shankar et al. reported similar findings, indicating that while healthcare professionals recognize AI's advantages, they often express fears about accountability and the reliability of AI systems, which could impede full adoption (13). Hence, it is crucial to address these concerns through targeted education and training.

As indicated in Table 3, educational qualifications significantly influenced readiness scores ($p < 0.01$). Nurses with advanced degrees—specifically, those with a master's—demonstrated higher readiness, aligning with findings by Alqaissi and Qtait, who emphasized that advanced educational backgrounds positively correlate with the adoption

of AI in nursing (10). However, no significant differences in readiness scores were found by gender or years of experience. This lack of correlation with experience diverges from previous studies, which suggest that seasoned practitioners often exhibit higher readiness levels due to accumulated skills and knowledge (14). Nonetheless, the slight increase in readiness with seniority is consistent with a study by Liu et al., which found that experienced professionals are generally more open to adopting innovations (15).

Thus, the findings of this study reinforce nurses' positive attitudes and moderate readiness to integrate AI into clinical practice. The demographic similarity to prior literature suggests that the trends observed in this study may reflect broader patterns in nursing across various global contexts. Importantly, addressing the discomfort and insecurity associated with AI requires educational initiatives and robust training programs. This process will ensure that nurses in Pakistan—and elsewhere—can leverage AI technologies to improve clinical outcomes without sacrificing the quality of care.

Conclusion

This study highlights that Pakistani nurses are generally optimistic and ready to integrate AI into their clinical practice. Higher educational attainment was strongly associated with greater readiness, underscoring the importance of continuous professional development. Addressing ethical concerns and system-related anxieties through tailored training will be crucial to achieving effective, sustainable AI adoption in nursing. By fostering informed confidence and technical competence, the nursing workforce can play a pivotal role in advancing AI-driven healthcare in Pakistan.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-MMS-033-24)

Consent for publication

Approved

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Conflict of interest

The authors declared no conflicts of interest.

Author Contribution

NS (MS Nursing Scholar)

Manuscript drafting, Study Design,

HS

Review of Literature, Data entry, Data analysis, and drafting articles.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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