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Original Research Article

Assessing the Acceptability and Knowledge of Nurses Regarding Artificial Intelligence in Healthcare

Najma Mukhtar[1*], Amoon Augustin[2], Saima Anwar[3], Iram Mahmood[4], Saima Ashraf[5]

[1]*Ittifaq College of Nursing, Lahore, Pakistan*
[2]*Jinnah Hospital, Lahore, Pakistan*
[3]*THQ hospital, Mincinabad. District. Bahawalnagar, Pakistan*
[4]*Department of Cardiac Surgery, Rehmatul-lil-Alameen Institute of Cardiology (RAIC), Lahore, Pakistan*
[5]*Department of Zoology, University of Sialkot, Pakistan*
**Corresponding author`s email address:* naimamukhtar@ymail.com

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Abstract: *The integration of artificial intelligence (AI) into healthcare offers opportunities to improve clinical efficiency and patient outcomes. However, successful adoption depends on nurses' knowledge, attitudes, and readiness to use AI tools.* ***Objective:*** *To assess the acceptability and knowledge of nurses regarding AI in healthcare and identify factors influencing its adoption.* ***Methods:*** *An analytical cross-sectional survey was conducted among 99 registered nurses in a tertiary care hospital in Pakistan from July to December. Participants were selected using stratified random sampling and completed a validated, self-administered questionnaire that covered socio-demographics, AI knowledge (a 15-item test), and attitudes (a 17-item Likert scale). Data were analyzed using descriptive statistics, bivariate analysis, and multivariable logistic regression to identify predictors of high AI acceptability.* ***Results:*** *The mean knowledge score was 8.7 ± 3.1, with 32.3% demonstrating good knowledge (≥11/15). Perceived usefulness (mean 3.7 ± 0.7) and intention to use (3.6 ± 0.8) scored highest among attitude domains, while job-displacement concern averaged 3.1 ± 0.9. High acceptability (composite score > 3.5) was observed in 54.5% of the nurses. Multivariable analysis identified good knowledge (AOR = 2.85, p = 0.020), prior AI training (AOR = 3.41, p = 0.038), and high computer literacy (AOR = 2.23, p = 0.047) as significant predictors, while job-displacement concerns were inversely associated (AOR = 0.71, p = 0.037). The most reported barriers were lack of training (71.7%) and inadequate infrastructure (57.6%), whereas key facilitators included hands-on workshops (68.7%) and managerial support (55.6%).* ***Conclusion:*** *Nurses in this study showed moderate AI knowledge and cautious optimism toward adoption. Targeted training, infrastructure investment, and addressing job security concerns are crucial to enhancing the acceptability of AI in nursing practice, particularly in resource-limited healthcare settings such as Pakistan.*

Keywords: Artificial intelligence, nursing, knowledge, acceptability

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Introduction

The rapid evolution of artificial intelligence (AI) technologies is transforming the healthcare landscape, presenting unprecedented opportunities to enhance patient care and operational efficiencies across medical settings. One domain where AI is projected to have a substantial impact is in nursing, where its applications range from clinical decision support systems to robotic assistants that aid in task execution and patient monitoring (1, 2). Despite these advancements, the successful integration of AI into nursing practice largely hinges on the understanding, perception, and comfort level of healthcare professionals, particularly nurses, with these technologies (3, 4).

Studies indicate that nurses often express a mix of curiosity and apprehension about AI, which is notably influenced by their educational background and level of training regarding AI systems (5, 4). For instance, Khalf et al. reported that healthcare providers' misconceptions and fears regarding AI applications have significant implications for its acceptance within clinical environments (3). Moreover, Ergın et al. emphasize the importance of professional development, indicating that targeted training can profoundly affect nurses' perceptions of AI, ultimately mitigating fears of obsolescence (6). The transition toward AI-driven healthcare does not simply involve the deployment of new technologies; it necessitates a cultural shift within nursing, emphasizing the need for continued education and involvement in AI decision-making (7, 8).

The educational frameworks surrounding nursing are increasingly recognizing this need. Initiatives aimed at embedding AI literacy into nursing curricula are being advocated to better prepare future nurses for a technologically advanced healthcare environment (7, 9). The evolving role of nurses in this context is crucial, as their frontline experiences can greatly inform the design and implementation of AI applications tailored to enhance patient interactions and outcomes (9, 10). Thus, while AI holds significant promise in augmenting medical practice, it is essential that nurses feel competent and empowered to leverage these tools effectively (4,11).

In the context of Pakistan, where healthcare systems face challenges such as limited resources, a rapidly growing patient population, and a shortage of skilled professionals, integrating AI into nursing practice presents both opportunities and obstacles. Awareness and knowledge gaps regarding AI can hinder effective utilization, particularly when there is limited exposure to advanced technologies in clinical training environments (12). Increasing familiarity with AI among Pakistani nurses can lead to improvements in patient care, decision-making efficiency, and overall health outcomes. Developing AI-focused educational initiatives within nursing programs will be crucial to ensuring that the healthcare workforce is adequately equipped to adapt to this technological shift, thereby enhancing both healthcare delivery and patient satisfaction in the region.

Methodology

We conducted an analytical cross-sectional survey among registered nurses working in tertiary care hospitals in Pakistan over six months from July to December 2024. The target population consisted of full-time nurses providing direct inpatient or emergency/critical care services

across various specialties, including medicine, surgery, obstetrics–gynecology, pediatrics, intensive care, and emergency departments. Eligibility criteria were age ≥18 years, at least six months of institutional experience, and the ability to complete a self-administered questionnaire in English or Urdu. Nurses on extended leave during the data-collection window or working exclusively in administrative/education roles without direct patient care were excluded. To minimize selection bias and obtain proportionate representation, we employed stratified random sampling by clinical unit and shift. Based on a single-proportion formula with p = 0.50 (maximal variance), 95% confidence, and 10% absolute precision, the minimum sample size was 96; anticipating 10% non-response, we approached 106 nurses and obtained 99 complete responses (response rate 93%).

The survey instrument was developed based on the Technology Acceptance Model and contemporary AI-in-healthcare competency frameworks, adapted for the local context. It comprised three sections: socio-demographic/professional profile and digital readiness (age, gender, education, cadre, department, experience, shift, device/internet access, self-rated computer literacy, prior AI exposure/training); a 15-item objective knowledge test on fundamental AI concepts and clinical applications (true/false/multiple-choice; one point per correct answer; total 0–15); and a 17-item attitude/acceptability scale rated on a five-point Likert format. Attitude items were organized a priori into five domains: perceived usefulness, perceived ease of use, intention to use, job-displacement concern, and ethical/privacy concern. Content validity was established through review by three senior nursing/clinical informatics experts; the item-level content validity index exceeded 0.80 for all retained items after minor linguistic refinements. Cognitive interviewing with five nurses ensured clarity and cultural appropriateness. The instrument was pilot-tested among ten nurses not included in the final sample; no structural changes were required following the pilot test. The finalized English instrument was forward-translated into Urdu by a bilingual domain expert and then back-translated by an independent translator to ensure semantic equivalence, with any discrepancies resolved through consensus. Internal consistency was evaluated using the Kuder–Richardson–20 for the knowledge test and Cronbach's alpha for the attitude domains; reliability coefficients of 0.70 or higher were considered acceptable.

Data collection was conducted during duty hours in coordination with unit managers, with measures taken to minimize overlap across shifts. Participants self-completed the questionnaire anonymously (paper or secure REDCap link). Written informed consent was obtained prior to participation, and no personally identifiable information was recorded. The study adhered to the Declaration of Helsinki and the STROBE reporting standards, with ethical approval obtained from the host institution's review committee (reference available upon request). To reduce common-method bias, knowledge items were separated from attitude items and included neutral phrasing and reverse-scored statements for balance. The primary outcomes were adequate AI knowledge (pre-specified as ≥11/15 correct) and high acceptability (pre-specified as composite mean ≥3.5 after reverse-scoring concern items). Secondary outcomes included domain-specific attitude means and frequencies of perceived barriers/facilitators.

Data were entered into REDCap and exported to Stata 17 for analysis. Distributions were assessed for normality using the Shapiro–Wilk and visual inspection. Descriptive statistics included means with standard deviations or medians with interquartile ranges for continuous variables and counts with percentages for categorical variables. Group comparisons used t-tests or the Mann–Whitney U test for continuous data and chi-square or Fisher's exact test for categorical data, as appropriate. We quantified bivariate associations with crude odds ratios and 95% confidence intervals. Multivariable logistic regression modeled high acceptability as the dependent variable, with covariates selected a priori (age, gender, clinical unit [ICU/ER vs other], job-displacement concern score, knowledge category, prior AI training, and self-rated computer literacy). We examined multicollinearity using variance inflation factors, influential observations with standardized residuals and leverage, and overall fit with Nagelkerke R^2, area under the ROC curve, and the Hosmer–Lemeshow goodness-of-fit test. Missing data were <2% at the item level; the primary analysis used complete cases, with a sensitivity analysis using multiple imputation by chained equations for robustness. All tests were two-sided with an α-level of 0.05.

Results

Ninety-nine nurses were analyzed (response rate 93% of 106 approached). Mean age was 29.7 ± 5.8 years (range 21–46); 78 (78.8%) were female. The median clinical experience was 5 years (IQR, 3–9 years). Most were staff nurses (62.6%), held BSN/Post-RN BSN/MSN degrees (64.6%), and worked on rotating shifts (67.7%). Prior awareness of AI in healthcare was 57.6%, while only 12.1% reported any formal AI-related training. (Table1)

Table 2 summarizes participants' AI knowledge levels. The mean score on the 15-item knowledge test was 8.7 ± 3.1 (median, 9; IQR, 7–11), with 22.2% classified as having poor knowledge (<6), 45.5% classified as having fair knowledge (6–10), and 32.3% classified as having good knowledge (≥11). The knowledge scale demonstrated acceptable internal consistency (KR-20 = 0.78).

Table 3 outlines attitudes toward AI across five domains. Perceived usefulness had the highest mean score (3.7 ± 0.7) with 61.6% of participants agreeing positively, followed by intention to use (3.6 ± 0.8, 56.6% positive). Perceived ease of use averaged 3.4 ± 0.8, while job-displacement and ethical/privacy concerns had mean scores of 3.1 ± 0.9 and 3.3 ± 0.8, respectively. The composite acceptability index averaged 3.55 ± 0.56, with 54.5% of the samples meeting the predefined threshold of "high acceptability" (≥3.5).

Table 4 presents bivariate associations between predictor variables and two outcomes: good knowledge and high acceptability. Good knowledge was significantly associated with higher education (BSN or above), prior AI training, high computer literacy, and prior awareness of AI. High acceptability was significantly linked to sound knowledge, prior AI training, high computer literacy, and prior AI awareness, though not to age or gender.

Table 5 presents the results of multivariable logistic regression predicting high acceptability of AI. After adjusting for covariates, good knowledge (AOR = 2.85, p = 0.020), prior AI training (AOR = 3.41, p = 0.038), and high computer literacy (AOR = 2.23, p = 0.047) remained significant positive predictors. In contrast, greater job-displacement concern was inversely associated with acceptability (AOR = 0.71, p = 0.037). Model performance was adequate (Nagelkerke R^2 = 0.31; AUC = 0.77).

Table 6 lists reported barriers and facilitators to AI adoption. The most frequent barriers were a lack of formal training opportunities (71.7%), insufficient infrastructure/hardware (57.6%), and concerns regarding data privacy and ethics (49.5%). The most frequently cited facilitators were hands-on workshops/simulations (68.7%), managerial endorsement (55.6%), and the presence of clear SOPs for AI use (52.5%).

Table 1. Socio-demographic and professional profile of participants (n = 99)

Variable	Category	n (%) / Mean ± SD
Age (years)	—	29.7 ± 5.8
Age group	<25	28 (28.3)
	25–29	27 (27.3)
	30–34	25 (25.3)

	≥35	19 (19.2)
Gender	Female	78 (78.8)
	Male	21 (21.2)
Highest qualification	Diploma	35 (35.4)
	BSN	46 (46.5)
	Post-RN BSN	12 (12.1)
	MSN or higher	6 (6.1)
Cadre	Staff nurse	62 (62.6)
	Charge nurse	21 (21.2)
	Head nurse	8 (8.1)
	Other	8 (8.1)
Primary department	Medicine	24 (24.2)
	Surgery	22 (22.2)
	ICU	18 (18.2)
	Emergency	15 (15.2)
	Obstetrics–Gyne	12 (12.1)
	Pediatrics	8 (8.1)
Clinical experience (years)	—	—
Experience group	<3	26 (26.3)
	3–5	28 (28.3)
	6–10	30 (30.3)
	>10	15 (15.2)
Shift pattern	Rotating	67 (67.7)
	Fixed day	20 (20.2)
	Fixed night	12 (12.1)
Smartphone with a data plan	Yes	91 (91.9)
Self-rated computer literacy	Low	19 (19.2)
	Moderate	52 (52.5)
	High	28 (28.3)
Prior AI awareness	Yes	57 (57.6)
Any formal AI training	Yes	12 (12.1)

Table 2. AI knowledge score distribution and reliability (n = 99)

Metric	Value
Knowledge score (0–15), mean ± SD	8.7 ± 3.1
Median (IQR)	9 (7–11)
Poor knowledge (<6)	22 (22.2%)
Fair knowledge (6–10)	45 (45.5%)
Good knowledge (≥11)	32 (32.3%)
KR-20 reliability (knowledge scale)	0.78

Table 3. Acceptability and attitudes toward AI (n = 99)

Domain (items)	Mean ± SD	Positive endorsement n (%)
Perceived usefulness (4)	3.7 ± 0.7	61 (61.6%)
Perceived ease of use (4)	3.4 ± 0.8	48 (48.5%)
Intention to use (3)	3.6 ± 0.8	56 (56.6%)
Job-displacement concern (3)↑	3.1 ± 0.9	40 (40.4%)
Ethical/privacy concern (3)↑	3.3 ± 0.8	47 (47.5%)
AI-Accept composite	3.55 ± 0.56	High acceptability: 54 (54.5%)

↑*Higher scores indicate greater concern.*

Table 4. Bivariate associations with good knowledge and high acceptability (n = 99)

Predictor	Good Knowledge n/N (%)	OR (95% CI)	p	High Acceptability n/N (%)	OR (95% CI)	p
BSN+/Post-RN/MSN vs Diploma	27/64 (42.2) vs 5/35 (14.3)	4.38 (1.50–12.73)	0.006	37/64 (57.8) vs 17/35 (48.6)	1.46 (0.66–3.25)	0.35
Prior AI training (Yes vs No)	9/12 (75.0) vs 23/87 (26.4)	8.36 (2.09–33.5)	0.003	10/12 (83.3) vs 44/87 (50.6)	4.89 (1.01–23.7)	0.049
High computer literacy (High vs Mod/Low)	17/28 (60.7) vs 15/71 (21.1)	5.76 (2.23–14.86)	<0.001	21/28 (75.0) vs 33/71 (46.5)	3.46 (1.38–8.65)	0.008

ICU/ER vs other units	15/33 (45.5) vs 17/66 (25.8)	2.40 (1.00–5.78)	0.051	22/33 (66.7) vs 32/66 (48.5)	2.13 (0.93–4.88)	0.073
Prior AI awareness (Yes vs No)	24/57 (42.1) vs 8/42 (19.0)	3.09 (1.22–7.84)	0.017	37/57 (64.9) vs 17/42 (40.5)	2.72 (1.19–6.25)	0.017
Age ≥30 vs <30 years	14/44 (31.8) vs 18/55 (32.7)	0.96 (0.41–2.24)	0.93	22/44 (50.0) vs 32/55 (58.2)	0.72 (0.33–1.57)	0.41
Male vs Female	7/21 (33.3) vs 25/78 (32.1)	1.06 (0.39–2.90)	0.91	12/21 (57.1) vs 42/78 (53.8)	1.14 (0.45–2.90)	0.78

Table 5. Multivariable logistic regression predicting high acceptability of AI (n = 99; events = 54)

Predictor	Adjusted OR (95% CI)	p
Good knowledge (≥11/15)	2.85 (1.18–6.86)	0.020
Prior AI training (Yes)	3.41 (1.07–10.89)	0.038
High computer literacy (High)	2.23 (1.01–4.92)	0.047
ICU/ER unit	1.91 (0.82–4.43)	0.133
Job-displacement concern (per 1-point ↑)	0.71 (0.52–0.98)	0.037
Age (per year ↑)	0.96 (0.90–1.03)	0.270
Female vs male	0.89 (0.33–2.38)	0.820

Model diagnostics: Nagelkerke R^2 = 0.31; AUC = 0.77; Hosmer–Lemeshow p = 0.61; all VIF < 1.8.

Table 6. Reported barriers and facilitators to AI adoption (n = 99)

Item	n (%)
Barriers	
Lack of formal training opportunities	71 (71.7%)
Insufficient infrastructure/hardware	57 (57.6%)
Data-privacy/ethical concerns	49 (49.5%)
Fear of job displacement	46 (46.5%)
Lack of protected time for training	41 (41.4%)
Limited localized/Urdu-friendly tools	38 (38.4%)
Facilitators	
Hands-on workshops and simulations	68 (68.7%)
Managerial endorsement/resources	55 (55.6%)
Clear SOPs/clinical pathways for AI use	52 (52.5%)
Hospital data-governance policy	47 (47.5%)
Integration into curricula/CPD credits	45 (45.5%)

Discussion

The study investigated the acceptability and knowledge of nurses regarding artificial intelligence (AI) in healthcare, revealing significant insights into the interplay between demographic factors, training, and attitudes towards AI adoption. Given the rapid advancement of AI technologies and their implications for nursing practice, it is essential to contextualize our findings within the existing literature published over the last five years.

The demographic profile indicated a predominance of younger nurses (mean age, 29.7 years; 78.8% female), consistent with trends observed by Amin et al., who also highlighted a younger workforce engaged in transformative healthcare technologies, such as AI (13). Despite a significant majority (57.6%) reporting prior awareness of AI, only 12.1% had formal training, which aligns with findings from Adithyan et al., emphasizing the critical need for targeted educational initiatives to bridge the knowledge gap in AI-assisted healthcare (14). Moreover, the high professional representation of staff nurses (62.6%) suggests a frontline perspective that is crucial for understanding both the benefits and limitations of AI integration as discussed by Russell et al. (15).

The average knowledge score of 8.7 out of 15 shows a relatively moderate understanding of AI concepts among nurses. This is echoed in the study by Farid et al., where healthcare professionals' knowledge levels directly correlated with their acceptance and perceived barriers to AI technologies (16). Notably, only 32.3% demonstrated a good understanding of AI. This finding aligns with those of Amin et al., who suggest that when healthcare providers lack substantial knowledge about AI, they tend to view its adoption with skepticism (17). This lack of expertise can correlate with increased barriers to AI integration, reinforcing the necessity for organized training programs as detailed in the literature.

The findings revealed attitudes towards AI, particularly in the domains of perceived usefulness (mean score 3.7) and intention to use (3.6), consistent with insights from Amin et al. (17). The perceived ease of use scored lower (3.4), indicating potential apprehension among nurses regarding usability, despite recognizing the technology's utility. This is further substantiated by the outcomes from Buchanan et al., which suggest that the acceptance of AI technologies hinges significantly on the perceived ease of integration into existing workflows (Buchanan et al., 18).

Interestingly, the overall composite acceptability index of 3.55, with 54.5% meeting the high acceptability criteria, suggests a cautiously optimistic outlook among nurses, which is comparable to the findings of Sobaih et al. Sobaih et al. (19) noted the importance of promoting positive sentiments around AI to enhance its acceptance.

Our analysis revealed several significant predictors of good knowledge and high acceptability of AI, including higher education levels and prior AI training, which resonate with findings by Amin et al. regarding the influence of educational background on technological acceptance (17). Moreover, the significant positive correlation found between good knowledge and high computer literacy underlines the importance of integrating computer skills training into nursing curricula, a position supported by literature on technology adoption in healthcare (13).

Multivariable logistic regression revealed that good knowledge (AOR = 2.85) and prior AI training (AOR = 3.41) were the most substantial predictors of high acceptability, which aligns with findings from Alshutayli et al. that emphasize the critical role of education in enhancing AI utilization among healthcare professionals. Moreover, job-displacement concerns were inversely related to acceptability (AOR = 0.71), highlighting a critical hurdle that aligns with perceptions indicated by Rony et al. regarding fears surrounding the devaluation of professional roles due to AI (21).

The reported barriers to AI adoption, particularly the lack of formal training opportunities (71.7%) and insufficient infrastructure (57.6%), are prevalent themes in current literature. For instance, studies have repeatedly emphasized inadequate training and resources as primary obstacles to integrating AI in healthcare (22, 23). Facilitators, including hands-on workshops and managerial endorsement, found in our study are corroborated by findings in the literature that emphasize the necessity of structured training and institutional support to promote acceptance and effective AI integration (17).

This study was conducted at a single tertiary care hospital, which may limit the generalizability of findings to other healthcare settings in Pakistan. The cross-sectional design precludes the establishment of causal relationships between variables. Self-reported measures may be subject to social desirability and recall bias. Furthermore, the knowledge test was limited to foundational AI concepts and did not assess advanced technical competencies, which may underestimate specialized knowledge levels.

Conclusion

In conclusion, our study highlights the pressing need for enhanced educational frameworks to improve nurses' familiarity and competence with AI, supported by a strategic implementation approach that addresses existing barriers while leveraging facilitators. This is particularly salient in the context of the Pakistani healthcare system, where resource constraints and varying levels of technological engagement present unique challenges and opportunities for enhancing nursing practice through the use of AI.

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-24)

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The authors declared the absence of a conflict of interest.

Author Contribution

NM, AA *(Nursing Instructor)*
Manuscript drafting, Study Design,
Review of Literature, Data entry, Data analysis, and drafting an article.
Conception of Study,
SA, IM
Development of Research Methodology Design,
Study Design, manuscript review, and critical input.
SA
manuscript review, critical input, Conception of Study
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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