

ASSESSMENT OF KNOWLEDGE OF ARTIFICIAL INTELLIGENCE AMONG STUDENT NURSES IN CHILDREN'S HOSPITAL, LAHORE, PAKISTAN

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Artificial Intelligence, Nursing Students, Knowledge, Nursing Education, Healthcare Technology, Digital Health.

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T Background: Artificial Intelligence (AI) is revolutionizing healthcare by enhancing decision-making, improving efficiency, and supporting clinical care. However, its integration into nursing education remains underexplored, especially in developing countries like Pakistan.

Objective: To assess the level of knowledge and perception regarding AI among nursing students at the College of Nursing, University of Child Health Sciences, Lahore, and to identify knowledge gaps and educational needs.

Methods: This descriptive cross-sectional study was conducted over four months (September–December 2024) among BSN students using a convenience sampling technique. A structured, self-administered questionnaire was distributed to 160 participants from 2nd, 3rd, and 4th-year BSN classes. Data were analyzed using SPSS v25, focusing on descriptive statistics.

Results: Most participants (89.6%) claimed understanding of AI, and 85.4% recognized its application in nursing. However, only 45.7% had formal exposure to AI education. Social media was the main information source (81%). Students overwhelmingly agreed that AI could revolutionize nursing (90.9%), improve patient care (81.1%), and reduce healthcare costs (87.8%). Ethical concerns were also noted, with 58.5% acknowledging medical ethical risks and 92.1% advocating for formal ethical guidelines.

Conclusion: While nursing students demonstrate a positive attitude and foundational understanding of AI, formal education on AI is limited. Integrating AI concepts into nursing curricula and addressing associated ethical issues are essential to preparing nurses for future AI-driven healthcare environments.

Introduction

Artificial Intelligence (AI) encompasses computer programs that can perform various tasks that traditionally require human intelligence to some extent, such as making, learning about or perceiving language (Martinez-Ortigosa, 2023). Nursing students are those who ultimately want to

practice as professional nurses after having undergone both theoretical and practical instruction. Having AI knowledge is the understanding of the concept of AI and the applications of AI in the healthcare field, especially the positive and negative sides and the ethical considerations of AI. There is an evolving

need among the nurses and students for an integrated understanding of AI, as the technology is being widely adopted in healthcare for clinical decision support, patient monitoring, health teaching, and the management of electronic health records and administrative services (Engelmann, 2020, Nagle et al., 2020).

The knowledge gap of AI among nursing students has become a global education concern. A global survey indicated that even though most nursing students acknowledge AI's importance for future clinical practice and have a basic knowledge of it, they have not had sufficient formal education on the topic (Salama et al., 2025). There is a considerable inconsistency in AI related content in nursing programs across North America and Europe, with a significant number of programs having no specific courses on the competencies, ethics, and practice of AI (Buchanan, et al., 2021). It is highly likely that future nurses will be ill equipped to employ emerging technologies, leaving many healthcare practitioners unprepared to operate in a healthcare environment where technology is increasingly used.

AI systems are making waves across the globe through their integration into various aspects of healthcare. In the diagnostic and analytic fields, AI applications have made processes more precise and aided in the development of patient monitoring systems. Even more advanced are AI applications that provide support for clinical decision-making processes. As advanced technologies are increasingly integrated into sectors within the healthcare system, some countries (e.g., the United Kingdom, Canada, Singapore, and United States) are incorporating AI, robotics, and health informatics into their nursing education programs (El Arab et al., 2025). AI education technologies, along with advanced tutoring systems and virtual simulations, have fostered advancements in clinical decision-making among nursing students (Pohane et al., 2024). As AI systems get more embedded within healthcare services, the demand for nursing professionals with AI and tech literacy is growing.

Pakistan faces a multifaceted and complex set of healthcare challenges. Comprehensive health

services remain underfunded (2.8% of the national budget), are below the developing world's standards (Muhammad Mustafa Habib, 2024), and are grossly inequitable. The National Health Vision (2016–2025) aims to modernize health systems and advance care through the enhancement of the workforce and the integration of new technologies. The gap in knowledge of the application of AI and new technologies will restrict the use and integration of emerging healthcare technologies in Pakistan (Li et al., 2024).

In Lahore, health sector institutions have begun integrating technology like telemedicine and electronic health records. Automating documentation and AI-assisted patient support have also been adopted. More and more, chatbots and virtual assistants are being used to convey information to patients and lessen the administrative duties of frontline workers (Naveed, 2023). Implementing AI is still in the early stages because of data privacy and ethics, an inadequate technological base, and a shortage of experts on AI technology. Future nurses who practice in these settings need to have adequate knowledge of healthcare technology to engage with it appropriately. (Muhammad Mustafa Habib, 2024)

The Children's Hospital in Lahore is an important pediatric care and training facility for nurses. It aids clinical training for nursing undergraduates. Child care often involves the need for sophisticated systems geared toward the early identification of a child's clinical deterioration, and rapid intervention. AI can support this process (Krittana Wong et al., 2022). Many nursing students have insufficient knowledge of AI which may inhibit their ability to practice safely and effectively. AI should help foster the safe use of technology in clinical environments and avoid the pitfalls of reliance on automation by ensuring proper interpretation of AI's recommendations. (Adomat, 2024)

An assessment of undergraduate nursing students' knowledge of AI is necessary to consider the existing gaps to prepare students for the evolving state of health care. Because of AI's rapid

advancement, the integration of AI in health care, and the need for digitally resilient nurses, the exposure to AI at the education/school level needs to be evaluated. This study assumes the outcomes of the study would be the basis for future AI initiatives in the nursing profession and to promote AI initiatives to create/update the nursing education curriculum. Knowledge of AI among nurses can strengthen the quality of health care, promote patient safety, and enhance the use of technology in health care (Rizwan et al., 2025).

Method

A descriptive cross-sectional study was implemented to measure the knowledge of Artificial Intelligence (AI) among undergraduate nursing students at the College of Nursing, Children Hospital and University of Child Health Sciences, Lahore. This study took place over the course of four months from September 2024 to December 2024. The population of interest was comprised of students in 2nd, 3rd and 4th Year (Annual System) of the BSN program. The researcher applied convenience sampling to decide the participants of the study, who met the inclusion criteria. The sample size was estimated to be 164 students which was derived from a target population of 293 with the application of a finite population correction, choice of a 95% confidence level, 5% margin of error, and a prevalence estimate of 41.8%. This study included interested and informed students only, and excluded 1st year BSN students.

Data Collection Procedure

Data collection occurred only after obtaining approval from the pertinent institutional authorities. Eligible students were approached in their classes, and the purpose, aims, potential benefits, and procedures of the study were explained to them. In the case of an affirmative response, the participants were asked to provide their written consent. Data collection was based on a questionnaire that had been previously used by Habib et al. (2024). The questionnaire was in two parts. The first part collected demographic

data: age and level of education. The second part of the questionnaire assessed the level of knowledge of the participants about Artificial Intelligence and its use in the field of healthcare and nursing. Participants were informed that the data would be collected and stored in an anonymous and confidential manner. They were also informed that they had the right to withdraw from the study at any time without any penalty.

Data Analysis Procedure

The data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics were used to analyze the demographics and knowledge data using mean and standard deviation. Knowledge was rated on three levels: poor, moderate, and good. Inferential statistics, including the Chi-square test, were used to assess the association between demographic data and knowledge level. A p-value of < 0.05 was considered significant.

Results

Demographic Analysis

Table 1 shows the demographics and AI-related features of the study participants. About half of the respondents were aged 21-22 years (54.9%, $n = 90$), and 41.5% ($n = 68$) were aged 19-20 years. Thus, the participants in this study were predominantly young adult nursing students. Most participants were in the 4th Year BSN (37.2%, $n = 61$), 2nd Year BSN (35.4%, $n = 58$), and 3rd Year BSN (27.4%, $n = 45$) programs. Social media was the primary source of information on artificial intelligence as indicated by 79.3% ($n = 130$) of the participants. Other sources included media (6.7%, $n = 11$), university/workplace (6.0%, $n = 10$), web browsing (4.3%, $n = 7$), friends and family (3.7%, $n = 6$) and other sources. In addition, more than half of the participants (54.3%, $n = 89$) had not participated in any AI-related formal sessions, and 45.7% ($n = 75$) had participated in formal artificial intelligence sessions while in the course of their studies.

Table 4.1

Demographic and Artificial Intelligence-Related Characteristics of Participants

Variable	Category	Frequency (n)	Percentage (%)
Age (Years)	19-20	68	41.5
	21-22	90	54.9
Year of Study	BSN 2nd Year	58	35.4
	BSN 3rd Year	45	27.4
	BSN 4th Year	61	37.2
Source of Information About AI	Social media	130	79.3
	Media	11	6.7
	Web Browsing	7	4.3
	Friends/Family	6	3.7
	University/Workplace	10	6.0
Attendance of Formal AI Sessions	Yes	75	45.7
	No	89	54.3

Table 2 showed nursing students had different levels of knowledge and understanding of AI. They reported that less than half (45.7%, n=75) had been to an AI-related formal session. In comparison, 54.3% (n=89) had not been formally trained. 79.3% (n=130) considered themselves skilled at using technology. More than half (52.4%, n=86) were knowledgeable about AI and self-reported knowledge of related concepts, machine learning and deep learning. 89.0%

(n=146) reported knowledge of at least one of the AI tools that they experienced, 89.6% (n=147) had a general knowledge of AI, and 85.4% (n=140) were knowledgeable of the AI tools that can be used in nursing. In addition, 66.5% (n=109) reported knowledge of the ongoing research and AI in the nursing field. The reported familiarity and knowledge of AI tools imply that nursing students are knowledgeable of AI, but have not been formally trained.

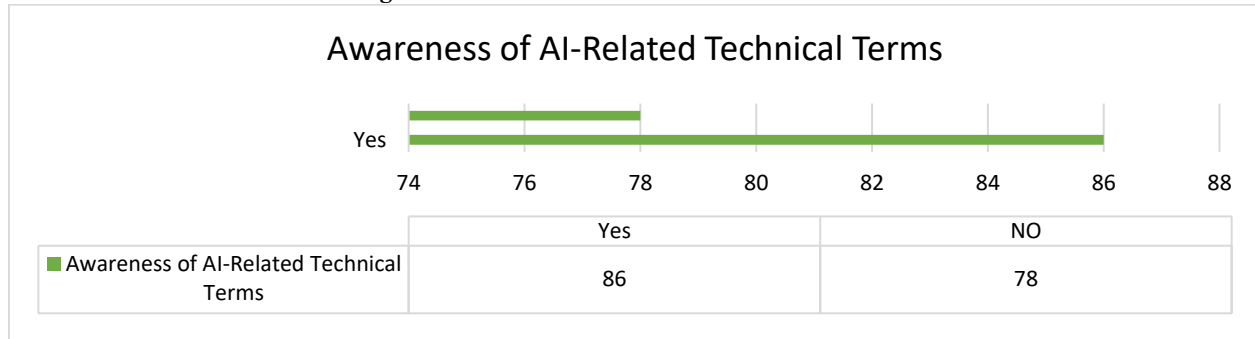
Table 2 Knowledge and Awareness of Artificial Intelligence Among Nursing Students

Variable	Yes n (%)	No n (%)
Attended formal AI sessions	75 (45.7)	89 (54.3)
Technologically adept	130 (79.3)	34 (20.7)
Aware of AI-related technical terms	86 (52.4)	78 (47.6)
Familiar with everyday AI applications	146 (89.0)	18 (11.0)
Understand artificial intelligence	147 (89.6)	17 (10.4)
Understand AI applications in nursing	140 (85.4)	24 (14.6)
Aware of current AI developments in nursing	109 (66.5)	55 (33.5)

As shown in Fig 1, just over half of the participants (52.4%, n = 86) reported being aware of technical terms related to artificial intelligence, such as

machine learning and deep neural networks, while 47.6% (n = 78) indicated a lack of familiarity with these concepts.

Fig 1 Awareness of AI-Related Technical Term



The results showed that nursing students had favorable views and attitudes towards artificial intelligence. The largest group of respondents believed that AI will change nursing practice (90.9%, n=149), will change the way we care for patients (81.1%, n=133), will change the way nurses make decisions (94.5%, n=155), and will change the health of populations (91.5%, n=150). Also, 87.8% (n=144) thought AI could potentially

lower the financial costs of healthcare. Acceptance of the usage of AI in nursing practice was found in the majority of the sample (89.0%, n=146). An even larger group (92.1%, n=151) thought that the development of medical AI ethics will safeguard the use of AI in medical care. From the data, there is an overall belief, approval, and hope that AI will support and strengthen nursing.

Table 3

Perceptions and Attitudes Toward Artificial Intelligence in Nursing

Statement	Agree n (%)	Disagree n (%)
AI will revolutionize nursing	149 (90.9)	15 (9.1)
AI can improve patient care	133 (81.1)	31 (18.9)
AI can improve nursing decision-making	155 (94.5)	9 (5.5)
AI can improve population health	150 (91.5)	14 (8.5)
AI will reduce healthcare costs	144 (87.8)	20 (12.2)
Acceptance of AI in nursing	146 (89.0)	18 (11.0)
Medical ethics toward AI are necessary	151 (92.1)	13 (7.9)

Knowledge of artificial intelligence among nursing students by year of study was assessed using the Chi-square test. It was found that the highest good knowledge of artificial intelligence was among the BSN 4th year (65.6%, n=40), followed by BSN 3rd year (44.5%, n=20), and BSN 2nd year (29.3%, n=17) students. On the other hand, BSN 2nd year students (24.1%, n=14) had the highest poor knowledge of artificial intelligence, compared to

BSN 3rd year (13.3%, n=6) and BSN 4th year students (4.9%, n=3). The Chi-square test indicated a statistically significant relationship between the year of study and the knowledge level of artificial intelligence ($\chi^2 = 21.47$, $df = 4$, $p = 0.001$). This means that students in the higher academic year were more knowledgeable of artificial intelligence than those in the lower academic year.

Table 4 Association Between Year of Study and Knowledge Level of Artificial Intelligence Among Nursing Students

Year of Study	Poor Knowledge n (%)	Moderate Knowledge n (%)	Good Knowledge n (%)	Total n (%)
BSN 2nd Year (n=58)	14 (24.1)	27 (46.6)	17 (29.3)	58 (100)
BSN 3rd Year (n=45)	6 (13.3)	19 (42.2)	20 (44.5)	45 (100)
BSN 4th Year (n=61)	3 (4.9)	18 (29.5)	40 (65.6)	61 (100)
Total	23 (14.0)	64 (39.0)	77 (47.0)	164 (100)

$$\chi^2 = 21.47$$

$$df = 4$$

$$p = 0.001$$

Discussion

The current research focused on the proficiency level of AI for undergraduate nursing students at the College of Nursing, University of Child Health Sciences, Lahore. Most of the participants were aged between 18 to 22 years, which suggests that they could be the future of the modern, advanced healthcare system. Abd El-Maksoud (2024) and Habib et al. (2024) reported similar age distributions for their studies as well.

Several of the participants reported that their primary means of gathering information related to AI was through social media, and many of them reported that they did not receive organized instruction on AI. More than 50% of participants reported that they did not receive any type of formal instruction on AI. This is consistent with the findings of Habib et al. (2024) who found that 78.7% of the Pakistani healthcare students and professionals reported that they did not receive any type of formal AI-related training. Salama et al. (2025) reported that about 70% of the nursing students did not have any formal education on the AI-related topics. This presents a significant gap in education and reinforces the need for AI-related education to be added to the nursing programs.

A major insight from this study is that, most of the participants considered themselves to be comfortable utilizing technology and knew different applications of AI that includes, but is not limited to, speech recognition, recommendation systems, and spam-detecting

software. Thus, it is likely that nursing students are digitally literate to an extent, which is likely to ease the implementation of AI in the healthcare field. Similarly, Labrague et al. (2023) reported similar findings and said that the technological competence of nursing students emerged to be a significant predictor of their readiness for AI. Sami et al. (2025), too, reported that healthcare students had a significantly high level of awareness of AI technologies and that digital competence aids the acceptance of AI.

Most of the participants showed understanding of the concepts of AI and their applications within nursing practice. Most of the students were able to articulate how AI could be utilized to enhance clinical decision-making, patient supervision and the overall delivery of healthcare services. These findings are in contrast to the findings of Wang et al. (2024), who reported that the level of AI knowledge of the nursing students was very low and that only a few of the students from that study were confident in the applications of AI to nursing. The awareness recorded in this study was likely a result of the rapid advancements in technology and the digitization of educational resources and the growing discourse of AI and its applications in the field of healthcare.

Participants reported overwhelmingly favorable views of integrating AI into both nursing education and practice. The majority thought that teaching AI was appropriate for undergraduate programs and thought that AI could enhance

patient care, improve clinical decisions, and positively influence population health. Findings by Amiri et al. (2024) were similar, finding in their systematic review that healthcare students strongly supported the use of AI in healthcare and saw the need for its inclusion in their courses. AI was thought to be a valuable resource for clinical judgment and patient-focused care by the respondents in the study by Rony et al. (2024a). The study findings show that respondents have an increasing awareness of the role of AI in nursing practice, and that AI will serve a supportive role and not a disruptive role.

The study also showed that participants thought of AI as a resource that could help decrease the burden and cost of care. The majority of respondents thought that AI would increase the efficiency of clinical practice and help healthcare personnel by completing routine tasks. These findings were similar to those reported by Sommer et al. (2024) in that nurses thought AI was a resource that would help facilitate documentation and help monitor patients and manage workflow. Eanes (2025) also reported that AI would help reduce the burden of documentation and the after-hours workload. These findings suggest that nursing students have an understanding of the potential benefits AI would bring to healthcare and the increased efficiency that care would bring. Even with positive views, concerns about implementing AI in nursing remained. Participants believed that widespread use of AI in healthcare would likely pose threats to privacy, responsibility, bias, and patient (and nurse) safety. Multiple challenges will likely impede AI progress in healthcare. Botha et al. (2024a, 2024b) have provided data security, bias in algorithms and inadequate regulation, and healthcare AI threats to professional autonomy as examples. (Most) participants did not believe that AI will take over nursing roles, however, human-centered care and empathy will be the cornerstones of professional nursing judgment. AI integration will be an optimistic endeavor for nursing students but will reflect the ethical and professional concerns of the associated practices/uses.

Conclusion

This study assessed the knowledge and perceptions of artificial intelligence (AI) among nursing students at the College of Nursing, University of Child Health Sciences, Lahore. The findings indicate that the majority of nursing students, particularly those aged 20 to 22 years, have a positive attitude towards AI and its potential to revolutionize nursing practice. A significant portion of students recognizes the importance of learning about AI, with most expressing the view that early integration of AI into nursing education would be beneficial. Despite their general enthusiasm, the students demonstrated varying levels of knowledge about AI, with most relying on informal sources like social media for information. The study also highlighted the perceived necessity of medical ethics in AI applications within nursing, with many students acknowledging potential ethical risks. These results underscore the need for enhancing formal AI education within nursing curricula to better prepare students for future healthcare environments.

Recommendations

- 1. Integration of AI in Nursing Curriculum:** Nursing education programs should incorporate AI training from the undergraduate level, ensuring that students develop the necessary knowledge and skills to work effectively in an AI-driven healthcare environment. Early exposure to AI concepts, tools, and applications will better equip future nurses to integrate these technologies into patient care.
- 2. Enhanced Formal AI Education:** Institutions should focus on increasing the availability of formal training in AI technologies through workshops, seminars, and integrated coursework. Collaborations with AI experts and healthcare technology providers could be valuable in designing comprehensive educational modules.
- 3. Ethics Training:** Given the ethical concerns raised by participants, nursing programs should prioritize training on the ethical implications of AI in healthcare. This would include addressing issues related to privacy,

security, decision-making, and the potential for bias in AI algorithms.

4. **Further Research:** Future studies should expand the sample to include male nursing students and those from various healthcare institutions. Longitudinal studies are also recommended to track the development of AI knowledge and attitudes over time, as well as its practical applications in nursing practice.

5. **Fostering AI Awareness through Social Media:** Given the widespread use of social media as a source of information, nursing schools and healthcare organizations should leverage these platforms to raise awareness about the benefits and challenges of AI in healthcare, providing accurate and credible content.

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