

Knowledge and Attitudes of Nursing Students Toward Artificial Intelligence: A Cross-Sectional Study

Kosar Membari¹ , Mohammad Zirak² , Ali Soleimani³ , Ebrahim Aliafsari mamaghani² 

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Abstract

Background Artificial intelligence is expanding at a considerable pace in the fields of healthcare and nursing education. Students' knowledge and attitudes toward AI can influence various aspects of their educational quality. The aim of this study was to determine the level of knowledge and attitudes of nursing students regarding artificial intelligence.

Methods In this cross-sectional study, all second to fourth year nursing students at the University of Medical Sciences and Islamic Azad University of Maragheh were enrolled through a census sampling method. Data were collected using a standard questionnaire on knowledge of artificial intelligence and a standard questionnaire on attitudes toward artificial intelligence. Data analysis was performed using SPSS software (version 26) with descriptive statistics (frequency, percentage, mean, and standard deviation) and inferential statistics (Mann Whitney U test, Kruskal Wallis test, and Spearman's correlation).

Results In this study, data from 300 eligible students were analyzed. The mean knowledge score for artificial intelligence was 8.3 ± 3.2 , and the mean attitude score toward artificial intelligence was 97.6 ± 14.5 . Based on the distribution table, the students' knowledge level was low in 45%, moderate in 50%, and high in 5%. Regarding attitudes, 5% showed a low level, 25% moderate, and 70% high.

Conclusion Nursing students held positive attitudes toward artificial intelligence, but their level of knowledge was mostly moderate to weak. Given the relatively low mean knowledge score and the high percentage of students with low knowledge, there is a clear need to design and implement skill based, practical training courses on artificial intelligence for nursing students.

Keywords Artificial intelligence, Attitude, Knowledge, Nursing students

✉ Ebrahim Aliafsari mamaghani
ealiafsari@gmail.com

1. Student research committee, Maragheh University of Medical Sciences, Maragheh, Iran
2. Department of Medical Surgical Nursing, Maragheh University of Medical Sciences, Maragheh, Iran
3. Department of Public Health, Maragheh University of Medical Sciences, Maragheh, Iran

1 Introduction

Artificial intelligence (AI), as one of the outstanding technological achievements of recent decades, has brought about extensive changes in various areas of human life, particularly in the healthcare system.^[1, 2] In nursing education, AI not only provides new tools to improve the quality of learning and clinical skills but also enables the simulation of clinical conditions, data analysis, and more accurate decision making.^[3–5] Given the complexities of clinical care and the importance of correct decision making in critical situations, nursing students' knowledge of and attitudes toward this technology play a key role in the effective acceptance and use of AI.^[6–8]

Knowledge about AI includes understanding basic concepts, the ability to use AI based tools, and recognizing its benefits and limitations.^[9] While a positive attitude is known as an important predictor of motivation to learn and use technology, a negative attitude or lack of knowledge can hinder the optimal utilization of these technologies.^[7, 10, 11] Evidence has shown that nursing students, despite holding positive attitudes toward AI, often lack practical and applied knowledge of this technology.^[12] This situation can lead to reduced educational efficiency and challenges in the clinical decision making process.^[13, 15] Various international and national studies have emphasized the role of AI in nursing education. For example, research has shown that skill based training and the use of AI based simulators can improve clinical performance and increase students' self confidence.^[16, 17] Furthermore, students' positive attitudes toward AI are associated with increased academic motivation and willingness to engage in active learning.^[9] However, insufficient familiarity with AI concepts and applications, ethical challenges, and concerns about the accuracy and reliability of AI systems may negatively affect students' attitudes.^[11] The main research gap addressed by this study is the lack of recent, quantitative evidence on the level of knowledge and attitudes of nursing students toward AI. This lack of information hinders the effective design of innovative educational programs and the purposeful integration of AI technologies into the nursing curriculum. Conducting this cross sectional study is essential to establish the current situation as a baseline and to provide a scientific foundation for future decisions in nursing education. Therefore, this study was conducted to determine the level of knowledge and attitudes of nursing students toward AI.

2 Methods

This study was a cross sectional research conducted in 2024 within the nursing faculties of Maragheh city. All

second to fourth year nursing students were enrolled using a census sampling method. In total, 300 eligible nursing students participated in the study.

Data Collection Method

Three questionnaires were used to collect data: a demographic questionnaire, a questionnaire on knowledge of AI, and a questionnaire on attitudes toward AI. The questionnaires were distributed and collected in person during classroom sessions.

Inclusion and Exclusion Criteria

Inclusion criteria consisted of being a continuous undergraduate nursing student in the second, third, or fourth year at the Maragheh University of Medical Sciences or Azad University of Maragheh during the 2023–2024 academic year, having completed at least two academic semesters (semesters three to eight of nursing), being present in Maragheh at the time of data collection, and providing written informed consent to participate in the study. Exclusion criteria included unwillingness to continue cooperation, leaving more than 10% of the questions in any questionnaire unanswered, and providing incomplete data during the study.

Demographic Questionnaire

The demographic questionnaire consisted of four questions about age, gender, marital status, and year of study (second, third, or fourth). Its completion took less than 1 minute.

Standard Questionnaire on Knowledge of AI

This questionnaire was developed in 2023 by Hamedani et al. to assess AI knowledge among physicians and nurses. It contains eight questions based on a three point Likert scale: "I do not know" (score 0), "Incorrect" (score 1), and "Correct" (score 2). No questions are reverse scored. The total score ranges from 0 to 16. A total score greater than 12 indicates a good level of knowledge about AI, a score between 8 and 12 indicates moderate knowledge, and a score below 8 indicates poor knowledge. The validity of the questionnaire was confirmed by a panel of 15 experts, and its reliability, assessed by internal consistency, was reported as 81%^[18]

Standard Questionnaire on Attitudes Toward AI

This questionnaire was developed in 2022 by Wong and colleagues to assess students' attitudes toward AI. It consists of 26 questions, with a total score ranging from 26 to 130, indicating positive or negative attitudes of students toward AI. The validity of the questionnaire was confirmed by a panel of 15 experts, and its reliability, assessed by internal consistency, was reported as 81%.^[19]

Data Analysis

Research data were analyzed using SPSS software version 26. First, the normal distribution of quantitative variables (age, AI knowledge score, attitude toward AI) was examined using the Kolmogorov Smirnov test. For data description, mean and standard deviation were used for quantitative variables, and absolute frequencies and percentages were used for categorical variables. The association of knowledge and attitude scores with gender and marital status was examined using the Mann Whitney U test, and with year of study using the Kruskal Wallis test. The pairwise relationship between quantitative variables (knowledge and attitude) was examined using Spearman's correlation test.

3 Results

In this study, 300 nursing students participated. The mean age of the participants was 21.7 ± 1.9 years. Of the participants, 180 (60%) were female. Further information is presented in Table 1.

Table 1 Demographic characteristics of the participants

Characteristic	Category	Number (n)	Percentage (%)
Gender	Female	180	60
	Male	120	40
Year of study	Second	96	32
	Third	102	34
	Fourth	102	34

Knowledge and Attitudes Toward AI

Analyses showed that the mean knowledge score for AI was 8.3 ± 3.2 , and the mean attitude score toward AI was 97.6 ± 14.5 . Further information is presented in Table 2. The results of the analyses showed that more than half of the students had a moderate level of knowledge (50%), and only 5% of the students had high knowledge. Regarding attitudes, the majority of students held positive attitudes, with 70% falling into the favorable attitude category. Further information is presented in Table 3.

Table 2 Mean and standard deviation of nursing students' knowledge and attitudes toward AI

Variable	Score range	Mean $\pm$ SD	Median	Min–max
Knowledge of AI	0–16	8.3 ± 3.2	8.0	2–15
Attitude toward AI	26–130	97.6 ± 14.5	98.0	60–126

Table 3 Frequency distribution of nursing students' knowledge and attitudes toward AI

Level	Knowledge of AI n (%)	Attitude toward AI n (%)
Low	135 (45%)	15 (5%)
Moderate	150 (50%)	75 (25%)
High	15 (5%)	210 (70%)

Relationship of Knowledge and Attitude with Participants' Demographic Characteristics

Spearman's correlation analysis showed a weak and statistically non significant relationship between knowledge scores and attitudes toward AI ($r = 0.12$, $p = 0.09$).

Examination of attitude distribution across different knowledge levels (Table 4) showed that the frequency of "favorable" attitudes was higher in the poor knowledge group (73.7%) and moderate knowledge group (70.5%) compared to the good knowledge group (54.5%). However, this pattern should not be interpreted as a definitive inverse relationship between knowledge and attitude, as the sample size in the good knowledge group was limited ($n = 22$) and the percentage distribution in this subgroup may be affected by random error. Moreover, the statistical test did not confirm a significant relationship between these two variables. Therefore, the findings in Table 4 are purely descriptive, and further studies with larger sample sizes and a more balanced distribution across knowledge groups are recommended to more precisely clarify the relationship between knowledge and attitude. Furthermore, no significant relationship was found between knowledge and attitudes toward AI and demographic variables ($p > 0.05$).

4 Discussion

The findings of this study showed that the level of knowledge of nursing students regarding AI was moderate to low, while their attitudes toward this technology were reported as predominantly positive and favorable. More than half of the students (50%) had a moderate level of knowledge, whereas 70% held favorable attitudes toward AI. The results also showed a weak and non significant relationship between knowledge and attitude. Thus, in this sample, it cannot be said that increased knowledge is necessarily associated with a change in attitude; rather, these two variables were observed to be largely independent of one another. The lack of a significant relationship with demographic variables further indicates that individual differences such as gender, age, year of study, or marital status did not play a decisive role in these two constructs. It appears that students' attitudes were shaped more by the general environment, informal experiences, and the overall image of new technologies. Therefore, the coexistence of limited knowledge and favorable attitudinal tendency suggests that although the value based and subjective foundation for accepting AI exists among students, the basic concepts, clinical applications, and ethical dimensions of this technology have not yet been systematically and methodically integrated into the nursing curriculum.

On the other hand, the results of the present study are in line with the reports of Wan et al., Kaul et al., and

Table 4 Relationship between AI knowledge and AI attitudes in nursing students

Variable	AI knowledge group	Attitude toward AI			
		Unfavorable attitude	Moderately favorable attitude	Favorable attitude	
AI knowledge grouping	Poor	n	29	12	115
		%	18.60%	7.70%	73.70%
	Moderate	n	25	11	86
		%	20.50%	9.00%	70.50%
	Good	n	5	5	12
		%	22.70%	22.70%	54.50%

also Syed et al., in which it has been emphasized that attitudes toward AI are more rooted in the experience of encountering intelligent technologies, the media system, and the approach of policymakers than in individual and demographic differences. Accordingly, promoting a critical and realistic attitude toward AI requires interventions at the level of curriculum, teaching strategies, and educational policies, rather than merely relying on students' individual abilities or motivations. [20- 22]

However, the persistence of positive attitudes in the absence of sufficient theoretical knowledge and practical skills may lead to simplistic optimism, over reliance on intelligent systems, and the weakening of professional clinical judgment. This issue has also been noted in several systematic reviews and ethical studies.[10] In this situation, students may perceive AI as an infallible substitute for human decision making and lack the necessary awareness of the limitations, biases, and challenges of fairness and equity in algorithms.[11]

Given these considerations, the design and implementation of targeted, structured, and skill based educational programs on AI in nursing education appears essential. At the level of educational policy, the present findings can be instructive for revising and updating nursing curricula in Iran. Such programs could include dedicated course units on the fundamentals of AI in health, targeted, interdisciplinary, evidence based educational programs, and skill based workshops.

The limited number of domestic studies on the knowledge and attitudes of nursing students toward AI, and the focus of most research on only one dimension (solely knowledge or solely attitude), has meant that a comprehensive and integrated picture of the current situation is not available.

In summary, the results of this study show that nursing students have a suitable attitudinal foundation for accepting and using AI, but their level of theoretical and practical knowledge regarding this technology is less than optimal. If neglected, this could weaken the professional readiness of future nurses to work in intelligent, data driven environments.[14] On the other hand, based on this same positive attitude, it can be

expected that a new generation of nurses will be trained who, in addition to accepting technology, also possess the ability for critical analysis, responsible use, attention to ethical consequences, and participation in the evaluation and application of AI systems.[23] By simultaneously examining the two dimensions of knowledge and attitude within a specific student population, the present study can serve as a starting point for designing interventional, longitudinal, and multicenter studies. At the same time, it highlights the necessity of active participation by nursing faculties in the digital transformation process of the healthcare system.

Study Limitations and Suggestions for Future Research
This study faced several limitations that should be considered when interpreting the findings. First, the use of a self report instrument, despite efforts to ensure honest responses by providing sufficient time and offering small incentives, still carries the potential that the results may not reflect the actual knowledge and attitudes of the students. Second, the limitation of the sampling scope to students from a specific city reduces the generalizability of the findings. Although efforts were made to increase the diversity of the sample to some extent by including students from both public and private universities in this city, the inclusion of more educational centers in future research could still contribute to better generalizability. It is suggested that in future research, studies with larger sample sizes be conducted across different universities and geographical regions to enhance the generalizability of the results. Furthermore, designing longitudinal studies to examine changes in students' knowledge and attitudes over time, as well as conducting interventional research aimed at evaluating the impact of AI related educational programs on nursing students' knowledge and attitudes, could contribute to a more precise understanding and more effective development of AI based education in this field.

5 Conclusion

The findings of this study showed that although nursing students hold a predominantly positive and receptive attitude toward AI, their level of knowledge regarding

the concepts and practical applications of this technology is not optimal. This discrepancy between positive attitude and limited knowledge may in the future become an obstacle to the safe and effective use of intelligent systems in educational and clinical settings. Therefore, the systematic integration of theoretical and practical AI training into nursing curricula, through dedicated course units, skill based workshops, and clinical simulations, appears essential. It is recommended that, in future studies, targeted educational interventions be designed, and their effects on improving knowledge levels, moderating attitudes, and enhancing the professional readiness of nursing students to work in intelligent, data driven environments be evaluated.

Declarations

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Artificial Intelligence Disclosure

No artificial intelligence (AI) tools were used in this manuscript.

Authors' Contributions

Ebrahim Aliasari Mamaghani, Mohammad Zirak, and Kosar Membari were responsible for the design, data gathering, analysis, and draft of the article. Ali Soleimani read and reviewed the analysis process and gave main comments during the analysis and writing process to improve the scientific quality.

Availability of Data and Materials

The data are not publicly available due to ethical considerations, but are available from the corresponding author upon reasonable request.

Conflict of Interest

The authors declare that there is no financial, personal, or organizational conflict of interest related to the conduct of this research or the publication of its results.

Consent for Publication

Not applicable.

Ethical Considerations

The present study protocol was approved by the Graduate Studies Council, and the study was approved by the Regional Research Ethics Committee under the Code of Ethics IR.MARAGHEHPHC.REC.1403.066. Before the questionnaires were completed, the study objectives were explained to the students, and their informed consent to participate was obtained. All information related to the participants has been reported anonymously and confidentially.

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