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KNOWLEDGE, ATTITUDE AND PRACTICE OF ARTIFICIAL INTELLIGENCE AMONG UNDERGRADUATE NURSING STUDENTS AT KARACHI

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ABSTRACT

Introduction/Background: *The study was shown to assess the knowledge, attitude, and practice of artificial intelligence (AI) among undergraduate nursing students in Karachi, recognizing the growing role of AI in improving healthcare efficiency and decision-making.* ***Method***: *A cross-sectional design was used, and data was collected from 195 BSN students across all four years at Jinnah College of Nursing and Ilmiya College of Nursing via structured questionnaire, with analysis performed in SPSS version 25.* ***Results***: *The findings showed that although maximum students had a basic understanding of AI (80.5%), fewer demonstrated knowledge of machine learning and deep learning (46.7%) or AI applications in healthcare (47.7%). Male students exhibited higher knowledge levels than females. Attitudes toward AI were mostly positive, with over 81% agreeing that AI was essential in nursing practice, while opinions were mixed regarding whether AI possibly will replace nurses in the future. Only 41.5% had previously used AI tools, yet a majority (83.6%) expressed willingness to apply AI in their future practice.* ***Conclusion***: *The study concluded that nursing students influenced limited detailed knowledge and minimal practical experience with AI despite showing favorable attitudes toward its use. It was suggested that nursing curricula be strengthened with AI-related content, supported by awareness programs and hands-on training, to better prepare future nurses for evolving technological advancements in healthcare*

Keywords:

INTRODUCTION

A software program called artificial intelligence (AI) makes judgments independently or aids humans in doing so by utilizing data sources (Hashimoto et al., 2020). Machine learning, representation learning, deep learning, and natural language processing are all included under this general phrase. A branch of computer science called artificial intelligence has the ability to evaluate vast volumes of data. However, it crosses numerous disciplines, including linguistics, statistics, medicine, philosophy, and psychology, in addition to computer science (He et al., 2019). Attitudes are often the result of knowledge or rearing. They can have an influential impact over behavior and affect how people act in different conditions. While attitudes are continuing, they can also change. The main constituent of attitude is cognitive, affective, and behavioral, which means they comprise judgments, emotional state, and activities. (Kendra et al., 2023). Knowledge is the awareness of

objectives, truths, data, skills and understanding acquired through practice and education. It is a theoretical or applied understanding of the text under study (Menonimus et al., 2023). Practices state to established methods, procedures, activities or behaviors that are systematically followed to achieve a particular goal, outcome, or standard. They often emerge from accumulated facts, experience, and shared considerate within a particular domain or community. Practices provide a structured framework for individuals or groups to carry out tasks, solve problems, make decisions or involve in activities in a constant and effective manner (Davenport., 2000).According to Abid et al. (2019) Artificial intelligence (AI) is presented in the medical services arrangement of created countries to eliminate the blunders and work on the viability, effectiveness, precision, and result of clinical practice. Utilization of computer helped clinical methods has the capacity to further develop the medical services results in rural areas of non-industrial nations. It was explained by Paranjape et al. (2020) in modern era health care practitioners are faced with numerous mechanical advances and a wealth of information Gathering this information furthermore, utilizing it to settle on an educated and customized choice represents a one-of-a-kind test that still can't seem to be survived. New advancements like man-made reasoning (simulated intelligence) have the characteristic capacity to acquire experiences from a lot of information from different sources and might be utilized to settle these issues. The utilization of computer-based intelligence has filled intensely in our regular routines. We utilize Google's smart hunt, iPhone individual associate voice acknowledgment and the executives of information and devices like City mapper to assist us with voyaging proficiently in urban areas (Yüzbaşıoğlu., 2020).In recent year Ahmed et al. (2022) conducted a study, man-made reasoning (computer-based intelligence) has acquired exceptional consideration and is being known as the fourth modern transformation. Pakistan are as yet slacking in training, research, and execution of artificial intelligence overall and in medical services specifically. The improvement of novel clinical school educational programs includes a cooperative exertion among educated authorities (for example computer researchers, information researchers) and experts in clinical teaching method. Thomas et al. (2016) highlights that effective methods for enhancing educational programs involve conducting targeted assessments of specific requirements among medical students. As the energy to coordinate artificial intelligence abilities into clinical training constructs, figuring out clinical understudies' pattern information, discernments, and worries about clinical man-made intelligence might give further knowledge into need regions for educational program advancement (Mehta et al., 2021).Restricted openness to artificial intelligence has been displayed to cause nervousness in undergraduate clinical understudies and impact their future vocation choices; subsequently, looking at public mentalities and current information of medical services understudies might be a strong way to deal with feature regions of need for educational plan decision-makers with respect to computer-based intelligence schooling. As the jobs of different medical services suppliers in present day medication are re-evaluated, the joining of man-made intelligence requires the interdisciplinary joint effort of medical services partners, including doctors and other medical services experts. It is basic to gather data from a different gathering of medical care understudies (Mousavi Baigi et al., 2023). Alan Turing (1912-1954) was the primary devotee to PC based Man-made brainpower. While AI began arising from the 2010s, the term simulated intelligence acquired its ubiquity since Dartmouth school gathering in 1956. Man-made intelligence utilizes modern PC calculations to 'shrewdly gain' highlights from a huge volume of medical care information and afterward consumes the acquired experiences to aid clinical practice. (Abid et al., 2019). The literature review on this topic is obtained from google scholar minimum research was performed on this topic that Knowledge, attitude and practice of artificial intelligence among undergraduate nursing students. The study conducted by Abuzaid et al. (2022) highlights the ongoing interest in integrating artificial intelligence into nursing practice. However, there exists a gap in comprehending the full scope of AI's

technological capacities. It is imperative that universities and professional organizations take proactive measures to establish comprehensive educational and training initiatives. Nurses need to develop a robust grasp of the fundamental AI principles and its seamless integration within their practice The recent study conducted by Syed and Basil A. Al-Rawi (2023) sheds light on the favorable attitudes and awareness of pharmacy students at a Saudi institution in Riyadh towards artificial intelligence (AI) in healthcare. The research underscores the necessity of keeping students informed about emerging medical technologies, particularly AI, its advancements, and consequential impacts. The study emphasizes the significance of prioritizing education related to AI-based treatments, with a focus on their acceptability. Additionally, to ensure effective training, it is recommended that subsequent online sessions be offered with relevant evaluations and practical activities, all while avoiding excessive burdens on the students. This study took place at the University of Jordan in Amman, Jordan. Guiding students in artificial intelligence, according to scholars, is essential for their complete integration into medical studies in essence, a strong education in AI and ML is critical for medical students to comprehend their applications, stay updated on trends in diagnosis and treatment, and bridge medical concepts with technological innovations. Saad et al. (2022) While some worry about AI displacing radiologists, most do not see it as a complete replacement. Many students avoid radiography due to this fear. Educating students about AI's role is crucial for alleviating concerns and ensuring radiology's future amid the expected AI-driven changes in practice. Gong et al., (2019). The study was performed at King's College London, located in London, UK. According to researcher that only 10.4% of students are comfortable using AI tools when necessary and have a basic understanding of evaluating AI performance. The majority don't feel prepared to work with AI after graduation. However, 11.3% of students feel knowledgeable enough for everyday clinical AI use. Those trained in AI express confidence in using basic AI clinical tools and feel better prepared for AI use in clinical practice. Sit et al., (2020). This study, utilizing a cross-sectional mixed methods approach, was conducted in Canada. Investigators identified themes of insufficient formal education and the dominance of non-AI subjects in the curriculum. Pucchio et al., (2022) In Pakistan, this study was carried out through a cross-sectional online survey. Despite limited awareness of AI's healthcare applications, most doctors and medical students held a positive view of AI and its implementation. Allocating additional funds for integrating AI into the medical curriculum and training physicians in AI usage is essential. Further research is needed to explore perceptions of AI's significance in the modern world. Ahmed et al., (2022). This study was conducted at Mashhad University of Medical Sciences, Mashhad, Iran. This review found healthcare students to have positive attitudes towards to enhance their comprehension of AI benefits, effective methods like face-to-face instruction, training manuals, and comprehensive AI education are necessary. Mousavi Baigi et al., (2023). A cross-sectional exploratory electronic survey was undertaken among nurses employed within the healthcare organization of the United Arab Emirates (UAE). Although there is a lack of knowledge about its technological capabilities, incorporating artificial intelligence into nursing practice will continue to spark curiosity. We strongly recommend colleges and professional organizations to implement appropriate education and training programs. Nurses should better understand the fundamentals of AI, as well as how it fits into nursing practice. Abuzaid et al., (2022). Encourage clinicians and developers for prospective randomized trials to enhance confidence in AI solutions. Demonstrating AI's potential to boost physician performance and patient outcomes is crucial to gaining trust. In medical education and ongoing training, integrating AI knowledge, skills, and attitudes is essential due to evolving physician work settings. Jungmann et al., (2020)

Methodology:

Study Design

This study employed a descriptive cross-sectional design to assess knowledge, attitude and practice of artificial intelligence among undergraduate students at nursing colleges.

Study Setting
The study was conducted in Jinnah College of Nursing, Sohail University Karachi and Ilmiya College of Nursing near Defense Mall Karachi, Pakistan. Both were private settings.

Study Population
The population of this study comprised nursing students of 1st, 2nd, 3rd and 4th year's Generic BSN program from two different Nursing institutes.

Study Duration
The duration of study were four months from 10th July, 2023 to 4th November, 2023.

Sampling Technique
A total of 195 BSN students were selected using a non-probability purposive sampling technique. This sampling method was chosen due to accessibility and availability of students during the study period. All participants who met the inclusion criteria and consented to participate were included in the study

Sample Size
The sample size for this study was calculated using the Slovin formula, which is commonly used to determine an appropriate sample size when the population size is known. The formula is expressed as $n = N / (1 + N(e)^2)$, where n represents the sample size, N is the total population, and e is the margin of error. For this study, the total population (N) consisted of 383 nursing students, and the margin of error (e) was set at 0.05, corresponding to a 95% confidence level. By substituting the values into the formula, the calculation was performed as follows:
$n = 383 / (1 + 383 \times (0.05)^2)$. Since $(0.05)^2 = 0.0025$, the equation becomes $n = 383 / (1 + 383 \times 0.0025)$, which equals $n = 383 / (1 + 0.9575)$. This simplifies to $n = 383 / 1.9575$, resulting in a final calculated sample size of approximately 195 participants. Therefore, the required sample size for this research study on artificial intelligence was 195 nursing students.

Inclusion and Exclusion Criteria:
The inclusion and exclusion criteria for this study were defined to ensure appropriate participant selection. The study included participants who were enrolled as full-time students in the undergraduate Bachelor of Science in Nursing (BSN) program, specifically Generic BSN students from the 1st to 4th academic year. Both male and female students aged 18 years or older who were willing to provide informed consent were eligible to participate in the study. However, students who were on leave during the study period or those who were unwilling to participate were excluded from the study.

Data Collection Tool:
The structured self-administered questionnaire consisted of: (i) 7 demographic variables, (ii) 4 dichotomous knowledge items, (iii) 4 Likert-scale attitude items (Strongly Agree to Strongly Disagree), and (iv) 4 categorical practice items.

Data Analysis Tool
The collected data were analyzed by Statistical Packages Social Sciences (SPSS) Software Version 25. Descriptive data such as Frequency and percentages were used to summarize demographic characteristics and Graphs and tables were generated using SPSS to present correlation of gender, age, academic year with knowledge, attitude and practice.

Result
Out of 195 (100%) students, there were 105 (53.8%) students from Jinnah College of Nursing And 90 (46.2) students from Illmiya institute of Nursing. And the male students were 151 (77.4%) and female students were 44 (22.6%). Among the participants, 17.9% (n = 35) were first-year students, 40.0% (n = 78) were second year students, 11.3% (n = 22) were third-year students, and 30.8% (n = 60) were fourth-year students. These variables are shown in table.1

Knowledge of AI:
About knowledge of AI, students were questioned about the basic concept of AI, its subtypes i.e., (machine learning (ML) and deep learning ML and DL(DL), and its applications. It was observed that 157 (80.5%) had a basic concept about AI but only 91(46.7%) had knowledge about ML and DL and only 93(47.7%) had knowledge about its applications. 38(19.5%) individuals had no

knowledge about the basic concept of AI, 104(53.3%) had no knowledge about ML and DL, and 102(52.3%) were unaware of any application of AI in the nursing field. Males were found to have more knowledge about AI than females.

Attitude toward AI:

Regarding the attitude towards AI in the health sector, 61(31.1%) individuals strongly agree and 98(50.3%) agree that AI is essential in the nursing field while only 1(0.5%) strongly disagree and only 7(3.6%) disagree with this. About 28(14.4%) had no opinion regarding this and among them, the majority were females. The question asked about attitude of nursing students that Artificial Intelligence will replace nurses in future only 24 (12.3%) strongly agree and 60(30.8%) agree with it. About 44(22.6%) disagree with this and 20(10.3%) students strongly disagree. About 47(24.1%) had no opinion according to it.

Practice of AI:

Only 81(41.5) nursing students had ever practically applied AI and all agreed that it made their respective tasks easy to complete. Meanwhile, the rest of the 114(58.5%) students never applied AI in any task. Concerning the practice in the future, 163(83.6%) students were ready to practically apply AI in the future, and 86(34.8%) medical students and 32(16.4%) students did not have any opinion-whether or not they would work with AI in future.

Table.1 Baseline Characteristics of the study population.

SR NO:	Variable	Value
01	**Gender**	
	Male	151 (77.4%)
	Female	44 (22.5%)
02	**Age**	
	18-25	182 (93.3%)
	26-32	11 (5.6%)
	33-40	2 (1.0%)
03	**Qualification**	
	1st year	35 (17.9%)
	2nd year	78 (40.0%)
	3rd year	22 (11.3%)
	4th year	60 (30.8%)
04	**Institute**	
	Jinnah College of Nursing	105 (53.8%)
	Illmiya Institute of Nursing	90 (46.2%)

Table.2 Correlation of gender with key questions.

Gender	Question	P -value
Male Female	Knowledge of AI	0.001
Male Female	Knowledge about machine learning and deep learning.	0.082
Male Female	Knowledge about any application of AI in nursing field.	0.29
Male Female	AI is essential in nursing field.	0.231
Male Female	Have you ever applied AI technology in any field.	0.47

Table.3 Correlation of a question to key questions.

Question	Question	P-value
Knowledge about Artificial Intelligence	Have you ever been taught about Artificial intelligence in nursing School/College?	0.027
Do you know about machine learning and deep learning (subtypes of AI)?	Have you ever been taught about Artificial intelligence in nursing School/College?	0.000
Knowledge about any application of AI in nursing field.	Have you ever been taught about Artificial intelligence in nursing School/College?	0.000023
You believe AI is essential in nursing field.	Have you ever been taught about Artificial intelligence in nursing School/College?	0.449
Have you ever applied AI technology in any field?	Have you ever been taught about Artificial intelligence in nursing School/College?	0.000351

Discussion:

The present study examined the knowledge, attitude, and practice (KAP) regarding artificial intelligence (AI) among undergraduate nursing students in Karachi. The findings demonstrated that while a majority of students had basic awareness of AI, their deeper understanding of its subcomponents and practical applications in healthcare remained limited. These findings highlight an important gap between awareness and practical competency in emerging digital technologies within nursing education.

In this study, 80.5% of participants reported having basic knowledge of artificial intelligence, but fewer students were familiar with advanced concepts such as machine learning and deep learning (46.7%), and only 47.7% were aware of AI applications in nursing practice. These findings are consistent with a study conducted among medical students and doctors in Pakistan by Ahmed et al., which reported that

although 71.3% of participants had basic knowledge of AI, only 35.3% were aware of machine learning and deep learning concepts (Ahmed et al., 2022). This suggests that healthcare students in developing countries may possess general awareness of AI but lack deeper conceptual understanding due to limited exposure within academic curricula.

Similarly, research conducted among healthcare students globally has reported comparable findings. A systematic review by Mousavi Baigi et al, 2023. found that healthcare students generally demonstrate moderate knowledge but positive perceptions toward AI, indicating the need for structured educational programs to improve understanding of AI technologies (Mousavi Baigi et al., 2023). These findings reinforce the necessity of integrating AI-related competencies into health professional education to prepare students for the rapidly evolving digital healthcare environment.

Another important observation in this study was the gender difference in knowledge levels, where male students demonstrated relatively higher knowledge about AI compared to female students. While the reasons behind this difference were not specifically explored in the present study, similar trends have been reported in previous research. Ahmed et al. (2022) also observed that male participants demonstrated greater familiarity with AI technologies than female participants. This disparity may be influenced by differences in technological exposure, digital literacy, or prior educational opportunities.

The findings also revealed that students generally held positive attitudes toward the integration of artificial intelligence in healthcare. In this study, more than 80% of participants either agreed or strongly agreed that AI is essential for the nursing profession. These results align with findings from Syed and Al-Rawi (2023), who reported that healthcare students in Saudi Arabia displayed favorable perceptions toward AI and recognized its potential to enhance healthcare delivery. Similarly, Abuzaid et al. (2022) emphasized that nurses acknowledge the potential of AI to improve clinical decision-making, patient monitoring, and healthcare efficiency.

Despite these positive attitudes, the practical use of AI tools among students was relatively low, as only 41.5% of participants had previously used AI in any capacity. This indicates a substantial gap between theoretical knowledge and practical application. Comparable results were observed in a study conducted among medical students in the United Kingdom, where most participants reported insufficient training and limited confidence in using AI tools in clinical practice (Sit et al., 2020). Similarly, Gong et al. (2019) reported that only a small proportion of medical students felt adequately prepared to use AI technologies in healthcare settings. These findings suggest that current healthcare education systems may not sufficiently prepare students for the integration of digital health technologies.

Another notable finding of this study was related to students' perceptions regarding the possibility of AI replacing nurses in the future. While some participants expressed concern about this possibility, a considerable proportion disagreed with the idea. This observation is supported by previous research which indicates that healthcare professionals generally perceive AI as a supportive tool rather than a replacement for human clinicians. For example, Al Ahmari et al. (2022) reported that although students believed AI would significantly advance healthcare, most disagreed that AI would replace healthcare professionals entirely. Similarly, Swed et al. (2022) found that the majority of medical students believed AI would enhance clinical practice rather than replace physicians.

The limited knowledge and practical experience with AI observed in this study may be attributed to the lack of formal AI education in nursing curricula. Several studies have highlighted the importance of incorporating AI education into healthcare training programs. Jungmann et al. (2020) emphasized that medical education must integrate AI-related knowledge and skills to ensure that future healthcare professionals can effectively collaborate with AI technologies. Likewise, Abuzaid et al. (2022) recommended that universities develop structured training programs and workshops to enhance nurses' understanding of AI applications in healthcare practice.

Overall, the findings of this study indicate that while nursing students demonstrate positive attitudes and willingness to adopt AI in their future practice, their knowledge and practical exposure remain limited. These findings emphasize the need for curriculum reform, digital health training programs, and hands-on educational experiences that focus on AI applications in nursing practice. Integrating AI education into undergraduate nursing programs may help bridge the gap between theoretical awareness and practical competency, thereby preparing future nurses to effectively utilize emerging healthcare technologies.

Ethical Considerations

The study received initial ethical approval from the Ethics Committee of Sohail University. Furthermore, student's participation was voluntary, and informed consent was obtained from all participants.

Privacy and Confidentiality:

Throughout the study, confidentiality and anonymity were upheld. Data were securely stored and used exclusively for research purposes. All information was kept confidential by assigning codes which was only be accessed by the researcher. The information on the computer was protected through password.

Strength of Study:

This study provides valuable insights into the knowledge, attitude, and practice of artificial intelligence among undergraduate nursing students in Karachi. One of the key strengths of this research is that it includes participants from two different nursing institutes, which increases the diversity of the sample and enhances the credibility of the findings. Additionally, the study involved students from all four academic years of the Generic BSN program, allowing for a broader understanding of AI awareness and perceptions across different levels of nursing education. Another strength of the study is the use of a structured questionnaire and statistical analysis through SPSS, which ensured systematic data collection and reliable interpretation of results. Furthermore, this research addresses an emerging and relatively underexplored topic in Pakistan, particularly within nursing education, thereby contributing important baseline data that can guide future research, curriculum development, and policy planning related to the integration of artificial intelligence in healthcare education.

Conclusion

The nursing students had lack of detailed knowledge and awareness about Al and its applications in healthcare, but has a positive attitude toward AI and were willing to practically adopt it. More resources need to be allocated for the planning and implementation of AI in the Nursing curriculum and for training of the nurses to apply AI in their daily practice.

Limitation of the study

The generalizability of this study is limited due to focus on two private nursing institutes and the adoption of a non-random sampling method, which may introduce potential sampling bias and undermine the external validity of the results."

Recommendations:

Based on the findings of this study, the following recommendations are proposed to encourage a more positive attitude towards Artificial Intelligence (AI) among nursing students:

Further research should be conducted to gain a deeper understanding of the current state of Artificial Intelligence knowledge among nursing students in Pakistan.

Awareness programs, including the integration of AI and simulation-based nursing programs, should be introduced into the nursing curriculum to enhance learning outcomes and better prepare nursing students for the evolving healthcare landscape.

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