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NURSING STUDENTS' ATTITUDES REGARDING ARTIFICIAL INTELLIGENCE: EXPLORING BENEFITS, RISKS AND BARRIERS

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Abstract
Artificial intelligence (AI) stands as a transformative technological advancement shaping contemporary society. This study **aimed** to assess nursing students' attitudes regarding artificial intelligence: exploring benefits, risks and barriers. **A descriptive** exploratory design was employed, **involving** 367 undergraduate nursing students selected randomly from Zagazig University's Faculty of Nursing. **Data were collected** using two tools: A self-administered questionnaire on demographic characteristics, AI knowledge, and the General Attitudes toward Artificial Intelligence scale. **Results** showed that nursing students demonstrated knowledge regarding the benefits (68.12%), risks (51.50%), and barriers (53.95%) of using AI, with an overall satisfactory knowledge level of 56.95%. Additionally, 68.39% of students exhibited positive attitudes towards AI. The study concluded that more than half of the nursing students had a satisfactory level of knowledge about AI, and more than two-thirds exhibited positive attitudes towards AI. Additionally, a positive correlation was found between the students' knowledge of AI and their attitudes towards it. **Recommendations** include developing educational programs to enhance AI understanding among nursing students and integrating AI into nursing practice curriculum.

Keywords: Artificial intelligence, Nursing students, Attitude, Benefits, Risks, and Barriers.

Egypt stands at a pivotal moment to embrace the digital era, as advancements in technologies continue to evolve every day. These developments create promising opportunities that is based on the emerging technologies of the Fourth Industrial Revolution, most notably Artificial Intelligence **(The National Council for Artificial Intelligence, 2021).** Egypt has begun to effectively integrate artificial intelligence and technology in various sectors to achieve Egypt's Vision 2030 and enabling sustainable development paths. The desired goal, according to the National Strategy for Artificial Intelligence, is to raise the contribution of artificial intelligence to more than 7.7% of the Gross Domestic Product by 2030 **(Arab Federation for Digital Economy, 2021).**

The field of healthcare is constantly evolving, driven by technological advancements and the need to provide quality care in an ever-changing landscape. One such technology that has

gained significant attention and potential in healthcare is Artificial Intelligence (AI). AI refers to the simulation of human intelligence in machines that are designed to perform tasks that typically require human cognition, such as problem solving, decision making, and pattern recognition **(Russell & Norvig, 2022).**

In healthcare, AI has been used to develop accurate and rapid diagnostic tools and personalized treatment plans. AI-based support systems offer numerous benefits; they can reduce healthcare costs, decrease the workload of nursing professionals by handling administrative tasks, reduce missing data, increase service efficiency, and improve nursing communication skills. Additionally, AI creates a highly valued support system for the well-being of clients and the healthcare sector in general, contributing to the satisfaction and clinical safety of clients and their family members **(Alowais et al., 2023).** Furthermore, AI can carry out a wide variety of tasks that humans are capable of, learn from previous experiences, and adjust to novel inputs and settings (**Kaplan & Haenlein, 2020).** As well, nurses can remotely monitor clients with chronic conditions or those in home care settings using AI-enabled wearable devices, ensuring timely interventions, and reducing hospital readmissions **(Van Bulck et al., 2023).** AI-powered chatbots and virtual assistants can help nurses communicate with clients and provide real-time information and support, enhancing clients engagement and education. AI can predict clients deterioration or complications, enabling nurses to intervene early and prevent adverse event **(Matheny et al., 2020).**

On the other hand, the integration of artificial intelligence (AI) in nursing presents several risks that warrant careful consideration. One major concern is the potential for AI to replace human interactions, which are crucial for empathetic client care and the therapeutic relationship between nurses and clients. Additionally, AI systems can inherit biases present in their training data, leading to biased decision-making that could adversely affect client outcomes **(Gerich et al., 2022).** There is also the risk of over-reliance on AI, where nurses might trust AI outputs without adequate verification, potentially leading to errors in client care. Furthermore, the implementation of AI in healthcare raises significant ethical issues, including data privacy, consent, and the transparency of AI algorithms Addressing these risks requires rigorous validation of AI systems, continuous education for healthcare professionals, and robust regulatory frameworks to ensure the ethical use of AI in nursing **(Bekbolatova et al., 2024).**

Artificial intelligence has the potential to revolutionize clinical practice, but several barriers must be addressed to realize its full potential. One significant barrier is the lack of quality medical data, which can lead to inaccurate outcomes. Data privacy, availability, and security are also potential limitations to applying AI in clinical practice. Additionally, determining relevant clinical metrics and selecting appropriate methodologies is crucial for achieving desired outcomes. Human contribution to the design and application of AI tools is subject to bias, which could be amplified by AI if not closely monitored **(West et al., 2019).** Moreover, human expertise and involvement are essential for the appropriate and practical application of AI to meet clinical needs; the lack of this expertise could hinder AI's practical application **(Maynez et al., 2020).** Addressing these barriers requires a multidisciplinary approach and cooperation of healthcare providers in multiple healthcare settings to share data, ensure its quality, and verify analyzed outcomes, which will be critical to the success of AI in clinical practice **(Alqahtani et al., 2023).**

Integrating AI-based technologies into nursing education and practice is crucial for preparing future nurses to leverage these tools effectively. Developing a positive attitude towards AI among nursing students ensures that they can harness its potential to enhance client care,

improve outcomes, and keep up with advancements in healthcare. It's about empowering them with the skills and mindset to embrace technology as a complement to their clinical expertise **(Lin et al., 2023).** Accordingly, providing appropriate training and education starting from the undergraduate level and continuing through the careers of current practitioners is essential. This approach ensures proper adaptation, delivers the best client care, and avoids legal or ethical issues or misinterpretations of outcomes **(Alqahtani et al., 2023).** Medical and nursing faculties are encouraged to incorporate AI-related topics into their curricula, ensuring that future healthcare professionals receive foundational knowledge about AI and its applications from the early stages of their education **(Dos Santos et al., 2018).**

The application of AI as support system in health care has gained special relevance in recent decades. AI applications in nursing involve electronic health records (HER) and data analysis, voice assistants who represent the future in EHR applications, health monitoring, clinical decision support, diagnosis and prognosis of certain clinical situations, such as cancer or new onset pathologies in hospitalized clients, robotics technology advances and mobile health and sensor-based technologies. Furthermore, this can be used in community care, remote areas, or in the hospital setting by identifying the possible diagnosis of the user early on, thereby accelerating the healthcare process **(Brian et al., 2022).**

Community health nurses play a crucial role in the delivery of client care, and the increasing demand for high-quality, evidence-based practices has put pressure on the nursing workforce to stay up to date with the latest technological advancements **(Seibert et al., 2021).** In this regard, AI has the potential to support nursing practices by providing real-time decision support, reducing the time spent on administrative tasks, and facilitating the efficient management of client data and care **(Hwang et al., 2022).**

Significance of the study:

As technology continues to advance, the role of AI in healthcare is expected to expand further, revolutionizing the way healthcare is delivered and experienced. Therefore, it becomes vital for nurse faculty to adequately equip student nurses with the necessary competences to effectively utilize AI in their studies. Ensuring that student nurses are prepared and ready to embrace AI technology is imperative for their successful integration into the healthcare workforce **(Labrague et al., 2023).** The significance of this study lies in its potential to impact the future of healthcare, as the global AI in healthcare market, valued at $6.7 billion in 2023, is projected to grow rapidly. With 70% of healthcare tasks potentially impacted by AI, understanding nursing students' attitudes is crucial for preparing them for future roles. Despite 86% of healthcare executives believing AI will enhance client care, 60% of nursing students feel unprepared to work with AI technologies. Many studies address these knowledge gaps, balance the 58% recognition of AI benefits against the 42% concern about risks, and influence the 75% of nursing programs that currently lack AI-related content, thereby promoting better adoption and utilization of AI tools in healthcare **(Allied Market Research, 2023).**

Aim of the Study:

The study aimed to assess nursing students' attitudes regarding AI and explore its benefits, risks, and barriers through:

1. Assessing the nursing students' knowledge levels regarding AI.
2. Exploring the benefits, risks, and barriers related to AI.
3. Identifying attitudes among nursing students regarding AI.

4. Assessing the correlation between nursing students' knowledge regarding artificial intelligence and their attitudes towards it.

Research Questions:

1. What are the nursing students' knowledge levels regarding AI?
2. What are the benefits, risks, and barriers of using AI as perceived by nursing students?
3. What are the nursing students' attitudes levels regarding AI?
4. Is there a correlation between nursing students' knowledge of artificial intelligence and their attitudes towards it?

Subjects and Method:

The subjects and methods for this study were under the following four designs as follows:

I. Technical Design

The technical design includes research design, setting, subject and tools for data collection.

A. Research design:

Descriptive exploratory design was used.

B. Setting:

The study was conducted at faculty of nursing, Zagazig University.

The Faculty of Nursing at Zagazig University is a distinguished institution dedicated to excellence in nursing education, research, and practice. Situated in the heart of Zagazig, Egypt, the faculty provides a comprehensive curriculum that integrates theoretical knowledge with practical skills, preparing students to meet the complex demands of the healthcare sector. The faculty boasts state-of-the-art facilities, including advanced simulation labs and clinical training centers, which enable students to gain hands-on experience in a controlled and supportive environment. With a commitment to fostering innovation and leadership in nursing, the faculty engages in various research projects and community service initiatives, aiming to improve healthcare outcomes locally and globally. Also, the faculty consists of seven departments: Medical and Surgical Department, Community Health Nursing Department, Pediatrics, Administration, Geriatrics, Obstetrics and Gynecology, and Mental Health Nursing. Additionally, the Critical Cases Department is currently being established. The Faculty of Nursing at Zagazig University offers various programs, including Technical and Intensive Programs.

C. Subjects:

A simple random sample was used in this study conducted over a four-month period, involving 367 students. The distribution of students across grades was as follows: First grade: 78 students out of 959, Second grade: 98 students out of 1205, Third grade: 122 out of students 1497, and Fourth grade: 69 students out of 846.

C1. Sample size:

The sample size was calculated according to the formula of **Yamane (1967)**

$$n = \frac{N}{1 + N(e)^2}$$

Where 'n' is sample size. 'N' is total number of all students studying in the Faculty of Nursing, Zagazig University (2022/2023). N= 4507. 'e' is Margin of error (MoE), e =0,05. Based on the formula, the sample size required for the study is 367 undergraduate students from the four academic years.

C2. Sample Technique:

A simple random sampling technique was used in this study. The research team obtained the names of the students from the student affairs office. They placed these names in a jar and randomly selected names according to the required sample size.

D. Tool of Data Collection:

The aim of this study was achieved through the utilization of two tools for data collection:

Tool I: Self-Administered Artificial Intelligence Knowledge Questionnaire

This tool is composed of two parts as follows:

- **Part I: Demographic Characteristics**

This section covers various characteristics of nursing students, including gender, age, residence, semester level, and years of working experience. It also asks about working in private hospitals and with artificial intelligence (AI) technology, internet use time per day (hours), and purposes of using the internet. Additionally, this part covers nursing students' family characteristics such as parents' education, occupation, and family income. It also inquires about previous exposure to information about artificial intelligence and sources of knowledge about artificial intelligence.

- **Part II: Self-Administered Artificial Intelligence Knowledge Questionnaire**

This questionnaire was developed by the research team after reviewing relevant literature guided by **Abdullah & Fakieh, 2020; Robinson, 2020; Shinners et al., 2021; Abuzaid et al., 2022.** It includes 39 items separated into six dimensions: Definition, Importance, Benefits, Risks, Barriers, and Applications of artificial intelligence in health aspects.

- **Scoring System for Knowledge**

Nursing students' responses were scored on a three-point Likert scale as follows: 1 for agree, and 0 for I don’t know or disagree. The total scores range from 0 to 39. The scores of items were summed up and converted into percentage scores, and the total was divided by the number of items to give the mean score. The knowledge level of nursing students was considered unsatisfactory if

the percentage was less than 60% (< 23 points) and satisfactory if the percentage was 60% or higher (≥ 23 points).

Tool II: General Attitudes Toward Artificial Intelligence Scale

The General Attitudes Toward Artificial Intelligence (AI) Scale, adopted by **Schepman and Rodway (2020),** comprises 20 items to assess general attitudes towards AI. This includes 12 positive statements covering opportunities, benefits, and positive emotions, and eight negative attitudes towards AI (concerns and negative emotions), which are represented by the following items: 3, 6, 8, 9, 10, 15, 19, and 20.

Scoring System for Attitudes

Each item was scored on a 5-point Likert scale: 1 indicating strongly disagrees, 2 indicating disagree, 3 indicating neutral, 4 indicating agree, and 5 indicating strongly agree. The item scores were totaled and divided by the number of items to yield a mean score. A low score (≤ 60%) reveals a negative attitude towards AI, whereas a high score (≥ 61%) reveals a positive attitude towards artificial intelligence **(Elsayed and Sleem, 2021).**

Validity

The study tools were rigorously reviewed by a panel of three experts from the faculties of nursing and medicine. This panel ensured the tools' clarity, relevance, comprehensiveness, understanding, and applicability. Based on their feedback, necessary modifications were made to enhance content validity, ensuring that the tools effectively measured the intended constructs.

Reliability

Reliability coefficients were calculated for the study tools, demonstrating high reliability. The "Knowledge" tool had a reliability coefficient of 0.886, and the "Attitudes to AI" tool had a reliability coefficient of 0.899, indicating consistent and reliable measurement.

Ethical Considerations

Ethical approval was obtained from the Scientific Research Ethics Committee at the University of Zagazig. The committee's norms and restrictions aligned with the study's goals, protocols, and techniques (Zu. Nur. REC 0154). Participants were informed that their participation was voluntary, with anonymity and confidentiality assured through data coding. They were also given the right to withdraw from the study at any time.

Operational Design

The operational design comprised three phases: the preparatory phase, pilot study, and fieldwork.

Preparatory Phase

During this phase, the researchers conducted an extensive review of current and past local and international literature, as well as theoretical knowledge relevant to various aspects of the study. This review included books, articles, journals, and internet sources to prepare the tools for data collection.

Pilot Study

A pilot study was conducted once the data collection tools were prepared, involving approximately 10% of the sample (37 students). This study tested the feasibility and reliability of the tools, helping to identify potential issues or challenges that might arise during the actual fieldwork.

Field Work

Prior to commencing the study, approval was obtained from each participant and the Scientific Ethical Committee of the Faculty of Nursing at Zagazig University. The tools were validated for face and content through expert feedback and pilot testing. Oral informed consent was obtained from each participant, and the study's aims and objectives were explained to the students in a lecture room at the Faculty of Nursing. A questionnaire covering various aspects of artificial intelligence, such as knowledge and attitudes, was administered to each participant. Data collection took place between March 2023 and May 2023, with each questionnaire taking between 30 and 35 minutes to complete. The research team met with the participants three days a week: Sundays, Mondays, and Wednesdays.

Administrative Design

The administrative design of the study was meticulously planned to ensure compliance with ethical guidelines and regulations. After explaining the study aim and objectives, official permission was sought and obtained from the Dean of the Faculty of Nursing at Zagazig University. This step was crucial for gaining access to the necessary data and resources for the study to proceed.

IV. Statistical design:

All data were collected, tabulated and statistically analyzed using IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. Quantitative data were expressed as the mean ± standard deviation (SD), and qualitative data were expressed as number and percentage. Pearson Correlation analysis was used for assessment of the relationship among the study variables. Best fitting linear regression model was done to identify the independent predictors of artificial intelligence's knowledge and attitude. Statistical significance is considered as highly statistically significant p - value< 0.01, significant p- value < 0.05 and statistically insignificant p-value ≥ 0.05. Additionally, Cronbach alpha coefficient was calculated to assess the reliability of the tool through their internal consistency.

Results

Part I: Socio-demographic Characteristics of the Nursing Students

Table 1: Demographic Characteristics of the Studied Nursing Students **(n = 367)**

Demographic Characteristics	No	%
Gender		
Male	115	31.30
Female	252	68.70
Age		
18 - < 19 Y	38	10.40
19- < 20 Y	71	19.30
20- < 21 Y	145	39.50
21+	113	30.80
Mean±SD	**2.91 ± 0.95**	
Residence		
Rural	279	76.00
Urban	88	24.00
Semester level		
First Level	78	21.30
Second Level	98	26.70
Third Level	122	33.20
Fourth Level	69	18.80
Years of working experience		
> 1 Y	99	27.00
1- < 3 Y	102	27.80
3- < 5 Y	87	23.7
5+	79	21.50
Working in private hospitals working with artificial intelligence (AI) technology		
Yes	27	7.40
No	340	92.60
Internet use time per day (hours)		
Mean±SD	**6.17± 4.87**	
Purposes of using Internet		
Social Media	251	68.39
Learning & Searching	188	51.23
Entertainment (games, music and watch movies)	124	33.79

Table 1 shows the demographic characteristics of 367 nursing students. 68.70% of them were females, with males comprising 31.30%. Age distribution shows that 39.50% were aged 20 to less than 21 years, with a mean age of 2.91 ± 0.95. 76.00% of them resided in rural areas. Regarding academic levels, 33.20% were in the third level. In terms of work experience, 27.80% had 1 to less than 3 years. Only 7.40% worked in private hospitals using AI technology, with 92.60% had no such experience. Students spent an average of 6.17 ± 4.87 hours per day on the internet, primarily for social media (68.39%), learning and searching (51.23%), and entertainment (33.79%).

Table 2: Distribution of the Studied Nursing Students According to Their Family Characteristics **(n = 367)**

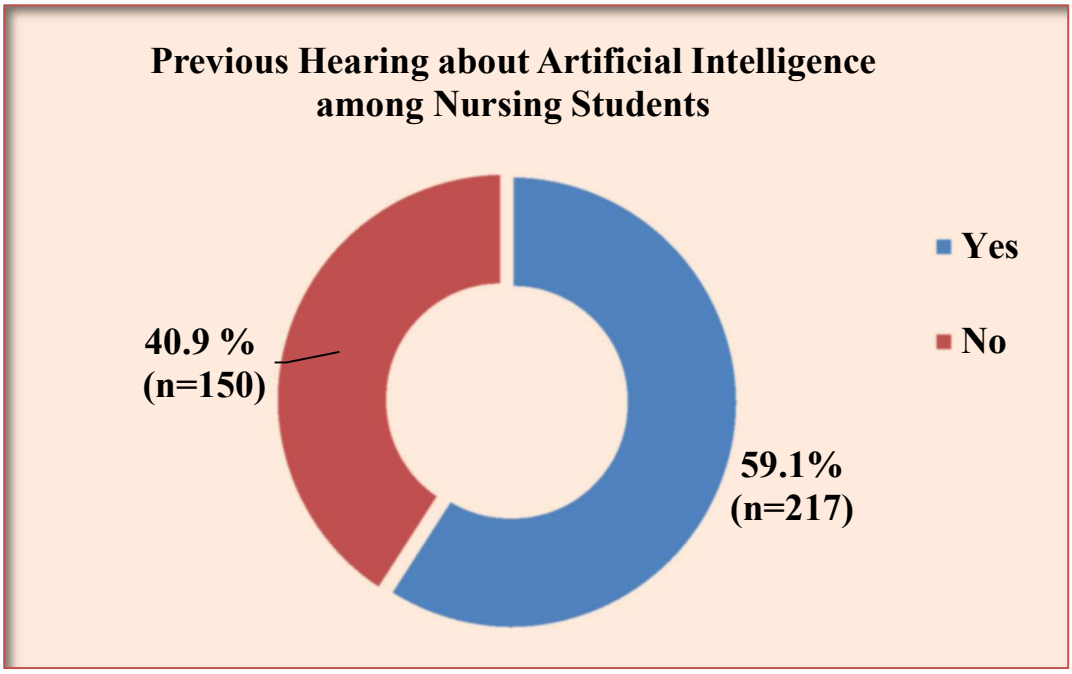
Family Characteristics	No	%
Father's Education		
Illiterate/read-write	42	11.44
Basic/ intermediate education	195	53.10
University	121	33.00
Graduate Studies (Master/Doctorate)	9	2.5
Father's Occupation		
Farmer/Worker	39	10.60
Employee	158	43.10
Craft worker	33	9.00
Professional	68	18.50
Freelancer/ Businessman	58	15.80
Others	11	3.00
Mother's Education		
Illiterate/read-write	91	24.8
Basic/ intermediate education	201	54.8
University	73	19.9
Graduate Studies (Master/Doctorate)	2	0.54
Mother's Occupation		
Working	111	30.20
Housewives	256	69.80
Family income		
Enough & save	82	22.30
Enough only	256	69.80
Not enough and borrowing	29	7.90

Table 2 provides an overview of the family characteristics of nursing students. 53.10% of fathers had basic or intermediate education, with 33.00% had a university education. Fathers were primarily employees (43.10%). Similarly, 54.80% of mothers had basic or intermediate education,

while 69.80% of mothers were housewives. Regarding family income, 69.80% of families had just enough income and 7.90% did not have enough income and needed to borrow.

Figure 1: Previous Hearing about Artificial Intelligence among Nursing Students **(n = 367)**

Figure 1 illustrates the previous hear of knowledge about Artificial Intelligence AI among nursing students. It shows that 59.1% (217 students), reported having prior knowledge of AI.



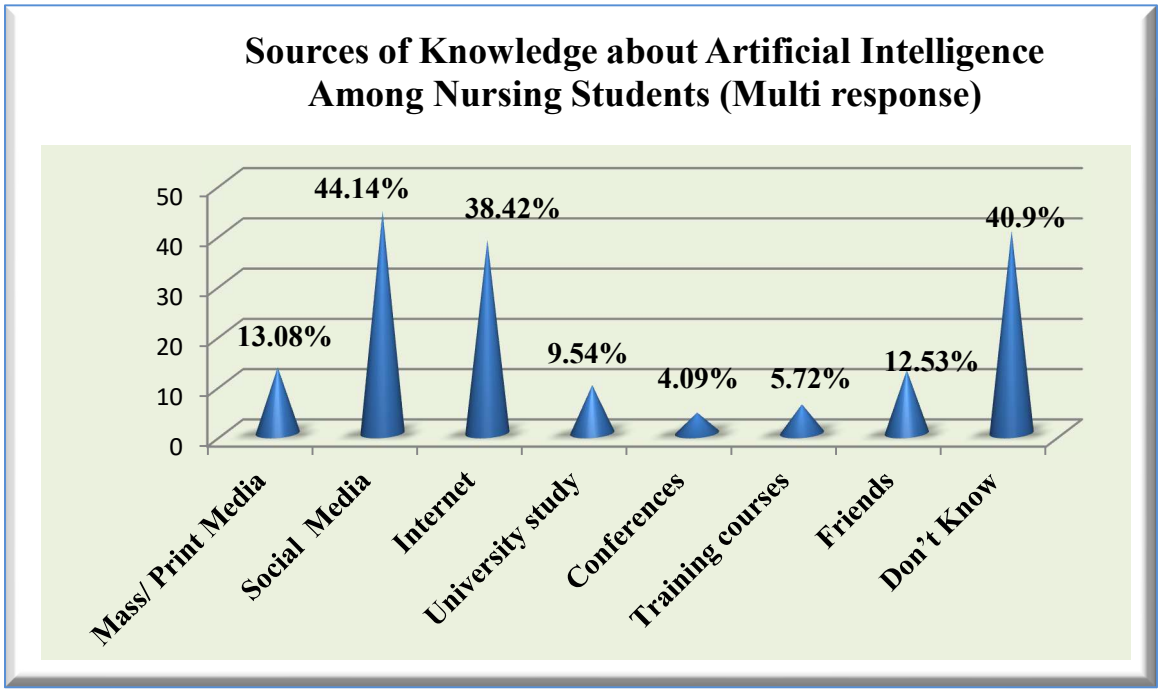


Figure 2: Sources of Knowledge about Artificial Intelligence Among Nursing Students **(n = 367) (Multi response)**

Figure 2 depicts that social media was the most common source, with 44.14% of students citing it. The internet followed closely, serving as a source for 38.42% of the students. University study contributed to 13.08% of students' knowledge about AI, while friends were a source for 12.53%. Less significant sources included conferences (9.54%), training courses (5.72%), and mass/print media (4.09%).

Part II: Nursing students' Levels of Knowledge (Benefits, Risks, Barriers) Regarding Artificial Intelligence

Table 3: Nursing Students' Knowledge about Artificial Intelligence **(n = 367)**

Artificial Intelligence Knowledge Domains	Subtotal Score	Mean±SD	Satisfactory		Unsatisfactory	
			No	%	No	%
Awareness about the concept of Artificial Intelligence AI	4	2.31 ±1.14	192	52.32	175	47.68
Importance of AI in health and nursing field	5	3.00 ±1.47	249	67.85	118	32.15
Benefits of Artificial Intelligence	9	6.11 ±2.58	250	68.12	117	31.88
Risks of Artificial Intelligence	11	6.18 ±3.01	189	51.50	178	48.50
Barriers of Artificial Intelligence	5	2.47 ±1.60	198	53.95	169	46.05
Applications of Artificial Intelligence in health aspects	5	3.30 ±1.70	262	71.39	105	28.61
Total Knowledge Score	**39**	**23.36 ±8.79**				

Table 3 reveals the distribution of knowledge among nursing students regarding various aspects of Artificial Intelligence (AI). Awareness about the concept of AI (2.31 ± 1.14), importance of AI in health and nursing (3.00 ± 1.47), benefits (6.11 ± 2.58), risks (6.18 ± 3.01), barriers (2.47 ± 1.60), and applications in health (3.30 ± 1.70). Satisfactory knowledge levels varied, with the highest percentages in applications of AI in health (71.39%) and understanding the benefits (68.12%). Overall, the students achieved a mean total knowledge score of 23.36 ± 8.79 out of 39.

Table 4: Responses of the Studied Nursing Students Regarding Benefits of Using Artificial Intelligence **(n = 367)**

Benefits of Using Artificial Intelligence	Mean±SD	Yes	
		No	%
AI can speed up the process in health care.	0.73± 0.44	269	73.30
AI can help reduce the number of medical errors.	0.75± 0.43	275	74.90
AI can deliver clinically relevant, vast amounts of high-quality data in real time.	0.73± 0.44	268	73.00
Artificial intelligence helps the client get answers instantly through chatbots without any restrictions on time or place.	0.67± 0.47	247	67.30
Artificial intelligence helps in performing tedious administrative tasks that may take a long time.	0.7± 0.46	257	70.00
Artificial intelligence helps reduce human error.	0.69± 0.46	252	68.70

Artificial intelligence can work 24 hours a day, every day of the week without physical stress.	0.72± 0.45	265	72.20
Artificial intelligence can predict surgical outcomes for clients.	0.39± 0.49	143	39.00
Artificial intelligence helps in the field of public health and epidemiology.	0.73± 0.45	266	72.50
Total Benefits Score	**Subtotal Score** 9	**Mean±SD** 6.11± 2.58	

Table 4 reveals that the mean scores indicate positive perceptions about AI's ability to speed up healthcare processes (0.73 ± 0.44), reduce medical errors (0.75 ± 0.43), deliver real-time clinically relevant data (0.73 ± 0.44), its contribution to public health and epidemiology (0.73 ± 0.45), and streamline administrative tasks (0.70 ± 0.46). Additionally, AI's capability to reduce human error (0.69 ± 0.46) and operate continuously without fatigue (0.72 ± 0.45). However, fewer students perceived AI's ability to predict surgical outcomes (0.39 ± 0.49) and to provide instant answers through chatbots (0.67 ± 0.47) positively, with 39.00% and 67.30 agreeing, respectively. The overall mean total benefits score was 6.11 ± 2.58 out of 9.

Table 5: Perceptions of Nursing Students on Risks Associated with Artificial Intelligence **(n = 367)**

Risks of Using Artificial Intelligence	**Mean±SD**	**Yes**	
		No	**%**
AI is not flexible enough to be applied to every client.	0.62±0.49	227	61.90
AI is difficult to apply to controversial subjects.	0.47±0.50	173	47.10
Artificial intelligence has a low ability to empathize and consider the emotional well-being of the client.	0.63±0.48	232	63.20
The artificial intelligence was programmed by a specialist with little experience in medical practice.	0.22±0.42	82	22.30
Lack of creativity and thinking outside the box to provide opinions in unexpected situations.	0.48±0.5	177	48.20
Inability to control the capabilities of artificial intelligence.	0.43±0.50	158	43.10
AI machines (currently) have no emotion.	0.67±0.47	244	66.50
AI can deteriorate or malfunction.	0.73±0.45	266	72.50
Decrease in the number of jobs for humans.	0.76±0.43	278	75.70
The rising costs of artificial intelligence.	0.71±0.46	259	70.60
Violations of ethical considerations and clients' rights occur during artificial intelligence programming.	0.47±0.50	171	46.60
Total Risks Score	**Subtotal Score** 11	**Mean±SD** 6.18±3.01	

Table 5 elucidates that the mean scores indicated varying levels of recognizing AI's risks. Students' perceived risks as: inflexibility of AI's application (0.62±0.49), difficulty to be applied to controversial subjects (0.47±0.50), low ability to empathize the client's emotional well-being (0.63±0.48), lack of creativity (0.48±0.5), AI machines having no emotion (0.67±0.47), possibility of deterioration or malfunction (0.73±0.45), decrease jobs for humans (0.76±0.43), AI's rising costs (0.71±0.46), and Violations of ethical considerations and clients' rights (0.47±0.50). However, fewer students recognized AI's risks regarding being programmed by a little experienced specialist (0.22±0.42), and inability to control AI's capabilities (0.43±0.50) as reported by 22.30% and

43.10% of the nursing students, respectively. The overall mean total risks score was 6.18±3.01out of 11.

Table 6: Responses of the Studied Nursing Students Regarding barriers of Using Artificial Intelligence **(n = 367)**

Barriers of Using Artificial Intelligence	**Mean±SD**	**Yes**	
		No	**%**
Poor knowledge of Information Technology IT.	0.62±0.49	226	61.60
Software legislation and oversight.	0.57±0.50	209	56.90
Promote quackery and sorcery.	0.27±0.44	98	26.70
Poor internet connection.	0.55±0.50	201	54.80
Promote self-medication.	0.47±0.5	171	46.60
Total barriers Score	**Subtotal Score** 5		**Mean±SD** 2.47 ±1.60

Table 6 articulates that the mean scores indicated varying levels of concern among the students: barriers such as poor knowledge of Information Technology (IT) scored a mean of 0.62 ± 0.49, with 61.60% of students agreeing it could be a hindrance. Similarly, concerns about software legislation and oversight scored a mean of 0.57 ± 0.50, with 56.90% acknowledging it as a barrier. Issues like promoting quackery and sorcery scored a mean of 0.27 ± 0.44, though 26.70% of students still saw it as a potential concern. Poor internet connectivity scored a mean of 0.55 ± 0.50, affecting 54.80% of students. Finally, the promotion of self-medication scored a mean of 0.47 ± 0.50, with 46.60% considering it a barrier. The overall mean total barriers score was 2.47 ± 1.60 out of 5.

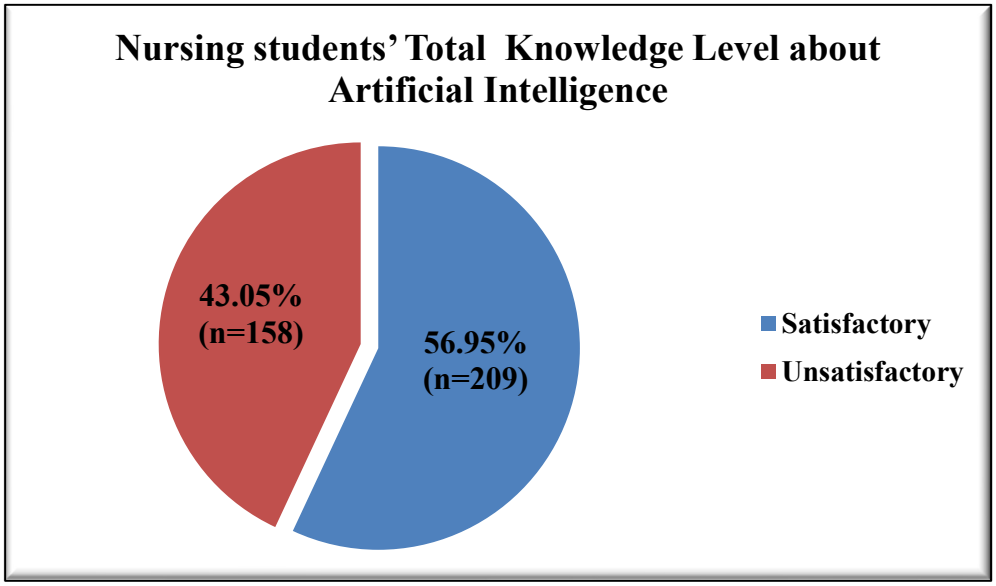


Figure 3: Nursing students' Total Knowledge Level about Artificial Intelligence **(n = 367)**

Figure 3 delineates the nursing students' total knowledge level about artificial intelligence. As shown, 56.95% of the nursing students had satisfactory total knowledge level about artificial intelligence.

Part III: Nursing students' Levels of Attitude Regarding Artificial Intelligence

Table 7: Distribution of the Studied Nursing Students According to Their Attitude about Artificial Intelligence AI **(n = 367)**

Items	SD		D		N		A		SA	
	No	%	No	%	No	%	No	%	No	%
For routine transactions, I would rather interact with an artificially intelligent system than with a human.	61	16.62	84	22.89	101	27.52	94	25.61	27	7.36
Artificial Intelligence AI can provide new economic opportunities for this country.	27	7.36	57	15.53	109	29.70	129	35.15	45	12.26
Organizations use AI unethically.	69	18.80	104	28.34	99	26.98	71	19.35	24	6.54
Artificially intelligent systems can help people feel happier.	32	8.72	60	16.35	161	43.87	92	25.07	22	5.99
I am impressed by what AI can do.	21	5.72	36	9.81	100	27.25	169	46.05	41	11.17
I think artificially intelligent systems make many errors.	24	6.54	53	14.44	142	38.69	124	33.79	24	6.54
I am interested in using artificially intelligent systems in my daily life.	26	7.08	56	15.26	140	38.15	116	31.61	29	7.90
I find Artificial Intelligence sinister.	53	14.44	123	33.51	127	34.60	42	11.44	22	5.99
Artificial Intelligence might take control of people.	37	10.08	91	24.80	105	28.61	98	26.70	36	9.81
I think Artificial Intelligence is dangerous.	29	7.90	67	18.26	137	37.33	89	24.25	45	12.26
Artificial Intelligence can have positive impacts on people's wellbeing.	22	5.99	36	9.81	97	26.43	170	46.32	42	11.44
Artificial Intelligence is exciting.	20	5.45	18	4.90	102	27.79	173	47.14	54	14.71
An artificially intelligent agent would be better than an employee in many routine jobs.	30	8.17	56	15.26	99	26.98	111	30.25	71	19.35
There are many beneficial applications of AI.	16	4.36	14	3.81	107	29.16	162	44.14	68	18.53
I shiver with discomfort when I think about future uses of Artificial Intelligence.	46	12.53	85	23.16	135	36.78	73	19.89	28	7.63
Artificially intelligent systems can perform better than humans.	34	9.26	60	16.35	148	40.33	93	25.34	32	8.72
Much of society will benefit from a future full of Artificial Intelligence	24	6.54	29	7.90	138	37.60	137	37.33	39	10.63
I would like to use AI in my own job.	33	8.99	37	10.08	137	37.33	114	31.06	46	12.53
People like me will suffer if Artificial Intelligence is used more and more.	31	8.45	94	25.61	152	41.42	62	16.89	28	7.63

Artificial Intelligence is used to spy on people	78	21.25	81	22.07	99	26.98	60	16.35	49	13.35

Abbreviations: SD, Strongly Disagree; D, Disagree; N, Neutral; A, Agree; SA, Strongly Agree.

Table 7 displays that the attitudes of nursing students towards artificial intelligence are diverse. The opinion that AI is exciting is on the first rank of the agreed attitudes towards artificial intelligence as opined by 47.14% of the nursing students, followed by the opinions that "AI can have positive impacts on people's wellbeing, I am impressed by what AI can do, there are many beneficial applications of AI, AI can provide new economic opportunities for this country, and an artificially intelligent agent would be better than an employee in many routine jobs" with percentages as follows (46.32%, 46.05%, 44.14%, 35.15% and 30.25%, respectively). Conversely, skepticism arises as 28.34% doubt that organizations use AI unethically.

Figure 5: Nursing students' Total Attitude Level about Artificial Intelligence **(n = 367)**

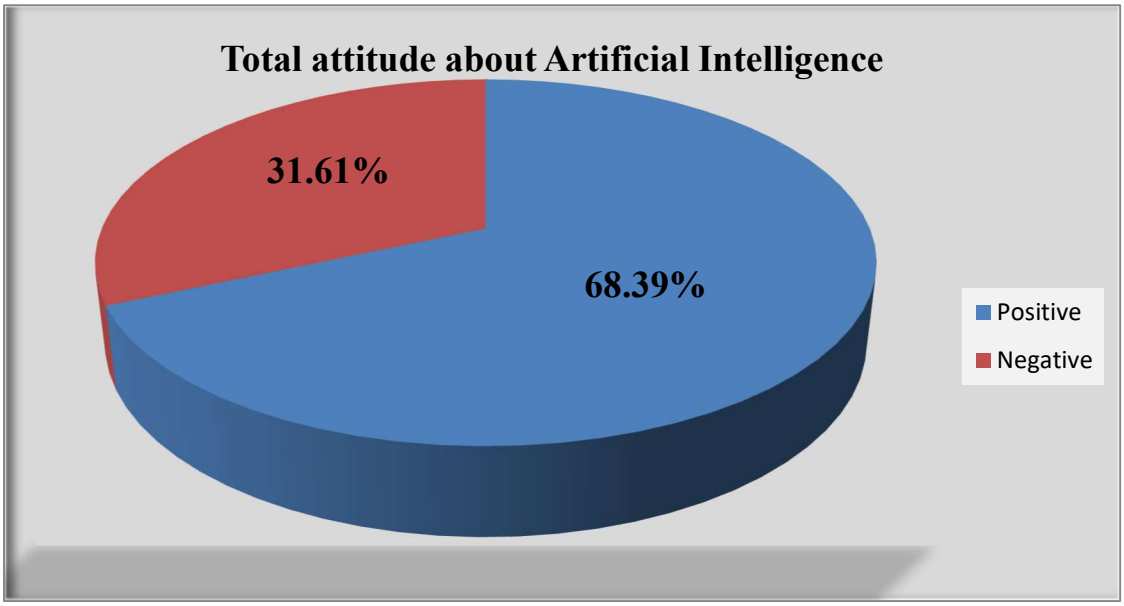


Figure 5 portrays that the total level of attitude about artificial intelligence was positive among 68.39% of the nursing students, while 31.61% demonstrated a total negative attitude.

Part IV: Correlations and Predictors of the Studied Variable among the Study Group

Table 7: Correlation between the Nursing students' Total Level of Knowledge and Their Total Level of Attitude about Artificial Intelligence **(n = 367)**

Item		Total attitude
Total knowledge	**R**	0.207
	p	0.001**

(**) Statistically significant at p<0.01. r Pearson correlation

Table 8 explains the correlation between the studied variables. A highly significant positive statistical correlation is observed between the total knowledge level of nursing students and their total attitude about artificial intelligence (p = 0.001; r =0.207).

Table 9: Best Fitting Linear Regression Model for Total Knowledge about Artificial Intelligence **(n = 367)**

Independent Variables	Unstandardized Coefficients		Standardized Coefficients	t test	P Value
	B	Std. Error SD	Beta β		
Gender	22.361	3.609		6.196	0.363
Age	0.218	0.91	0.012	0.24	0.811
Residence	-2.876	0.917	-0.312	-3.136	0542
Semester Level	0.6	0.982	0.029	0.611	0.002
Years of Working Experience	2.389	0.848	0.279	2.816	0.005
Working in Private Hospitals Working With Artificial Intelligence Technology	0.733	0.32	0.121	2.291	0.023
Previous knowledge about Artificial Intelligence	5.568	1.545	0.175	3.603	0.001

Note: R Square= 0.226, Adjusted R Square = 0.210, F = 14.94, significant p<0.05.

Table 9 presents the best fitting linear regression model for the total knowledge about artificial intelligence. It indicates that the nursing students' semester level (p=0.002), years of working experience (p=0.005), working in private hospitals working with AI technology (p=0.023) and having previous knowledge about AI (p=0.001) were statistically independent positive predictors of total knowledge about artificial intelligence. Overall, the model's R Square of 0.226 indicates that these variables collectively explain 22.6% of the variance in AI knowledge among nursing students.

Table 10: Best Fitting Linear Regression Model for Total Attitude toward Artificial Intelligence **(n = 367)**

Independent Variables	Unstandardized Coefficients		Standardized Coefficients	t test	P Value
	B	Std. Error SD	Beta B		
Gender	55.725	4.82		11.562	0.533
Age	1.111	1.312	0.045	0.847	0.389
Residence	0.729	1.225	0.066	0.595	0.552
Semester Level	1.121	1.162	.062	.965	.335
Years of Working Experience	3.008	1.215	0.136	2.541	0.001
Working in Private Hospitals Working With Artificial Intelligence Technology	2.341	1.384	0.108	2.453	0.011
Previous knowledge about Artificial Intelligence	2.253	2.064	0.059	1.092	0.276

Note: R Square= 0.040, Adjusted R Square = 0.022, F = 2.15, significant p<0.05.

Table 10 illustrates the best fitting linear regression model for the total attitude toward artificial intelligence. It indicates that years of working experience (p=0.001) and working in private hospitals working with AI technology (p=0.011) were statistically independent positive predictors of total attitude toward artificial intelligence. Overall, the model's R Square of 0.040 indicates that these variables collectively explain 4% of the variance in attitude towards AI among nursing students.

Discussion

Nowadays AI is emerging as new innovations, and getting popular due to its ability to analyze clinical data and client details with greater amounts of research evidences for clinical problem-solving and decision making and enhance new knowledge **(Compassion in a Technological World, 2018).** Because of these capacities, the AI can renovate different aspects of health care systems in the forthcoming decades. These innovations of AI in nursing require training to transform the nursing education and practice aspects. Nursing students need skills and knowledge to integrate AI knowledge into health care practice **(Pepito & Locsin, 2019).** Therefore, the current study aimed to assess nursing students' attitude regarding AI and explore its benefits, risks and barriers.

The findings of the present study revealed that slightly more than two-thirds of the nursing students were female, and two-fifths were aged 20 to 21 years, with an average age of 2.91 ± 0.95 years. Nearly one-fourth had 1-3 years of working experience, and the majority did not work in private hospitals utilizing AI technology. This may be attributed to the nursing profession being traditionally female-dominated due to gender roles and norms, and the profession's encouragement of engagement. Additionally, the average daily internet usage was 6.17 ± 4.87 hours, with slightly more than two-thirds using the internet for social media. More than half of the parents of these nursing students had intermediate education, with around two-thirds of mothers being housewives. These factors could certainly influence nursing students' attitudes toward AI.

The present study findings illustrated that about three-fifths of the nursing students had prior knowledge of AI. This may be due to the widespread integration of AI technology across various sectors in response to Egypt's Vision 2030, which emphasizes the use of AI in diverse working settings, including the healthcare sector. This finding was aligned with a study conducted in **Karnataka** by **Sheela (2022)**, which revealed that more than half of nursing students had previous knowledge about AI. In contrast, **Abdullah & Fakieh (2020)** found that the overall perception of healthcare employees in **Saudi Arabia** toward AI was moderate. Additionally, the majority of respondents were unaware of the benefits and most common obstacles associated with using AI in the health sector, highlighting a need for training. The discrepancy between the results might be due to differences in the study settings.

The present study findings also revealed that the primary source of information for nursing students' knowledge about AI was social media. This is likely due to social media and the internet being invaluable resources for knowledge and learning. Their vastness, accessibility, timeliness, diversity of perspectives, and ability to connect people make them valuable tools for expanding knowledge and understanding of the world. Therefore, the researchers believe there is a need to enhance the university curriculum to include more comprehensive and up-to-date AI courses. This finding was supported by **Robinson (2020)**, who found in a study conducted in **Nigeria** that the internet and social-media was the main source of information (89.32%). Conversely, this result contrasted with **Abuzaid et al. (2022) in Sharjah**, **UAE**, where 51% of respondents stated their AI knowledge was self-taught, while 20% gained it through various courses. The discrepancy between results might be due to the diversity in the specialties of the study samples.

Addressing the first objective and research question, the present study findings illustrated that more than half of the nursing students had satisfactory knowledge of AI. The highest

mean percentage, ranking first, was related to applications of AI in health aspects. This might be due to the nursing students' use of AI technology in their daily lives through smartphones and other devices, making them aware of the concept and importance of using AI in nursing settings, especially after the COVID-19 pandemic. The lowest percentage, ranking last, was related to the risks of AI. From the researchers' point of view, nurses consider AI technology flexible enough for use with every client and are unaware of its hazards if misused. This finding was corroborated by **Abuzaid et al. (2022)**, who found that 70% of nurses and nursing students in the **UAE** had knowledge about AI applications. Also, **Abdullah & Fakieh (2020)** in **Saudi Arabia** reported that the highest score was regarding AI applications in healthcare, followed by advantages of using AI among healthcare employees. This result was inconsistent with **Elsayed & Sleem (2021)** in **Egypt,** who found that the perception of advantages of using AI achieved the highest mean score, followed by concerns about AI applications in healthcare among nurse managers. This discrepancy might be attributed to differences in perceptions and concerns among study samples.

Addressing the second objective and research question, exploring the benefits, risks, and barriers related to AI, the study findings illustrated that reducing the number of medical errors was the main benefit identified by nursing students, followed by speeding up healthcare processes. This finding might be explained by the ability of AI technologies to process vast amounts of data accurately, rapidly, and efficiently, detect patterns, and provide real-time decision support, potentially reducing errors and improving client safety. This finding was aligned with a study conducted in **Egypt** by **Abd El-Maksoud (2024),** where most students indicated that the advantages of using AI in healthcare included reducing medical errors and speeding up processes. Similarly, in a study conducted in **Saudi Arabia, Abdullah & Fakieh (2020)** found that speeding up healthcare processes was the main advantage identified by respondents.

According to the present study results, the highest risk score associated with using AI was the fear that AI could decrease the number of jobs for humans. This phenomenon might be attributed to fear of obsolescence and the notion that AI will render human roles irrelevant. In agreement with this finding, **Robinson (2020)**, in a study conducted in **Nigeria,** clarified that participants feared AI could eliminate the human factor. This finding was also consistent with **Goldin (2019)** who reported that AI would lead to millions losing their jobs, resulting in economic decline in developing countries like those in Africa. On the contrary, **Bernard (2020)** emphasized that AI would change the world order concerning the types of jobs performed by humans and would not necessarily cause outright job loss. Correspondingly, **Masriadil et al. (2023),** in a study in **Indonesia,** found that humans who adapt would not be replaced by machines; instead, there would be an integration of human-machine work, where AI and automation would become tools for human labor rather than replacements. These discrepancies among studies might be attributed to varying levels of in-depth knowledge of AI and information technology.

The current study results revealed that poor knowledge of information technology was the highest barrier to using AI. This finding could be explained by the fact that the majority of nursing students had not previously attended any artificial intelligence training courses and stated that the nursing curriculum did not include the fundamentals of AI. Similarly, a study in **Turkey by Yüzbaşıoğlu (2020)** indicated that participants gained more learning materials through attending workshops, academic lectures, and scientific conferences related to the uses of AI in healthcare. Conversely, a study conducted in **Singapore by Chan & Zary (2019)** mentioned that the biggest

challenges of learning AI among medical students were digitalization and lack of computer knowledge. These differences might be attributed to discrepancies in cultures and educational environments.

Addressing the third objective and research question, which focused on identifying attitudes among nursing students in relation to AI, the present study findings illustrated that more than two-thirds of the nursing students had a positive attitude toward AI, and less than half of them felt AI was exciting. This finding might be attributed to the students' belief that AI is transforming the future of healthcare delivery and would be beneficial in clinical practice, diagnosis, and client care. Moreover, attitudes toward AI influence emotions, behaviors, experiences, and beliefs about AI; thus, learners need to have a positive attitude toward AI. This finding is consistent with **Lukic et al. (2023) in Croatia**, who reported that around two-thirds of nursing students had a positive attitude towards AI. Similarly, a study by **Swed et al. (2022)** in **Syria** illustrated that participants showed satisfactory perception and attitude toward AI use in healthcare practice and its importance. In contrast, **Chaieb et al. (2023) in Saudi Arabia** found that employees in the Saudi healthcare sector had a moderate level of acceptance of AI applications, with most respondents indicating concern that their jobs would be replaced by AI. This difference might be attributed to the lower level of knowledge among respondents.

Addressing the fourth objective and research question, which assessed the correlation between nursing students' knowledge and their attitudes regarding AI, the current study findings revealed a highly statistically significant positive correlation between AI awareness and positive attitudes toward AI. Nursing students with a high level of AI knowledge showed a positive attitude toward AI. This finding might be attributed to the fact that AI technology acceptance and positive attitudes can change behavioral intentions influenced by raising awareness about AI technology's ease of use and sufficient knowledge about its benefits and usage in healthcare settings. This result was strongly supported by **Kwak et al. (2022) in Korea**, who revealed that positive awareness of AIHTs among nursing managers influenced positive attitudes toward AI-based technology. Similarly, a study **in India by Jindal & Bansal (2020)** reported that the majority of the students (62.5%) responded that they had some knowledge about AI and an optimistic attitude about the integration of AI in clinical practice.

In multivariate analysis, the present study results revealed that nursing students' demographic characteristics (semester level, years of working experience, working in private hospitals using AI, and previous knowledge about AI) were identified as significant independent positive predictors of students' knowledge scores, as confirmed by the study's regression model. This result might be explained by the global trend showing the need to use AI to reduce the rate of infection spread. Additionally, all health settings are trying to use AI in different nursing contexts, which link the awareness of nursing students to the use of AI in various workplaces, especially at the present time. The correlation of the semester level, years of working experience, and previous knowledge with the need for AI and technology in health settings aligns with the global trend. This finding was consistent with a study conducted in **Egypt by Elsayed & Sleem (2021),** who revealed that nurse managers' demographic characteristics (years of experience, education, and working in hospitals using AI) had a significant positive effect on their knowledge.

The present study findings also revealed that nursing students' demographic characteristics, such as years of working experience and working in private hospitals with AI, were significant independent positive predictors of students' attitude scores in the regression model. This outcome suggests that working in private hospitals utilizing AI and accumulated years of experience are pivotal environmental factors influencing individuals' perceptions and attitudes towards AI adoption. This finding was aligned with a recent study by **Elderiny et al. (2024)** conducted in **Egypt**, which similarly found a positive relationship between student nurses' demographic characteristics (age, years of working experience, and exposure to AI in hospitals) and their attitudes towards AI. In contrast, a study by **Labrague et al. (2023)** in the **Philippines** found no significant difference in nurses' attitudes towards AI based on their qualifications, hospital settings, or working experiences. These discrepancies among studies may be attributed to cultural variations.

Conclusion:

Based on the findings of this study, it was concluded that more than two-thirds of nursing students had knowledge regarding AI's benefits, with over half had knowledge of its risks and barriers. Overall, more than half of the surveyed nursing students demonstrated satisfactory knowledge regarding AI. Furthermore, more than two-thirds of the students exhibited positive attitudes towards the integration of AI in healthcare. Additionally, there was a statistically significant positive correlation between nursing students' knowledge of AI and their attitudes towards it. Moreover, years of working experience and employment in private hospitals with AI were identified as significant independent positive predictors for both students' knowledge and attitude regarding AI, while semester level and previous knowledge about AI were positive predictors for students' knowledge alone.

Recommendations:

1. Develop educational programs aimed at enhancing nursing students' understanding of artificial intelligence.
2. Implement training initiatives to facilitate the seamless and safe integration of AI into the nursing practice curriculum, ensuring its practical application.
3. Organize workshops and educational programs that educate nursing students about the benefits, risks, and barriers of artificial intelligence.

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