The Relationship between Nurse's Perspectives and Nurse's Attitude toward Artificial Intelligence

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Abstract

Background: As artificial intelligence (AI) becomes increasingly integrated into healthcare, understanding nurses' perspectives and attitudes toward AI is essential for its effective adoption. **Aim**: This study aimed to assess the relationship between nurses' perspectives and their attitudes toward AI in healthcare, and to evaluate the effect of an educational training program. **Design**: A quasi-experimental research design with pre-, post-, and a three-month follow-up assessment was utilized. **Setting**: The study was conducted at Badr University Hospital, affiliated with the Ministry of Health and Helwan University. **Subjects**: A convenience sample of 77 nurses participated.**Methods**: Data were collected using two validated tools: (I) a self-administered questionnaire on nurses' perspectives toward AI in healthcare, and (II) the General Attitudes Toward Artificial Intelligence Scale (GAAIS). A structured educational intervention focusing on AI was implemented. **Results**: There was a significant increase in nurses' perspective and attitude scores toward AI in the post-test and follow-up phases compared to pre-test (p < 0.001). The total mean score of nurses' perspectives increased from 39.32±14.9 (pre) to 66.37±11.6 (post), and attitude scores increased from 56.03±21.9 (pre) to 92.30±16.2 (post). A strong positive correlation was found between nurses' perspectives and attitudes toward AI across all phases (r = 0.985, p < 0.001). **Conclusion**: The educational program significantly improved nurses' perspectives and attitudes toward AI, and a strong correlation between these variables was observed. **Recommendations**: Nursing administrators should integrate AI-focused training development, into continuous professional development plans and strategic digital health initiatives.

Keywords: Nurse's Perspectives, Nurse's Attitude, Artificial Intelligence.

Introduction

The integration of artificial intelligence (AI) into healthcare has become a hallmark of contemporary clinical innovation, offering transformative potential across patient care, administrative efficiency, and medical decision-making. As healthcare systems strive for enhanced precision and responsiveness, AI technologies are increasingly adopted to support patient engagement, manage clinical workflows, and improve outcomes. Forecasts suggest that by 2025, the majority of healthcare organizations will incorporate AI into their operations to advance patient-centered care and streamline performance (**Jose et al., 2022**). AI refers to the

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computational capability of machines to simulate human intelligence through data interpretation, learning, and autonomous decision-making. With the emergence of platforms such as ChatGPT, discussions surrounding AI's practical and ethical implications have intensified (**Sommer et al., 2024**).

Within hospital settings, AI and robotics are rapidly gaining traction, particularly in diagnostics, clinical risk stratification, and automation of repetitive tasks. These innovations are instrumental in boosting accuracy, reducing costs, and enabling timely interventions in clinical routines (**Sunarti et al., 2021**). Technologies such as machine learning, data mining, and robotic interfaces are now leveraged to analyze electronic health records, forecast disease trajectories, and tailor treatment protocols to individual patients (**Hossen & Armoker, 2020**). By converting clinical data into actionable insights, AI facilitates faster and more informed therapeutic decisions **(Woo et al., 2021).**

In clinical care pathways, AI contributes significantly to patient monitoring, early detection of health deterioration, and the design of personalized care plans. It enhances clinical responsiveness and supports proactive decision-making across the continuum of care (**Liu et al., 2020**). For nurses, engaging with AI involves interpreting sensitive health data, necessitating strict adherence to privacy standards and ethical guidelines such as those outlined in HIPAA (**Sulosaari et al., 2022**).

Nurses, as central figures in patient care, are pivotal to the successful integration of AI in healthcare. Nurse managers play a key role in fostering environments that encourage the ethical and practical use of AI tools. While many nurses recognize the potential of AI to enhance efficiency and patient safety, their attitudes toward adoption are shaped by exposure, training, and the culture of the institutions in which they work (**Arishi et al., 2023**). In high-stakes scenarios such as emergency care and inter-shift handovers, nurses' acceptance of AI can critically influence care quality. By alleviating administrative burdens and facilitating real-time access to data, AI supports evidence-based practice and clinical decision-making (**Martinez-Ortigosa et al., 2023**).

One of AI's key contributions in nursing is its ability to capture and synthesize complex patient information through smart monitoring systems. These technologies integrate real-time physiological data with patient-reported outcomes to provide nuanced clinical perspectives. To effectively utilize these systems, nurses require ongoing digital literacy and institutional support for innovation. The integration of AI in healthcare is further linked to improved workflow efficiency, cost-effectiveness, and accountability in care delivery (**Mir et al., 2023**). Historically, nurses have employed digital tools such as wearable devices, mobile diagnostics, and voice assistants—now recognized as components of broader AI systems. As the healthcare sector deepens its reliance on AI, a critical examination of the nurse-AI interface becomes increasingly important (**Sabra et al., 2023**).

Despite AI's growing footprint in healthcare, notable gaps persist in understanding how nurses adapt to and perceive these technologies over time. Much of the existing literature is limited to cross-sectional studies, which offer limited insight into changes in nurses' attitudes following educational exposure (**Alruwaili et al., 2024**). There is also insufficient evidence on how structured training programs influence nurses' readiness for AI integration in practical settings (**Ramadan et al., 2024**). This gap is particularly evident in the Arab region, where digital transformation is advancing rapidly, yet empirical studies exploring ethical considerations and nursing-specific adoption of AI remain limited (**Ibrahim et al., 2025**). In response, the current study develops and implements an educational program focused on artificial intelligence and evaluates its impact on nurses' perspectives and attitudes at three time points: pre-intervention, post-intervention, and follow-up three months. The results aim to inform healthcare leaders and policymakers about the organizational and individual factors that facilitate or hinder the successful adoption of AI in nursing practice.

Significance of the Study

The integration of artificial intelligence (AI) into healthcare is rapidly transforming the landscape of nursing practice. AI technologies are increasingly being used to support clinical decision-making, streamline workflows, enhance diagnostic accuracy, and improve patient outcomes. These advancements are not only reshaping the roles and responsibilities of nurses but also redefining their professional identities and competencies **(Ronquillo et al., 2021).**

Despite the growing presence of AI in healthcare, perceptions among healthcare professionals remain mixed. For instance, a study by Jha et al. (2022) revealed that a significant proportion of respondents were skeptical about AI's ability to provide preventive care advice (64.4%), make accurate diagnoses (60.2%), or develop personalized treatment plans (56.5%). However, the same study also highlighted a positive outlook toward robotic surgery, with 63.2% of participants believing it could improve surgical outcomes, despite concerns about patient acceptance.

In the nursing field specifically, recent studies have shown a generally positive attitude toward AI adoption. **Abdelaliem et al. (2023)** found that 89.4% of nurses demonstrated high levels of technology acceptance, and 65.1% reported active adoption of AI technologies. Furthermore, nurses exhibited high perceived usefulness (97.1%) and ease of use (78.3%) of AI tools, although moderate levels of innovativeness and discomfort were also noted.

These findings underscore the importance of equipping nurses with the knowledge and skills necessary to effectively engage with AI technologies. By fostering technological readiness and addressing concerns related to AI integration, nursing education and practice can evolve to meet the demands of a digitally driven healthcare environment. Ultimately, empowering nurses to harness AI will not only enhance their professional development but also contribute to improved healthcare quality, efficiency, and patient-centered care.

Aim of the study

This study aims to explore the impact of a structured educational program on nurses' perspectives and attitudes toward artificial intelligence (AI) in healthcare settings. Specifically, it seeks to evaluate how targeted training influences nurses' understanding and acceptance of AI technologies across different time points.

The specific objectives are to:
1. Assess nurses' perspectives on artificial intelligence before the intervention (pre-test), immediately after the intervention (post-test), and during the follow-up phase.
2. Evaluate nurses' attitudes toward artificial intelligence across the same three phases.
3. Design and implement a structured educational training program focused on artificial intelligence and its relevance to professional nursing practice.
4. Examine the relationship between nurses' perspectives and their attitudes toward artificial intelligence before and after participation in the educational program.

Research hypothesis: -

Following the development and implementation of an artificial intelligence training session for nursing personnel, a positive relationship will be observed between their perspectives and attitudes toward artificial intelligence across the pre-intervention, post-intervention, and follow-up phases.

Subject and methods

Research design: A **quasi-experimental (pre–post-follow-up, single-group)** research design was utilized to assess changes in nurses' perspectives and attitudes toward artificial intelligence following an educational

training program. This design was selected to evaluate the impact of the intervention and examine the correlation between both variables across time.

Setting: The study was directed at Badr University Hospital affiliated with Helwan University and localized the region of Badr City, Cairo, Egypt.

Sampling: A convenient sample of all available nurses (77 nurses) from both sex working who accepted to participate in this study, and available at the time of the study.

Inclusion criteria: Full time, and with a minimum of six months experience, permanent nurses personnel's that working in hospital departments.
As the following distribution:

Hospital Departments	No.of nursing personnel
ICU	11
CCU	3
ER	14
OR	4
Inpatient	20
Outpatient	10
Oncology	3
Catheterization	1
Dialysis	11
Total	**77**

Tools for data collection:

Tool (I): Nurses' perspectives toward artificial intelligence in health care questionnaire: It consists of two main parts

- **Part (I): Personal characteristics sheet;** intended to gather data connected to personnel characteristics data of the study subjects such as: (Age, gender, material status, nurse level of education, years of experience, wage, how many years have you been working with technology / artificial intelligence in nursing, and department / unit). Marital status and wage were collected as part of the general demographic data to provide a broader understanding of the study population. These factors may reflect differences in personal responsibilities or financial conditions, which could potentially shape how nurses engage with or perceive changes in clinical practice such as the use of artificial intelligence.
- **Part (II): A structured self-administrative questionnaire;** constructed and adapted by the researcher based on **Sabra, et al. (2023)**, and reviewed by experts, and pilot tested. The scale consists of 15 items that contain two dimensions;
    - The first dimension was knowledge of artificial intelligence. It was included 10 items.
    - The second dimension was application of an artificial intelligence in health care, it was included 5 items.

The scoring system:-

It used a 5-point Likert scale that nurses' responses as (1) strongly disagree, (2) disagree, (3) neutral, (4) agree and (5) strongly agree. Negative items were reverses. Additionally, 1-2 on the 5-point Likert scale (< 60%) are classified as low level, 3 on the 5-point Likert scale ($\geq$ 60% to < 75%) as moderate level, and 4 & 5 on the 5-point Likert scale ($\geq$ 75%) as high level.

Artificial Intelligence questionnaire consisted of 2 dimension and (15 items**)** with a total score of (75). The aggregate scores for every item were quantity and transformed into a percentage score as consequent
- The low level is less than 60% equal (15-44 score).

   o   The moderate is equal or more than 60 % to less than 75% equal (45-56 score).

   o   The high level is equal or more than 75% equal (57-75 score).

Tool (II): General Attitudes towards Artificial Intelligence Scale (GAAIS); a structured self-administrative scale constructed and adapted by the researcher based on as **Schepman** and **Rodway (2022),** scale was validated by experts, and pilot tested. The scale consists of 21 items by using attention check was identified the positive and negative items, the positive items were numbers, (1, 2, 4, 5, 7, 11, 12, 13, 14, 16, 17, 18) while the negative items were numbers, (2, 6, 8, 9, 10, 15, 19, 20, 21).

The scoring system:-

It used a 5-point Likert scale that nurses' responses as **(1)** strongly disagree, **(2)** disagree, **(3)** neutral, **(4)** agree and **(5)** strongly agree. Negative items were reverses. Additionally, 1-2 on the 5-point Likert scale (< 60%) are classified as low level, 3 on the 5-point Likert scale ($\geq$ 60% to < 75%) as moderate level, and 4 & 5 on the 5-point Likert scale ($\geq$ 75%) as high level **(Hamedani et al., 2023)**.

Attitude regarding artificial intelligence consisted of 2 dimensions and (21 items) with a total score of (105).

Score Categorization for Analysis:

For further analysis and group comparison, the total GAAIS score (ranging from 21 to 105) was categorized into three levels:

- **Low** attitude (21–62)
- **Moderate** attitude (63–78)
- **High** attitude (79–105)
  These cutoff points were used to classify nurses into groups, and the mean scores within each category were reported in the results section.

Validity and reliability:

Validity:

Validity (face and content) of the tools was completed. The tools were translated into Arabic and tested by a group of 5 experts particular in nursing administration at different 3 universities; Ain sham University (3 professors); Damanhour University (1 professor); and Cairo university (1 professor).

Reliability:

Cronbach's Alpha was used to determine the internal reliability of the tool. Reliability of the tools was tested to   determine the extent to which the questionnaire items are related to each other and the result was (0.990 & 0.977) for nurses' perspectives toward artificial intelligence in health care questionnaire and general attitudes towards artificial intelligence scale, respectively.

Ethical and legal consideration:

The research authorization got from the Faculty of Nursing ethical committee of Helwan University before offset the training, an authorization got from the Manager of Badr Hospital connected with the University. Informed consent was given to each sharing subject superior to information accumulation; participant informed about the determination and wonted consequences of the study, and confident about harmless presence, participant's partnership was willing, and they had the right to be removed from the study at whatever time outside some reason. Participants still were confident that anonymity and confidentiality remained approved, as were the assembled information second-hand for the study purpose. Ethics, principles, civilization and trust were esteemed.

Pilot study

The pilot study was completed activity on (10%) of the total sample content (8 nurses) to test relevance and clearness of forms and occasion wanted to complete it. No adjustments existed finished so participant in the pilot study remained contained in the study sample.

Field Work

The field work was conducted between **August 2023 and May 2024** and organized into four systematic phases: assessment, program design, implementation, and evaluation.

1- Assessment Phase (August – September 2023):

Following official approval, the researcher coordinated with the Director of Badr University Hospital to explain the purpose of the study and obtain a list of eligible nurses, including details such as department, qualifications, gender, age, and years of experience. A pilot study was conducted on 8 nurses, whose data were included in the final sample (total n=77), as no major modifications were required.

Pre-intervention data collection took place over one month, using two validated self-administered tools: (1) the Nurses' Perspectives toward Artificial Intelligence Questionnaire and (2) the General Attitudes toward Artificial Intelligence Scale. Each tool required approximately 15–20 minutes to complete. Data collection was scheduled to avoid disrupting clinical duties. The researcher visited the hospital three times per week, during the morning shift (9:00 AM–2:00 PM), with each visit lasting 4–5 hours.

2. Program Design Phase (October – November 2023):

Based on the pre-test results, the researcher developed an educational training program targeting nurses' understanding and attitudes toward artificial intelligence in healthcare. Nurses were divided into eight groups (eight groups of 10 nurses and one group of 7) based on shift schedules and workload, with the support of hospital nursing leadership.

3. Implementation Phase (December 2023 – January 2024):

The educational program was delivered over 8 weeks. Each group attended three sessions per week, totaling six sessions. Sessions were conducted in the hospital's education room during the day shift and included various instructional methods such as lectures, group discussions, and brainstorming activities. Educational materials included PowerPoint presentations, whiteboard illustrations, and printed booklets provided by the researcher. Each session lasted approximately 2–3 hours, including a 15-minute break. At the end of each session, nurses were informed of the next session's objectives and schedule.

1. Evaluation Phase (February – May 2024):

Program effectiveness was evaluated at two time points: immediately after the last session (post-test) and three months later (follow-up). The same tools used in the pre-test were administered to assess any changes in nurses' perspectives and attitudes toward artificial intelligence. Follow-up data collection was completed between April and May 2024.

Statistical analysis

Data admission and exploration were completed using SPSS statistical package version 26. Categorical variables were articulated as number and percentage while incessant variables were conveyed as (mean ±SD). Chi-Square ($x2$) tested the association between row and column variable of qualitative data. ANOVA test associate the mean of typically disseminated quantitative variables. While T independent test

associate the mean of typically disseminated quantitative variables in two groups. As well, Pearson correlation measured correlation between quantitative variables.

For all tests, a two-tailed p-value ≤ 0.05 was considered statistically significant, P-value ≤ 0.01 was considered highly statistically significant, while, p-value> 0.05 was considered not significant. Eta square (**η2**) measured the effect size (The referential framework for identifying the effect size for ANOVA-test value) **(Cognitive and Brain Science Unit, 2021***).*

Results

Table (1): Frequency distribution of personal characteristics among the studied nurses (n=77)

Personal characteristics		No	%
▪ Age (in years)	20 < 25	46	**59.7**
	25- < 30	29	37.7
	30- < 35	2	2.6
	$\overline{x} \pm$ SD	**24.98 ± 2.39**	
▪ Gender	Male	45	**58.4**
	Female	32	41.6
	Male to Female Ratio	**1.4:1**	
▪ Marital status	Single	45	**58.4**
	Married	32	41.6
▪ Educational Level	Nursing Diploma	13	16.9
	Technical Institute	41	**53.2**
	Bachelor	23	29.9
▪ Year of experience	1 < 5 years	50	**64.9**
	5 years < 10 years	27	35.1
	$\overline{x} \pm$ SD	**4.80 ± 2.11**	
▪ Wages	3000 < 4000 pounds	29	37.7
	4000 < 5000 pounds	38	**49.4**
	5000 < 6000 pounds	7	9.1
	≥ 6000 pounds	3	3.9
	$\overline{x} \pm$ SD	**4305.2 ± 807**	
▪ Years of working with A.I.	1 < 3 years.	45	58.4
	3 < 5 years.	22	28.6
	5 < 10 years.	9	11.7
	≥ 10 years.	1	**1.3**
	$\overline{x} \pm$ SD	**3.25 ± 1.85**	
▪ Working Department	ICU	11	14.3
	CCU	3	3.9
	ER	14	18.2
	OR	4	5.2
	Inpatient	20	**26.0**
	Outpatient	10	13.0
	Oncology	3	3.9
	Catheterization	1	**1.3**
	Dialysis	11	14.3

Table (1) describes that about (59.7%) of the age of the studied nurses were ranged from 20- < 25 years old, with a mean age of 24.98 ± 2.39. Considering gender and marital status, (58.4%) of nurses were male with a male to female ratio = 1.4:1 and single. As well, (53.2%) of the studied nurses holding a technical certificate and had bachelor degree. Regarding years of experience (64.9%) of the studied nurses holding had experience in nursing field lasting from 1 years < 5 years with a total mean of 4.80 ± 2.11 and (58.4%) of nurses had experience in working with A.I. lasting from 1 < 3 years with a total mean of 3.25 ± 1.85, respectively. Finally, (49.4%) them were paid a salary ranged from 4000 < 5000 pounds with a total mean of 4305.2 ± 807. For working department; (26%) of the studied nurses were working at inpatient department while (1.3%) working at catheterization unit.

Table (2): Total mean score of the studied nurse's perspectives regarding artificial intelligence in health care during pre, post & three months follow up (n=77)

Items		Pre $\overline{x} \pm SD$	Post $\overline{x} \pm SD$	3 months follow up $\overline{x} \pm SD$	F Test	P- Value
Knowledge	Low	19.02±5.15	24.20±6.2	23.14±6.3	103	0.000 ***
	Moderate	32.80±2.30	33.86±2.2	33.89±2.4		
	High	42.25±3.44	46.83±4.4	42.74±4.2		
	Total	**25.32±10.1**	**44.18±7.8**	**39.92±7.3**		
Application	Low	9.78±2.1	11.50±3.1	11.0±2.82	78.1	0.000 ***
	Moderate	15.85±1.3	16.86±1.06	16.0±1.15		
	High	21.71±2.3	23.41±2.31	21.36±2.1		
	Total	**14.0±4.9**	**22.19±3.87**	**20.06±3.7**		
Total	Low	30.16±7.9	36.40±9.3	34.71±9.3	95.6	**0.000 *****
	Moderate	49.80±3.5	51.28±3.1	51.0±4.1		
	High	64.41±5.3	70.30±6.6	64.2±6.3		
	Total	**39.32±14.9**	**66.37±11.6**	**59.98±11.1**		

*Significant p ≤ 0.05   **Highly significant p ≤ 0.01   F: ANOVA Test

Table (2) denotes, during the post-test phase, the studied nurses perceived higher mean score (66.37±11.6) of AI in health care, followed by the phase of follow-up test (59.98±11.1) as compared with the phase of pre-test 39.32±14.9 (Total score=75).

Table (3): Total mean score of the studied nurse's attitude regarding artificial intelligence in health care during pre, post & three months follow up (n=77)

Items		Pre $\overline{x} \pm SD$	Post $\overline{x} \pm SD$	3 months follow up $\overline{x} \pm SD$	F Test	P- Value
Positive effect of A.I.	Low	21.87 ± 6.2	29.80 ± 3.5	29.13 ± 4.4	84.0	0.000 ***
	Moderate	37.26 ± 2.4	39.0 ± 2.1	39.0 ± 2.8		
	High	52.58 ± 5.7	55.97 ± 5.4	51.38 ± 5.3		
	Total	**32.05 ± 12.3**	**52.73 ±9.3**	**47.78 ± 8.9**		
Negative effect of A.I.	Low	16.59 ± 4.4	22.25 ± 3.0	21.29 ± 2.9	83.0	0.000 ***
	Moderate	27.86 ± 1.6	29.50 ± 1.5	29.60 ± 1.4		
	High	39.50 ± 3.8	42.27 ± 3.9	38.52 ± 3.9		
	Total	**23.97 ± 9.6**	**39.57 ± 6.9**	**35.79 ± 6.5**		
Total	Low	39.49 ± 11.4	53.0 ± 6.8	51.13 ±7.7	83.8	

Moderate	65.26 ± 4.2	70.22 ± 4.6	69.67 ± 4.6		**0.000** ***
High	91.85 ± 9.6	98.57 ± 9.0	89.98 ± 9.2		
Total	**56.03 ± 21.9**	**92.30 ± 16.2**	**83.57 ± 15.5**		

*Significant p ≤ 0.05   **Highly significant p ≤ 0.01   F: ANOVA Test

Table (3) shows that, during the post-test phase, the studied nurses perceived higher mean score (92.30 ± 16.2) of attitude regarding AI in health care, associated to the follow-up phase test (83.57 ± 15.5) compared with the phase of pre-test (56.03 ± 21.9) (Total score=105).

Table (4): Relation between personal characteristics and the studied nurses' perspective regarding artificial intelligence in health care during pre, post & three months follow up (n=77)

Personal characteristics		**Artificial intelligence in health care**		
		Pre- Test	**Post test**	**Follow-up**
		$\overline{x} \pm$ SD	$\overline{x} \pm$ SD	$\overline{x} \pm$ SD
▪ Age (in years)	20 < 25	30.83±61.91	61.91±12.3	55.48±10.2
	25- < 30	50.45±11.9	72.86±6.4	66.10± 8.7
	30- < 35	73.50±2.1	75.0±0.0	75.0 ± 0.0
	F & P	**44.2 (0.000**)**	**10.4 (0.000**)**	**13.2 (0.000**)**
▪ Gender	Male	47.0± 12.7	73.1 ± 4.9	64.87±7.3
	Female	28.53± 10.5	56.9±11.8	53.13±11.8
	t & P	**6.7 (0.000**)**	**8.1 (0.000**)**	**5.3 (0.000**)**
▪ Marital status	Single	36.76 ± 13.2	65.16±12.7	58.11±11.4
	Married	42.94±16.6	68.09±9.9	62.62±10.2
	t & P	**1.8 (0.07)**	**1.1 (0.279)**	**1.7 (0.07)**
▪ Education	Nursing Diploma	20.08±4.4	46.0±9.9	41.23±10.0
	Technical	35.37±6.8	68.15±7.0	59.95±2.4
	Bachelor's degree	57.26±9.5	74.74±1.3	70.65±5.6
	F & P	**115 (0.000**)**	**81 (0.000**)**	**122 (0.000**)**
▪ Year of experience	1 < 5 years	30.16±7.9	61.72 ± 12.1	54.82±9.6
	5 < 10 years	56.30±8.5	75.0± 0.0	69.56±6.2
	t & P	**13.3 (0.000**)**	**5.6 (0.000**)**	**7.1 (0.000**)**
▪ Wages (pounds)	3000 < 4000	25.97±6.3	55.14±10.9	51.79±11.3
	4000 < 5000	42.66±9.3	72.68±5.3	62.29±5.9
	5000 < 6000	62.43±2.5	75.0±0.0	75.0±0.0
	≥ 6000	72.33±2.5	75.0±0.0	75.0±0.0
	F & P	**69.9 (0.000**)**	**32.4 (0.000**)**	**21.6 (0.000**)**
▪ Years of working with A.I.	1 < 3 years.	29.13±7.4	60.64±12.1	54.40±10.0
	3 < 5 years.	48.32 ± 7.0	74.18±3.8	64.59±6.2
	5 < 10 years.	64.33±4.3	75.0±0.0	75.0±0.0
	≥ 10 years.	75.0±0.0	75.0±0.0	75.0±0.0
	F & P	**89.5 (0.000**)**	**12.7 (0.000**)**	**19.1 (0.000**)**

*Significant p ≤ 0.05   **Highly significant p ≤ 0.01   F: ANOVA Test   t test : t Independent Test

Table (4) indicates that there was a highly statistically significant relation between personal characteristics (Age, gender, education, and year of experience, wages, and years of working with A.I) and the studied nurse's perspective regarding AI in health care throughout the study phases at P ≤ 0.01. Furthermore, the studied nurses with an age range of 30- < 35 years, male, and holding a bachelor certificate, who had experience ranged 5 < 10 years, paid salary ≥ 6000 pounds and had years of working with A.I. lasting ≥ 10 years had a higher mean score of artificial intelligence in health care throughout the study phases.

Table (5): Relation between personal characteristics and the studied nurse's attitude regarding artificial intelligence in health care during pre, post & three months follow up (n=77)

Personal characteristics		Attitude regarding artificial intelligence		
		Pre- Test	Post test	Follow-up
		$\overline{x} \pm$ SD	$\overline{x} \pm$ SD	$\overline{x} \pm$ SD
▪ Age (in years)	20 < 25	44.52±14.2	85.96±16.5	77.13±13.5
	25- < 30	70.90±19.1	101.4±10.5	92.31±13.2
	30- < 35	105±0.0	105.0±0.0	105±0.0
	F & P	33.0 (0.000**)	11.1 (0.000**)	14.1 (0.000**)
▪ Gender	Male	68.22±18.2	101.8±7.5	90.67±10.8
	Female	38.88±13.8	78.88±15.7	73.59±15.6
	t & P	7.6 (0.000**)	8.5 (0.000**)	5.6 (0.000**)
▪ Marital status	Single	52.69±20.1	90.71±17.3	81.16±15.3
	Married	60.72±23.8	94.53±14.4	86.97±15.2
	t & P	1.5 (0.114)	1.0 (0.313)	1.6 (0.105)
▪ Education	Nursing Diploma	25.54±4.6	63.00±9.6	56.92±9.6
	Technical	52.12±10.6	94.76±10.0	83.3±4.6
	Bachelor's degree	80.22±16.1	104.4±2.5	99.04±8.3
	F & P	92.3 (0.000**)	104 (0.000**)	154 (0.000**)
▪ Year of experience	1 < 5 years	43.72±13.8	85.44±16.5	76.0±12.7
	5 < 10 years	78.81±14.7	105.0±0.0	97.59±9.1
	t & P	10.3 (0.000**)	6.1 (0.000**)	7.7 (0.000**)
▪ Wages (pounds)	3000 < 4000	36.55±11.1	76.55±14.4	71.38±14.4
	4000 < 5000	60.53±12.0	100.9±8.3	87.24±9.1
	5000 < 6000	91.57±5.9	105.0±0.0	105.0±0.0
	≥ 6000	104.33±1.1	150.0±0.0	105.0±0.0
	F & P	74.3 (0.000**)	33.7 (0.000**)	25.8 (0.000**)
▪ Years of working with A.I.	1 < 3 years.	42.22±13.2	83.91±16.2	75.47±13.1
	3 < 5 years.	66.36±9.7	103.68±6.1	90.41±10.1
	5 < 10 years.	94.33±7.5	105.0±00	105.0±00
	≥ 10 years.	105.0±0.0	105.0±00	105.0±00
	F & P	63.7 (0.000**)	14.9 (0.000**)	21.5 (0.000**)

*Significant p ≤ 0.05   **Highly significant p ≤ 0.01   F: ANOVA Test   t test : t Independent Test
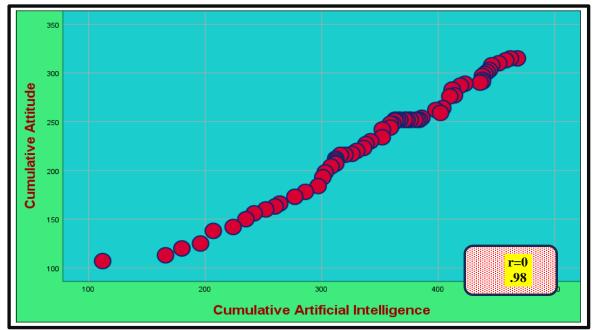
Table (5) shows that there was a highly statistically significant relation between personal characteristics (Age, gender, education, year of experience, wages, years of working with A.I) and the studied nurse's attitude regarding artificial intelligence in health care throughout the study phases at P ≤ 0.01. Furthermore, the studied nurses with an age range of 30- < 35 years, male, and holding a bachelor certificate, who had experience ranged 5 < 10 years, paid salary ≥ 6000 pounds and had years of working with A.I. lasting ≥ 10 years had a higher mean score of attitude regarding artificial intelligence in health care throughout the study phases.

Table (6): Correlation between nurses' perspectives and attitudes toward artificial intelligence at different study phases (n=77)

Attitude regarding artificial intelligence:	Artificial intelligence in health care					
	Pre-test		Post-Test		Follow-up	
	r	P	R	P	r	P
Pre-test	0.984	0.000**				
Post-Test			0.990	0.000**		
Follow-up					0.984	0.000**

Note: Correlation is based on total scores of both tools (Nurses' Perspectives Questionnaire and GAAIS).

r: Pearson correlation coefficient; **p**: Significance level. **p ≤ 0.01** is considered highly statistically significant.

Table (6) clarifies that, there was a high statistically significant positive correlation between AI in health care and throughout the study phases among the studied nurse at r= ranged from 0.948 to 0.990 & P= 0.000.

Cumulative: Sum of the pre and post in addition to follow-up scores

Figure (1): Scatter dot correlation between nurse's perspectives and nurse's attitude toward artificial intelligence (n=77)

Fig (1) clarifies that, there was a high statistically significant positive correlation between artificial intelligence (cumulative) in health care and cumulative attitude among the studied nurse at r= 0.985 & P= 0.000.

Discussion

In contemporary healthcare systems, the integration of artificial intelligence (AI) has become imperative for enhancing communication, collaboration, and overall quality of care. AI literacy among healthcare professionals, including nurses, is a critical determinant of successful implementation, as it can enhance clinical outcomes, minimize errors, and improve the delivery of services **(Gad et al., 2021)**.

The demographic profile of the participating nurses in the current study revealed that nearly three-fifths were between 20–25 years old, and over one-third were aged 25–30 years (M±SD: 24.98 ± 2.39). A majority were male and single, with 1 to <3 years of experience working with AI. Less than two-thirds had between 1–5 years of clinical experience, while more than one-third had 5–10 years. Their monthly wages mostly fell within the 3000–5000 EGP range.

This profile may reflect broader healthcare workforce trends in Egypt, where early-career nurses may prefer public sector positions for experience but often seek opportunities abroad or in the private sector for financial and professional advancement. Moreover, delays in marriage and limited promotion opportunities within governmental hospitals may influence lifestyle choices and professional decisions.

These findings are congruent with the study by **Elsawy et al. (2024)**, who reported that more than one-quarter to less than half of nurses were in their twenties, with over half being male and having 1–3 years of AI exposure. Similarly, **Al-Sabawy et al. (2023)** found that most nurses were aged 26–35, with three-quarters being male and nearly half possessing less than five years of experience.

However, contrasting demographics were noted by **Mohamed et al. (2023)**, where most participants were aged 30–40 (M±SD: 16.7 ± 7.6 years of experience), predominantly female, and largely married. This contrast may reflect institutional differences in recruitment or regional workforce distributions. Likewise, **Elsabahy et al. (2023)** studied only female nurses, most aged 40–50, with extensive professional experience and prior exposure to AI training.

Alruwaili et al. (2024) observed that about three-quarters of nurses were female, primarily aged between 20–39, with varying levels of experience and basic AI exposure, underscoring the diversity of nurse profiles in AI-related research.

Regarding departmental distribution and qualifications, over one-quarter of nurses in our study were stationed in inpatient departments. More than half held a technical diploma, while fewer than one-third held bachelor's degrees. This may be attributed to organizational structuring, where technical nurses are often retained due to workforce availability, while bachelor's holders may pursue private or international careers.

Comparable findings were reported by **Elsawy et al. (2024)**, who found that nurses primarily worked in inpatient or critical care departments, with technical diplomas being the predominant qualification. Similarly, **Mohamed et al. (2023)** found all participants were inpatient staff, split between surgical and medical units, with varying qualifications. **Al-Sabawy et al. (2023)** and **Alruwaili et al. (2024)** also reported majority inpatient placement and varying educational backgrounds.

In terms of knowledge outcomes, the current study observed a significant increase in nurses' AI-related perspectives post-intervention, with scores decreasing slightly at follow-up but remaining significantly higher than baseline. These results are consistent with **Elsabahy et al. (2023)**, who noted statistically significant knowledge improvements post-intervention and sustained effects at follow-up.

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Zhang et al. (2022) reported similar findings in Chinese emergency settings, where structured AI training resulted in improved knowledge and practical applications of smart technologies, supporting the utility of AI education in clinical environments.

Attitude assessments showed parallel trends. Nurses exhibited significantly more positive attitudes toward AI in both post-test and follow-up phases compared to pre-test. These results align with **Sabra et al. (2023),** who noted that two-thirds of participants had a positive post-intervention attitude, and **Mohamed et al. (2023)**, who found sustained attitude improvement following structured AI training.

Analysis of the relationship between personal variables and AI-related perspectives revealed significant associations with age, gender, educational level, experience, salary, AI exposure, and departmental placement. Similar associations were found by **Mohamed et al. (2023)**, **Sabra et al. (2023)**, and **Elsayed and Sleem (2021)**, reinforcing the influence of demographic and experiential factors on AI acceptance.

Additionally, strong positive correlations between nurses' attitudes and their AI-related knowledge were found throughout the study. This supports previous findings by **Elsayed and Sleem (2021)**, **Ahmed et al. (2024)**, and **Ghazy et al. (2023)**, all of whom reported statistically significant associations between perception and attitude scores in AI-focused nursing research.

The findings from Table (6) underscore a consistently high and statistically significant **positive correlation** between nurses' perspectives and attitudes toward artificial intelligence across the pre-test, post-test, and follow-up phases (r = 0.984 to 0.990, p = 0.000). This strong association suggests that improvements in nurses' cognitive understanding of AI are closely linked to more favorable attitudes toward its adoption in clinical practice. These results align with previous studies that reported similar trends. For example, **Elsayed and Sleem (2021)** found a significant positive relationship between nurse managers' perceptions and their attitudes toward AI integration in hospital settings. Likewise, **Ahmed et al. (2024)** and **Ghazy et al. (2023)** demonstrated that enhanced awareness of AI technologies was predictive of increased acceptance and willingness to use AI in daily care. Such findings reinforce the importance of designing interventions that target both conceptual knowledge and attitudinal readiness to ensure successful and sustainable AI adoption in nursing practice.

The findings of this study carry both theoretical and practical implications. Theoretically, the significant relationship between nurses' AI-related knowledge and their attitudes supports established behavioral models such as the Technology Acceptance Model (TAM), which posits that perceived usefulness and ease of use influence technology adoption **(Schepman & Rodway, 2022)**. The strong positive correlations identified reinforce the premise that cognitive and affective dimensions are interdependent in shaping readiness for AI implementation in clinical settings **(Elsayed & Sleem, 2021; Ahmed et al., 2024)**. Practically, the observed improvements following the educational intervention validate the effectiveness of targeted training in enhancing AI literacy and acceptance among nurses, particularly in contexts with limited prior exposure **(Mohamed et al., 2023; Sabra et al., 2023)**. The sustained effects recorded after three months further emphasize the durability of such programs and highlight the value of integrating AI-focused education within ongoing professional development efforts **(Elsabahy et al., 2023; Abdelkareem et al., 2024)**. These implications suggest that strategic investment in AI education at the nursing level can accelerate safe, ethical, and efficient digital transformation across healthcare systems **(Ronquillo et al., 2021)**.

A notable strength of the present study lies in its inclusion of a structured three-month follow-up phase, which allowed for the evaluation of sustainability and memory retention regarding nurses' knowledge and attitudes toward AI. While many prior studies **(e.g., Sabra et al., 2023; Mohamed et al., 2023)** have been

limited to pre- and immediate post-intervention assessments, our design offers a more comprehensive evaluation of long-term impact. The follow-up phase enabled assessment of whether the observed improvements in perception and attitude were maintained over time, thus providing evidence of the educational program's durability and practical value in real-world healthcare settings **(Elsayed & Sleem, 2021; Abdelkareem et al., 2024)**. This extended timeframe enhances the validity of the findings and underscores the potential for sustained behavioral change following structured AI training.

Despite the strengths of this study, several limitations should be acknowledged. First, the use of a single-group quasi-experimental design without a control group may limit the ability to definitively attribute observed changes to the intervention alone **(Sabra et al., 2023; Mohamed et al., 2023)**. Additionally, the sample was drawn from one hospital in a specific geographic location, which may restrict the generalizability of the findings to other healthcare settings with different organizational cultures or resources **(Alruwaili et al., 2024)**. Self-reported measures may also introduce response bias, as participants may provide socially desirable answers rather than objective reflections **(Elsayed & Sleem, 2021)**. Lastly, while the three-month follow-up offers valuable insights into retention, longer-term outcomes beyond this period remain unknown and warrant further investigation (**Abdelkareem et al., 2024**). Future studies should consider randomized controlled designs with larger, multi-center samples to enhance external validity and explore broader implications of AI education in nursing.

Conclusion

In conclusion, this study underscores the significant impact of structured educational interventions in enhancing nurses' perspectives and attitudes toward artificial intelligence (AI) in healthcare settings. The findings revealed a marked improvement in both knowledge and attitudes immediately after the intervention, with a moderate retention of gains observed at the three-month follow-up. These results suggest not only the effectiveness but also the sustainability of such training programs in influencing long-term professional behavior and cognitive readiness. Furthermore, the strong positive correlation identified between nurses' perspectives and attitudes toward AI highlights the interdependence of cognitive understanding and emotional receptiveness in successful technology adoption.

Demographic characteristics such as age, gender, education level, work experience, and department affiliation were found to significantly influence both perspectives and attitudes. This highlights the necessity of tailoring AI educational programs to address the diverse needs and backgrounds of nursing personnel. Importantly, this study adds to the growing body of literature by incorporating a follow-up phase—an often overlooked component—which provides valuable insights into memory retention and the durability of attitudinal shifts. As healthcare systems increasingly integrate AI technologies, investing in targeted, evidence-based training programs for nurses is essential to ensure ethical, efficient, and patient-centered implementation. These findings carry valuable implications for nursing leadership, healthcare policymakers, and educators striving to prepare the nursing workforce for the digital future of care.

Recommendations

Based on the study findings, the following recommendations are proposed:

For Nursing Practice

- Provide continuous AI-focused training to enhance nurses' competencies and confidence in using AI tools.
- Encourage integration of AI into daily nursing care to reduce errors and support decision-making.
- Promote digital literacy and a culture of innovation among nursing staff.

Organizational Level

- Develop strategic plans to integrate AI with electronic health records and clinical systems.
- Ensure alignment of AI initiatives with institutional goals for efficiency and quality of care.
- Support AI adoption through infrastructure, staffing, and digital resources.

Educational Level

- Incorporate AI content into nursing curricula and ongoing staff development programs.
- Establish structured, regularly updated training aligned with clinical needs.
- Foster interprofessional collaboration in AI education and implementation.

Research Level

- Conduct longitudinal studies to assess long-term impact of AI education, as demonstrated by the 3-month follow-up in this study.
- Explore demographic factors influencing AI adoption for more targeted interventions.
- Investigate barriers to AI integration in diverse clinical and regional settings.

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