The Effect of Educational Program on Nurses' Knowledge and Attitude Regarding Artificial Intelligence

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Abstract

Background: There is a vast growth of Artificial Intelligence (AI) applications across all aspects of healthcare. Nursing practice is critical where AI technology will enhance practice and patient outcomes.**The aim**of this study was to evaluate the effect of educational program on nurses' knowledge and attitudes regarding artificial intelligence.**Design**:A quasi-experimental design was used in this study. **Setting:** This study was conducted atMansoura University Hospitals at medical and surgical departments. **Sample**: A simple random sample included (203) nurseswere selected from the previously mentioned settings. **Tools:** Two tools were used to collect the necessary data for achieving the study objective: A self-administered Artificial Intelligence Knowledge Questionnaire and A General Attitudes towards Artificial Intelligence Questionnaire.**Results**: The primary source of information for nurses' knowledge about artificial intelligence was from Internet (73.9%).The total level of knowledge was satisfactory among 16.3% of studied nurses at pre intervention period, while it was 82.8% at immediately post intervention, and decreased to 68% at follow-up. Additionally, the total positive nurses' attitudesmean score improved from 53.35 ±21.07 at pre-interventionto 77.19±18.64 at immediately post and decreased to 67.95±23.62 at follow-up with statistically significant differences. Moreover, highly statistically significant differences between the demographic characteristics (marital status, and educational qualifications) and total knowledge level post intervention (P<0.001). **Conclusion:** This study revealed that the educational intervention had highly statistically significant positive effect on the studied nurses' knowledge, and attitudes regarding artificial intelligence. Therefore, it is **recommended** toencourage nurses to increase their knowledge and attitudes toward artificial intelligence through workshops and training programs, and providing further education and training are required to enable them integrate AI into nursing practices.

Key words: Artificial Intelligence, Attitude,Effect of Educational Program, Nurses, Knowledge

Introduction:

Egypt had become a safer place to live and do business, and to achieve Egypt's Vision 2030, the country has begun to adopt artificial intelligence and technology in various sectors. The government is becoming more intrusive in sparking the growth of artificial intelligence through initiatives aimed at boost research and development within its borders. regarding an Egyptian society powered by artificial intelligence and robotics, the government has set a general target of 7.7% of Egypt's Gross Domestic Product to be derived from artificial intelligence and robotics by 2030 **(Egypt's Artificial Intelligence Future, 2020).** Additionally, Artificial intelligence technologieshave the capability advance nursing performance and make it possible for nurses to give their patients more individualized, evidence - based care through improvingnurses' professional and helping in solving the problems **(Abd El-Monem, 2023).**

Artificial intelligence has an impact on the roles of senior management by increasing their creativity and strategic thinking **(Ronquillo et al., 2021).** Artificial intelligence has many applications in healthcare, including assisting in disease assessment, diagnosis, and solving various clinical problems, reducing lost data, enhancing good nursing communication skills, improving inpatient care management, diminish nurse workload, and improving patient safety **(Zhou et al.,2022).** As well, **Liu et al. (2022),**clarified that nursing intervention canadvantage from AI-based medical information processing.

Artificial Intelligence Technology (AIT) is a branch of computer science designed to imitating

of by human brain by realizing tasks or solving problems also used in nursing care of patient, and automating various processes, including learning and decision-making **(Maddox et al., 2019).** There are three types of AI in hospital that include machine learning; refers to a set of statistical techniques for solving problems, the other is deep learning which refers to a type of machine learning approach and extending neural networks, and the latest is natural language processing which refers to the confluence of artificial intelligence and linguistics and includes intelligent analysis of written language **(Dash et al., 2019).**

The internalization of professional knowledge, skills, attitudes, values, and standards of ethics, as well, the subsequent incorporation of these traits into one's personal identity and behavior in nursing education and practice is what lead to the development of a professional identity. Medical health nurses with a strong sense of professional identity, understand that their position, fully meets these criteria in accordance with professional ideals and ethical standards **(Kabeel and Eisa, 2017).**Many factors that influence the development of professional identity include; educational setting, critical thinking, clinical practice, cognition, personal characteristics, societal and environmental characteristics, and public illustration **(Rani et al., 2019).**

The way medical surgicalnurses'perspective their work affects how they approach helping patients with their challenges. In addition, the attributes and skills of selected medical health nurses can influence the level of care and help them understand patients, find solutions to problems, and provide comprehensive care, which is the ultimate goal of the nursing process **(Kim &Sim, 2020).** The ability to come up with applicable and effective answers to problems that derive in daily life is referred to as problem-solving. A problem-solving strategy empowers a person or group to focus on something in order to acquire expertise (**Altas, 2020).**

Now, there are big AI applications used in nursing practice, such as speech acceptance **(Ronquillo et al., 2021),** data mining, and forecast of physical deterioration. Nevertheless, the future applications of AI technology will aid nurses provide individualized, evidence-based care and integrate relevant data **(Hannaford et al., 2021).**In contrast to the vast bulk of AI research, which focuses on developing and testing AI algorithms and their related prediction models, few studies explored the perceptions of nurses and nursing students **(O'Connor, 2021)**. A recent survey, of 675 nurses in the US reported that 30% of respondents know how AI is used in clinical nursing practice, while 70% had fair or no knowledge of the technology employed in AI (**Swan & Haas, 2021**). It is possible that this deficit of knowledge exists across the discipline and needs to be addressed. There is no mistrust that the application of AI will endure to increase in healthcare practice and education.Prosperous implementation of AI into clinical practice requires a thorough understanding of the attitudes and behaviors of the nurses as end-users towards the existing and future AI applications. Moreover, assessing the present knowledge of AI among nurses is basic to identify future training requirements, as they are the technology users and have straight contact with patients**(O'Connor, 2021)**.

The nursingprofession is critical to the delivery of health care because it works directly with patients and ensures that diagnosis and treatment plans work efficiently. Daily nursing tasks are broad and varied and include maintaining patient charts, recording, taking vital signs, assisting with physical examinations, and communicating between patients, nurses'professionals and administration sectors **(Taryudi et al., 2022).** Therefore, there is no doubt that the impact of AI in nursing practice will be transformative. An example of the application of artificial intelligence in nursing practice is the use of robots in drug dispensing, bots for special needs and decision-making applications for nursing diagnosis, planning and intervention**(Booth et al., 2021).** Nurses are important in the delivery of nursing care, so they must be aware and knowledgeable about artificial intelligence. However, most of the current studies focused on the development of AI applications and compared the work done before and after the integration of AI; some studies have attempted to understand the knowledge and willingness to integrate AI into their daily practices **(Maskara et al., 2017).**

1. Significance of the study:

Artificial intelligence technologies have the skill to advance nursing practice and make it possible for medical surgical nurses togivetheirpatients more individualized, evidence -based care throughincreasemedical surgical nurses' professional personality and approvingin answer the problems. To achieve a competitive better in the labor market, there is a need to radical change to digitalize healthcare sectors. From this point, artificial intelligence has completed to take the attention of key healthcare top managers and providers who are currently experiencing a dilemma of whether or not to fully or partially integrate it into their work **(Elsayed&Sleem, 2021)**. The advancement of artificial intelligence technology to additional adoption and value across health care is perpetuated by cost, quality, care outcomes, and support to analyze large amounts of data efficiently. However, few inquiries have investigated nurses' educational intervention regarding artificial intelligence technology **(Shaik, 2020)**.

1.2. Aim of the study

This study aimed to evaluate the effect of educational program on nurses' knowledge and attitudes regarding artificial intelligence. This was achieved through the following objectives:

1. Assess the nurses' knowledge levels about artificial intelligence.
2. Identify the nurses' attitudes towards artificial intelligence technologies.
3. Plan, implement, and evaluate the effect of educational intervention on improving nurses' knowledge, and attitudes about artificial intelligence.

1.3. Research hypotheses:

- H1. Applied artificial intelligence educational program has an effect on nurses' knowledge levels towards artificial intelligence technologies.
- H2. Applied artificial intelligence educational program has an effect on nurses' attitudes' levelstowards artificial intelligence technologies.

Subjects and Methods

2.1 Research design:

This research used a quasi-experimental design (a pre- and post-intervention study) to evaluate the effect of the educational program.

2.2 Setting:

This study was carried out atall medical and surgical departments in Mansoura University Hospitals

2.3Subjects:

The study subjects included two hundred and three (203) nurses of a simple random sample of nurses in the study settings(medical departments 85 from 119 nurses, and 118 nurses from 149 of surgical departments.

2.4 Sample size:

Based on data from literature **(Sindermann et al., 2021)**, considering level of significance of 5%, and power of study of 80%, the sample size was calculated using the following formula:

$$n = \frac{(Z\alpha/2 + Z\beta)^2 \times 2(SD)^2}{d^2}$$

where, SD = standard deviation obtained from previous study; $Z_{\alpha/2}$, for 5% this is 1.96; Z_{β}, for 80% this is 0.84 and d, for the expected difference. Therefore,

$$n = \frac{(1.96 + 0.84)^2 \times 2(1.9)^2}{(0.528)^2} = 203.0$$

Based on the above formula, the sample size required is 203.

2.5Study tools:

Data werecollected using two study tools: A self-administered Artificial Intelligence Knowledge Questionnaire, and the General Attitudes towards Artificial Intelligence (AI) Scale.

- **Tool (I):**A self-administeredArtificial Intelligence Knowledge Questionnaire.The researchers developed this questionnaire to assess nurses' knowledge of artificial intelligence. It includes two sections as follows:
- **Part I:**Covered nurses' demographic characteristics as: age, gender, marital status, educational level, and years of professional experience. As well, this part asks about the name of the department,

having previously dealt with artificial intelligence, and the source of knowledge of artificial intelligence.

- Part II: Included artificial intelligence knowledge, developed by the research team after reviewing relevant literature and guided by Lennartz et al., (2021); andShimon et al., 2021), to assess the artificial intelligence knowledge levels of nursespre and post sessions. The questions were divided into 12 categories: Definition of artificial intelligence in the nursing field (2 marks), how artificial intelligence works (2 marks), importance (2 marks), advantages (6 marks), disadvantages (6 marks), types of artificial intelligence (4 marks), Basic Components of AI (5 marks), barriers (5 marks), principles (6 marks), applications (examples of artificial intelligence that can help the medical and surgical nurse, and examples of artificial intelligence in the nursing field (10 marks). Additionally,this part is asking about problems of artificial intelligence in the nursing field (10 marks), and principles (5 marks).

Scoring system:

Each true or false response, received "Two marks" if it was complete and correct, "One" if it was correctbut incomplete and a "zero" if it was don't know. The nurse was considered to have satisfactory artificial intelligence knowledge if the percent score was 60%, or higher and unsatisfactory artificial intelligence knowledge if the percent score was less than 60%.

- **Tool (II):**General Attitudes towards artificial intelligence questionnaire, adapted from **SchepmanandRodway (2020),** it uses 24 statements and aims to assess the general attitudes toward AI through five point Likert scale ranged from 1-5, 1 (Strongly disagree), 2 (Disagree), 3 (Neutral), 4 (Agree) and 5 (Strongly agree).

Scoring System:

Based on cut of value 60%, the nurses' attitude is determined as negatively ≤60 and positive attitude ≥ 61.

3. Fieldwork:

3.1. Administrative and Ethics considerations:

Approval to conduct this study was obtained from the Human Research Ethics Committee of the Faculty of Nursing, ZagazigUniversity on 1-1-2023. To obtain official approval to conduct the study, an official letter issued by the Dean of the Faculty of Nursing at Zagazig University to the Director of the Mansoura University hospital. Accordingly, approvals were obtained to all the Medical and Surgical departments.Nurses who agreed to participate in the study provided written consent. Voluntary participation of nurses was confirmed. Nurses were informed that they could withdraw from the study at any time without giving any reasons. Confidentiality was established through the use of tokens to ensure anonymity. The questionnaire did not address any religious issues among the study sample.

Tools Validity and Reliability:

All of the tools were translated into Arabic and retranslated into English by the researchers. A panel of five experts from in the field of AI and medical surgical Nursing department, Faculty of Nursing, Zagazig University tested the tools to appraise their face and content validity. The experts revised the tools for their content, clarity, simplicity, relevance, completeness and suitability. Minor changes were made in response to their feedback. From the standpoint of experts, the tools were valid. As for reliability, the Cronbach's alpha value (Internal consistency) of the nurses' knowledge was 0.884, and of the nurses' attitudes was 0.897, indicating high reliability of the tools.

3.3 Pilot study:

It was conducted on 21 nurses; represent 10%, of the study sample. It was done to identify the clarity, and feasibility of the tools used in the study. The pilot study's data were analyzed. Nurses who participated in the pilot study wereremoved from the main study sample.

3.4 Program:

The overall data collection process took six months from beginning of January 2023 to end of June 2023. The educational intervention for artificial intelligence was implemented according to the following phases**:**

I. Assessment phase:

Once permission was granted to proceed with the study, the researchers visited the study settings (i.e., medical and surgical departments of Mansoura University Hospitals). The researchers began recruiting the sample of nurses. The researchers introduced themselves to each nurse individually, gave them an overview of the study's objectives and procedures, and invited them to take part. The researchers read and explained each item of study tools to each nurse and recorded her\his responses to each item. The researchers began filling in the questionnaire which took about 30 to 40 minutes to be completed. Using the research questionnaire, they interviewed each nurse individually to obtain baseline data of demographic characteristics, knowledge questionnaire and attitude scale. Data were primarily assessed to create a foundation for the intervention sessions. Nurses were reassured that information obtained is strictly confidential and would not be used for any purposesother than research.

II.Planning phase:

Based on the literature relevant to the artificial intelligence research, researchers gained a comprehensive understanding of all aspects of artificial intelligence. The results obtained from the assessment phase, reported to characteristics of the study sample, the researchers designed the intervention sessions' content. In addition, the researchers designed an illustrated a booklet and its content was proved and it was distributed to the studied nurses in medical and surgical departments to be used as a guide for self-learning. The researchers worked with the principals of the hospital to find a suitable place for the educational intervention, it was the lecture room, dedicated to providing workshops and training for nurses. This room contains data display for any lectures. A handout was prepared and distributed to nurses by the end of each session of the program.

The researchers established the AI educational intervention for the studied subjects according to the following steps:

- **Setting the program objectives**
  - **General objective:** The general objective of the intervention program was to increase nurses' knowledge levels and improve their positive attitudes toward artificial intelligence.

Specific objectives: after implementing the current program, the nurses should be able to:

- Define the artificial intelligence and its characteristics in the nursing field.
- Explain the importance of artificial intelligence.
- Discuss how does artificial intelligence work
- List the advantages of artificial intelligence and its strategy.
- Identify the barriers of artificial intelligence
- Enumerate the disadvantages of artificial intelligence.
- Discuss the four types of artificial intelligence.
- Explain the components of artificial intelligence.
- Discuss the applications of AI (Examples of AI that can help the medical surgical nurse, and examples of AI in the health field).
- List the most important problems of artificial intelligence and their solutions in the health field.
- Explain the principles that address the AI.
- Demonstrate the problems and solutions of artificial intelligence in the nursing field.
- Discuss the statements of the general attitudes' scale and improving the positive attitudes towardsAI.

III. Implementation phase:

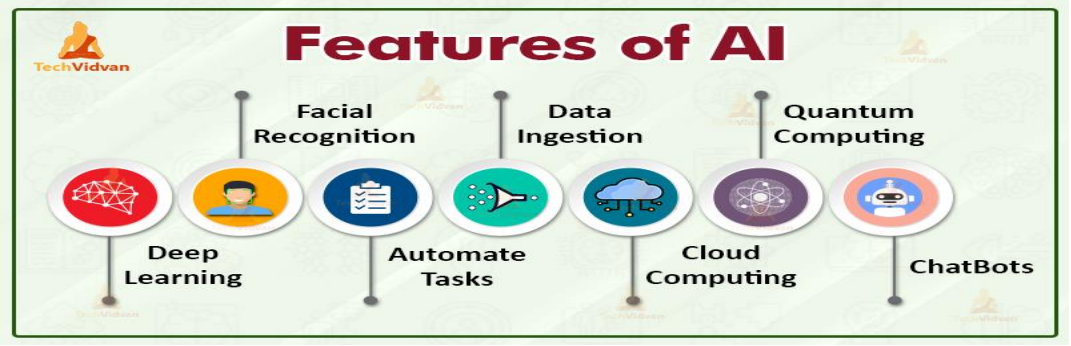
All selected nurses were subjected to the health education intervention. The message was delivered using a question-and-answer approach. The program was implemented by the researchers in the selected settings. The nurses were divided into fifteen groups, each group included 13 nurses and only one group of them included21nurses.Each session had specific objectives and title based on its content, which varied according to the nurse

comprehension and assimilation of the information, as well as the time available and the content of each session. The same contentswere presented to all nurses, and sessions were conducted using lectures, role model and small group discussions, and the brochures booklet and were employed throughout.

A PowerPoint presentation supported the health education intervention, and four videos were showntoall computer users in the current study on alaptop computer, followed by a group discussion about the contents. In addition, researchers helped nurses gain knowledge of feedback. Also, brochures with attractive images and simple, clear text were distributed on CDs to guide them after the intervention. Each session is started by a summary of what had been given in the previous one and explanation of the objectives for the current one, using simple language to accommodate the nurses' level of understanding. During the sessions, reinforcement techniques such as praise were used to encourage active participation and increasing learning.

The sessions were as follows:

- **First session:** During this session, the researchers gave an overview of the educational intervention, including the goal, the number of sessions, the duration of each session, the location of the meeting, and the schedule. Then, apre-testing was performed using data collection tools.
- **Second session:** The researchers provided nurses an overview about definition and importance of artificial intelligence, AI is the basis for mimickinghuman intelligence processes through the creation and application of algorithms built into a dynamic computing environment. Stated simply, AI is trying to make computers think and act like humans. Additionally, the researchers discussed the main characteristics of AI, and the areas in which AI has applications in clinical settings according to the figure.



Adopted from Commins, J. (2019): Top 7 Artificial Intelligence Characteristics with Examples**. Cited on line May 6, 2023. Retrieved fromfrom: https://techvidvan.com/tutorials/artificial-intelligence-features/.**

- **Third session: It** initiated by review of the previous session followed by discussion about the role of AI in nursing care,as well, discussion how artificial intelligence works. Artificial intelligence is being used in healthcare to analyze complex medical and health care data, and to approximate conclusions based solely on input data. The AI is applied to practices such as; diagnostics, treatment protocol development, drug development, personalized medicine, and patient monitoring and care. AI technologies can analyze vast data sets in the form of health records and images, population data, claims data and clinical trial data to uncover patterns and insights that humans could not find on their own **(Luca et al.,2023).**The AI simplifies the lives of patients, nurses, doctors and hospital administrators by performing tasks that are typically done by humans, but in less time and at a fraction of the cost. The AI can improve the speed and accuracy in use of diagnostics, give

practitioners faster and easier access to more knowledge, and enable remote monitoring and patient empowerment through self-care. AI has the potential to fundamentally transform the practice of medicine and the delivery of healthcare **(Floridi et al., 2023).**

- **Fourth session**: It includes group discussions about advantages of artificial intelligence, such as reduction in human errors,takes risks instead of humans, available 24x7, helping in repetitive jobs, digital assistance, faster decisions, daily applications, and new inventions. As well as, artificial intelligence strategies were also discussed.
- **Fifthsession**:It initiated by review of the previous session, followed by discussion about the barriers of artificial intelligence, such as; cultural barriers, fear, shortage of talent, and lack of a strategic approach to AI adoption, and solutions to any problems were discussed as, computing power, trust deficit, limited knowledge, human-level, data privacy and security, the bias problem, and data scarcity.
- **Sixth session**:It started by review of previous sessions then showing videos that contained the types of artificial intelligence. Then the researchers discussed the components of artificial intelligence.The components of AI include machine learning, Natural Language Processing, Computer Vision, Robotics, and Expert Systems. These components enable machines to learn, understand, and interact with the world around them in ways that were previously impossible.
- **Seventhsession**:It started by review of previous sessions, then great emphasizes are made on increasing nurses' awareness about the applications of AI as examples of artificial intelligence that can help the medical surgical nurse. As well, examples of artificial intelligence in the nursing field. Additionally, the researchers explained the problems of artificial intelligence in the health field. Also, the principles that address the artificial intelligence in the nursing field.
- **Eighth session:** It includes group discussions about the problems and solutions of artificial intelligence in the nursing field. Moreover, discussed how to improve the positive attitude toward artificial intelligence.
- **Ninth session:** It includes group discussions about knowledge how artificial intelligence enhances practice and patient outcomes. Each session lasted between 25 and 30 minutes. The total theoretical sessions was 104 sessions and eight practical sessions.
- **Tenth session:**The researchers summarized all previous sessions, identifying nurses' comments about the advantagesof the educational intervention. It also included communication channels between researchers and nurses to answer any question from the nurses and thanking them for their participation.

IV. Evaluation phase

The artificial Intelligence Knowledge Questionnaire, and the General Attitudes towards Artificial Intelligence (AI) Scale, was distributed again immediately and after three months of the program implementation to compare with the pre-test. It took each nurse approximately 38 minutes to complete the questionnaireand to evaluate the program effect on nurses. The follow-up period was completed in June 2023.

StatisticalAnalysis:

All statistical analyses were performed using SPSS for windows version 20.0 (SPSS, Chicago, IL). Continuous data were normally distributed and were expressed in mean ±standard deviation (±SD). Categorical data were expressed in number and percentage. One-way analysis of variance (ANOVA) test was used for comparison among more than two for variables with continuous data. Chi-square test (or Fisher’s exact test when applicable) was used for comparison of variables with

categorical data. The reliability (internal consistency) test for the questionnaires used in the study was calculated. Statistical significance was set at $p<0.05$.

Results:

Table (1) describes that 88.7% of the studied sample were females, 48.3% of them aged from 30–40 years. Additionally, 41.9% had 10–20 years of experience, and 38.9% of them had B.Sc. degree of nursing education. As well, 58.1% of them were working in surgical departments.

Figure (1) illustrates that the primary sources of information for nurses' knowledge about artificial intelligence were from internet (73.9%), followed by TV (21.7%) and Facebook (4.4%).

Table 2 indicates that, all domains of knowledge improved after implementation of the program. Only 14.3% of the study sample identified the definition of artificial intelligence at preprogram which increased to 55.2% at immediate posttest and decreased to 47.8% three months after follow-up. A considerable change was noticed between studied sample pre, (14.8%), immediately post program implementation (55.7%) and follow-up (45.3%) related to how artificial intelligence works among males and females nurses with statistically significant difference $X^2 = 157.286$ at $p= 0.001$. Additionally, the highest domain of knowledge pre – intervention was identifying the applications (17.2%) that may be arisen from artificial intelligence which changed in immediate post intervention to 52.7, followed by disadvantages of artificial intelligence (15.8%), which increased in immediate post program implementation to 59.1% and decreased in follow-up to 40.9%. Moreover, the principles of artificial intelligence in the health field among male and female nurses was noticed increased between studied sample from, 14.3% at pre at immediately and post program implementation to 61.6% with statistically significant difference ($X^2 = 172.215$ at $p= 0.001$).

Figure (2) illustrates that the total level of knowledge was satisfactory among 16.3% of studied nurses at pre intervention period, while improved was 82.8% at immediately post intervention period, and decreased to 68% at follow-up.

Table (3) shows that at pre- intervention artificial intelligence might take control of nurses, I shudder with alarm when I think of the future uses of artificial intelligence, and artificial intelligence is used to spy on nurses are considered the lowest mean scores (2.28±1.04, 2.36 ±1.08 and 2.39 ±1.08 respectively). Furthermore, the artificial intelligence is considered high mean score among nurses attitudes towards using artificial intelligence is exciting (3.08 ±1.41) followed by artificial intelligence can provide new economic opportunities for this hospital (3.01 ±1.37) while, artificial intelligence can have positive impacts on nurses' wellbeing came on the third rank (2.94 ±1.34). Additionally, the total means score of positive attitude improved from pre (53.35 ±21.07) compared to immediate post 77.19±18.64 and decreased to 67.95±23.62 at follow-up. Highly statistically significant differences were detected among all attitudes items in the three phases of intervention.

Figure (3) indicates that the total level of attitudewas positive among 26.1% of studied nurses at pre intervention period while it was 81.8% at immediately post intervention period, and decreased to 63.5% at follow-up.

Table (4) demonstrates highly statistically significant differences between the demographic characteristics (single, and master educational qualifications) and total knowledge level post intervention ($P<0.001$).

Table (5) shows that highly statistically significant differences between the demographic characteristics (master educational qualifications and experience more than 20 years) and total attitudes level post intervention ($P<0.001$).

Table (1): Frequency Distribution of the Demographic Characteristics among the Nurses (n=203)

Items	N	%
Age (years)		
< 30	42	20.7
30 – 40	98	48.3
> 40	63	31.0
Mean ±SD	37.7 ±9.1	
Gender		
Male	23	11.3
Female	180	88.7
Marital Status		
Married	154	75.9
Single	49	24.1
Educational qualifications		
Secondary nursing	59	29.1
Nursing institute	52	25.6
B.Sc.N,	79	38.9
Master	13	6.4
Experience (Years)		
Less than 10	51	25.1
10 – 20	85	41.9
More than 20	67	33.0
Mean ±SD	16.7 ±7.6	
Department		
Surgical	118	58.1
Medical	85	41.9

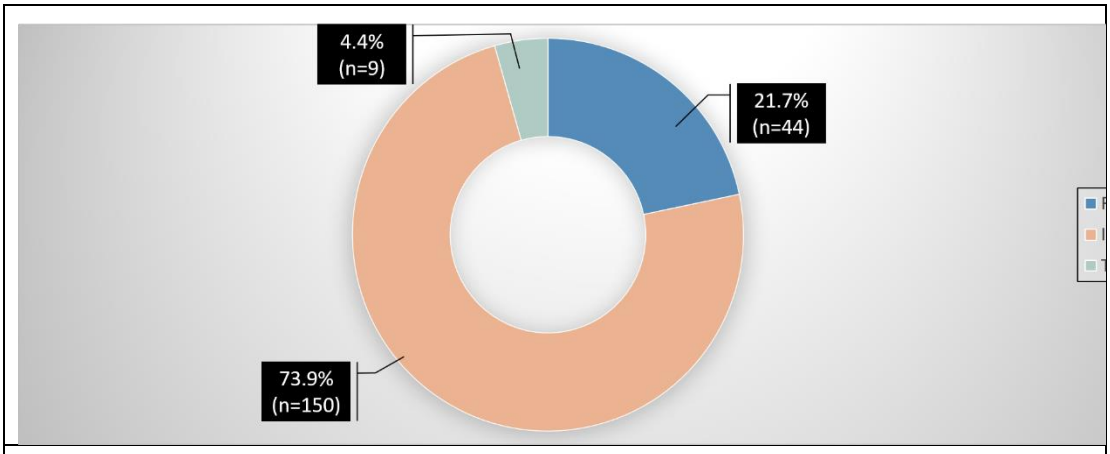


Figure 1. Distribution of Source of Information among about AI among the Nurses (n=203)

Table (2): Comparison of nurses' knowledge at pre intervention, immediate post and follow-up (n=203)

	Pre Intervention		Immediate Post		Follow – Up			
Knowledge of Artificial Intelligence	Correct		Correct		Correct		Chi – Square	
	No	%	No	%	No	%	X^2	P
Definition of artificial intelligence	29	14.3	112	55.2	97	47.8	165.136	<0.001**
How artificial intelligence works	30	14.8	113	55.7	92	45.3	157.286	<0.001**
Importance of artificial intelligence	30	14.8	117	57.6	83	40.9	158.154	<0.001**
Advantages of artificial intelligence	26	12.8	119	58.6	90	44.3	159.685	<0.001**
Disadvantages of artificial intelligence	32	15.8	120	59.1	83	40.9	147.154	<0.001**
Types of artificial intelligence	21	10.3	112	55.2	91	44.8	152.872	<0.001**
Components of artificial intelligence	25	12.3	116	57.1	84	41.4	154.835	<0.001**
Applications of artificial intelligence that can help the medical surgical nurse	35	17.2	107	52.7	83	40.9	125.383	<0.001**
Barriers of artificial intelligence in the health field	27	13.3	109	53.7	84	41.4	143.580	<0.001**
Principles of artificial intelligence in the health field	29	14.3	125	61.6	92	45.3	172.215	<0.001**

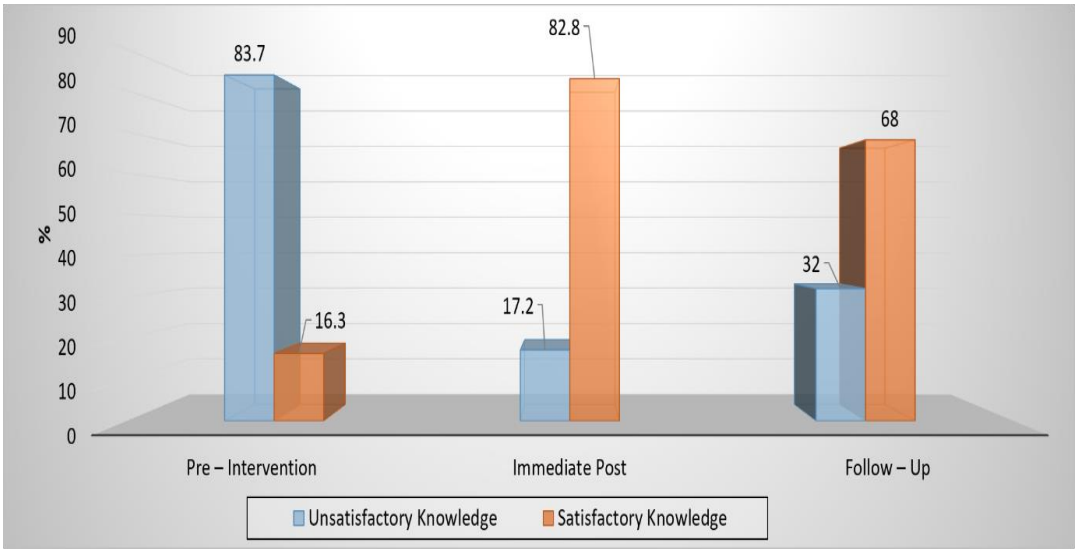


Figure (2) Comparison of Nurses' Knowledge Total Score at pre Intervention, Immediate Post and Follow-Up

Table (3): Comparison of Nurses' Attitudes at pre Intervention, Immediate Post and Follow-Up(n=203)

Attitudes	Pre – Intervention	Immediate Post	Follow – Up	Oneway ANOVA	
	Mean ±SD	Mean ±SD	Mean ±SD	F	P
I am interested in using AI systems manually in my daily life	2.63 ±1.20	3.74 ±1.71	3.33 ±1.52	28.744	<0.001**
There are many beneficial applications of Artificial Intelligence	2.94 ±1.34	4.18 ±1.91	3.72 ±1.70	28.714	<0.001**
Artificial Intelligence is exciting	3.08 ±1.41	4.38 ±2.00	3.91 ±1.78	28.818	<0.001**
Technical Artificial intelligence can provide new economic opportunities	3.01 ±1.37	4.28 ±1.95	3.82 ±1.74	28.917	<0.001**
I would like to use Artificial Intelligence in my own job	2.85 ±1.30	4.06 ±1.85	3.62 ±1.65	29.155	<0.001**
An artificially intelligent agent would be better than an employee in many routine jobs	2.69 ±1.23	3.83 ±1.75	3.41 ±1.56	28.881	<0.001**
I am impressed by what Artificial Intelligence can do	2.85 ±1.30	4.05 ±1.85	3.61 ±1.65	28.645	<0.001**
AI can have positive effects on nurses' well-being	2.94 ±1.34	4.18 ±1.91	3.73 ±1.70	28.794	<0.001**
Artificially intelligent systems can help Nurses feel happier	2.83 ±1.29	4.03 ±1.84	3.59 ±1.64	28.999	<0.001**
Artificially intelligent systems can perform better than humans	2.47 ±1.13	3.52 ±1.61	3.13 ±1.43	29.008	<0.001**
A lot of organizations will benefit from a future full of AI	2.78 ±1.27	3.95 ±1.80	3.52 ±1.60	28.773	<0.001**
For routine transactions, I would rather interact with an artificially intelligent system than with a human	2.71 ±1.24	3.85 ±1.76	3.43 ±1.57	28.511	<0.001**
I think Artificial Intelligence is dangerous	2.73 ±1.25	3.88 ±1.77	3.45 ±1.58	28.590	<0.001**
Organizations use Artificial Intelligence unethically	2.44 ±1.11	3.47 ±1.58	3.09 ±1.41	28.902	<0.001**
I find Artificial Intelligence sinister	2.40 ±1.10	3.62 ±1.65	3.04 ±1.39	38.671	<0.001**
Artificial Intelligence is used to spy on Nurses	2.39 ±1.08	3.80 ±1.73	3.04 ±1.39	49.791	<0.001**
I shudder with alarm when I think of the future uses of artificial intelligence	2.36 ±1.08	3.61 ±1.65	3.09 ±1.41	40.859	<0.001**
AI may control nurses	2.28 ±1.04	3.59 ±1.64	3.09 ±1.41	46.212	<0.001**
I think artificially intelligent systems make many errors	2.54 ±1.16	3.62 ±1.65	3.22 ±1.47	29.148	<0.001**
Nurses like me will suffer if AI is used more and further	2.43 ±1.11	3.46 ±1.58	3.08 ±1.41	28.902	<0.001**
Total Attitude Score	53.35 ±21.07	77.19 ±18.64	67.95 ±23.62	65.210	<0.001**

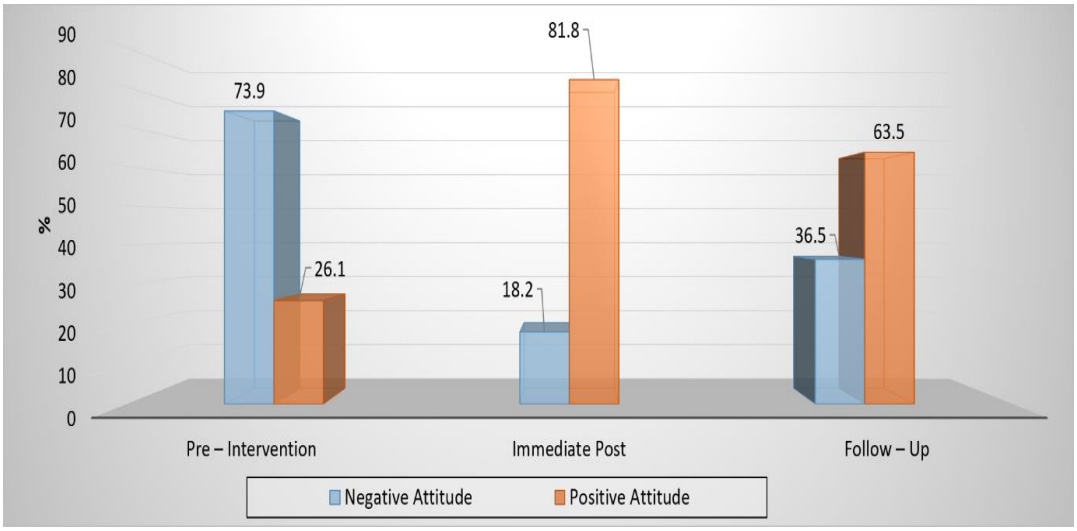


Figure 3: Comparison of Nurses' Attitude Total score at pre intervention, Immediate Post and Follow-up (n=203)

Table (4): Association between the Demographic Characteristics and Total Knowledge Level Post Intervention(n=203)

Variables	Inadequate (n=35)		Adequate (n=168)		Chi – Square	
	N	%	N	%	X^2	P
Age (years)						
< 30	6	17.1	36	21.4		
30 – 40	19	54.3	79	47.0		
> 40	10	28.6	53	31.5	0.656	0.720
Gender						
Male	5	14.3	18	10.7		
Female	30	85.7	150	89.3	0.368	0.544
Marital Status						
Married	10	28.6	13	7.7		
Single	25	71.4	135	80.4	10.086	<0.001**
Educational qualifications						
Secondary nursing	23	65.7	36	21.4		
Nursing institute	10	28.6	42	25.0		
BSC	2	5.7	77	45.8		
Master	0	0.0	13	7.7	34.378	<0.001**
Experience (Years)						
Less than 10	16	45.7	35	20.8		
10 – 20	13	37.1	72	42.9		
More than 20	6	17.1	61	36.3	10.587	0.005*
Department						
Surgical	20	57.1	98	58.3		
Medical	15	42.9	70	41.7	0.017	0.896

Table (5): Association between the Demographic Characteristics and total attitude level post intervention(n=203)

Variables	Negative Attitude (n=37)		Positive Attitude (n=166)		Chi – Square	
	N	%	N	%	X^2	P
Age (years)						
< 30	8	21.6	34	20.5		
30 – 40	17	45.9	81	48.8		
> 40	12	32.4	51	30.7	0.098	0.952
Gender						
Male	2	5.4	21	12.7		
Female	35	94.6	145	87.3	1.581	0.209
Marital Status						
Married	30	81.1	124	74.7		
Single	7	18.9	42	25.3	0.673	0.412
Educational qualifications						
Secondary nursing	27	73.0	32	19.3		
Institute nursing	9	24.3	43	25.9		
BSC	1	2.7	78	47.0		
Master	0	0.0	13	7.8	48.190	<0.001**
Experience (Years)						
Less than 10	28	75.7	23	13.9		
10 – 20	7	18.9	78	47.0		
More than 20	2	5.4	65	39.2	62.162	<0.001**
Department						
Surgical	18	48.6	100	60.2		
Medical	19	51.4	66	39.8	1.670	0.196

Discussion:

Nowadays AI is emerging as new innovations, and getting popular due to its ability to analyze clinical data and patient details with greater amounts of research evidences for decision making and enhance new knowledge **(Compassionin 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. Nurses need skills and knowledge to integrate AI knowledge to clinical practice (**Pepito&Locsin,2019).**Due to rapid advances in technology, law, and patient expectations, healthcare organizations must implement AI, which can help proactively treat patients, reduce future risks, and streamline business operations. As a result of these challenges, healthcare organizations have become essential to the success and prosperity of the healthcare system by reducing organizational costs and providing high quality services (**Ahlstedt et al., 2020**).

The present study revealed that majority of nurses were female, and about one-half of them were in the age range of 30 to 40 years with a mean of 37.7 ±9.1 years. As well, the highest percentages of them had a bachelor's degree in nursing, were married and slightly more than two fifths the majority of them had 10–20 years of experience. These findings might be due to the profession of nursing encourages engagement. As well, previously the nursing profession used to accept only females. These results consistent with those of an **Egyptian** study done by **Mohamed et al. (2023),** who found that all head nurses were female, and 51.1% were in the age range of 40 to less than 50 years with a mean of 40.53±4.918 years. Most of them had a bachelor's degree in nursing, 97.8% were married 80.4% had ≥ 15 years of experience.

The results of the current study revealed that there are significant positive relations between nurses' demographic characteristics (years of experience, and education), and their attitudes toward using AI. These results might be due tothat all health settings are trying to use AI in different nursing settings. These findings were consistent with those of a study by

Jsebaert (2019), aimed to assess attitudes towards robots and AI at work in 22 European countries'' and revealed that education has a significant positive effect on robots and AI attitudes at work. However, older adults make new strategies to avoid using of technologies and robots. Additionally, this study finding were inagreement with those of **Elsayed&Sleem (2021)** in **Egypt**, who reported that a significant positive relations were detected betweennurse demographic characteristics (job, education, years of experience, and work position) and their attitudes toward using AI.

In the present study the primary sources of information for nurses' knowledge about AI were from internet, followed by TV. This might be due to that the internet is an invaluable resource for knowledge and learning. Its vastness, accessibility, timeliness, diversity of perspectives, and ability to connect with others make it a valuable tool for anyone seeking to expand their knowledge and understanding of the world around them. These finding supported with those of**Robinson (2020),** in Nigeria**,** who mentioned that the internet has been the main source (89.32%). These results contrast with those of**Abuzaid et al (2022)** in **Sharjah, Sharjah, USA,** who found that 51% of respondents stated their knowledge on AI was obtained through self-taught measures for most of the participants, while 20% of them gained it through various courses. Only 8% stated they learned through postgraduate courses.

In the present study, findings confirmed the first research hypothesis, which stated applied artificial intelligence educational program has an effect on nurses' knowledge levelstowards artificial intelligence technologies. The current study results revealed that pre-intervention minority of nurses had unsatisfactory knowledge regarding AI. However, after educational intervention, there were statistically significant differences among all domains scores of nurses' knowledge of artificial intelligence between before immediate after intervention and follow-up. This indicates that the overall knowledge level of nurses improved immediately after the educational program was implemented. This increase in nurses' satisfactory toward AI, might be explained by nurses understanding the advantages and uses of AI and the value of artificial intelligence in nursing through the AI educational intervention as it can observe their environment, recognize objects, assist in decision-making, resolve conflicts, plan actions, learn new things, solve complex problems. In addition, it might be due to the success of the program for improving all domains of AI knowledge. These previous results were in convenience with those of**Abdullah &Fakieh (2020),** aimed to identify attitudes toward and perceptions of AI implementation in the health care sector among employee. The study was conducted in 4 hospitals in **Riyadh, Saudi Arabia,**which identified that 3.11 out of 4 respondents fear that AI will replace employees and have a general lack of knowledge regarding AI in prior intervention. In addition, most of the respondents were not aware of the most common benefits and challenges of AI applications in the health sector. The results also showed that technicians are the most affected by AI applications due to the nature of their jobs, which do not require much direct human interaction. As well, these results were in agreement with those of**Abuzaid et al. (2022),**in **Sharjah, USA,** who found lack inknowledge toward AI. 75% of all respondents agreed that the nursing curriculum should include some basic knowledge of AI. These results were in line with the findings of those ofa very recent studycarried out by**Mohamed et al. (2023**), who mentioned that there were significant differences in the mean difference scores of head nurses both before and after intervention (25.196) and between pre-intervention and follow-up (25.033).These results were similar with **those of Zhou (2022),** who in study which aimed to investigate the use of artificial intelligence in clinical nursing, among **Chinese** nursing staff concluded that the study yielded excellent results and contributed to the use of artificial intelligence technology in clinical nursing, also recommended the development of effective application measures in tandem with the actual work content. Furthermore, with a calculated partial η2 value of.977, the study found a significant difference in head nurses' attitudes toward artificial intelligence technologies among pre- and post-intervention, pre- and

follow-up, and post-and-follow-up, denoting that the program had a substantial impact on head nurses' attitudes toward artificial intelligence technologies.

These previous findings were consistent with those of **Liu (2022)**, in a study aimed at evaluating AI technology-based medical information processing and emergency nursing management that stated that nurses and AI robots may work together in clinical settings in the near future. . With concern over nurses' workload increasing and nurseshortages, the need for AI care robots is critical to developing effective nurse-assistance devices.These results wereby**Oh et al (2019)**, in the United States, who found that among 669 participants completed the survey, only 40 (5.9%) answered that they had good familiarity with AI. However, most participants considered AI useful in the medical field (558/669, 83.4% agreement). The advantage of using AI was seen as the ability to analyze vast amounts of high-quality, clinically relevant data in real time. Respondents agreed that the area of medicine in which AI would be most useful is disease diagnosis (558/669, 83.4% agreements). One possible problem cited by the participants was that AI would not be able to assist in unexpected situations owing to inadequate information (196/669, 29.3%). Only 237 (35.4%) answered that they agreed that AI could replace them in their jobs. These findings were supported with those of**Robinson (2020),** in **Nigeria,** who foundmajority of the study sample understand that AI is applied in radiology (96.50%), and surgery (94.05%). As well, 91.81% of responded that there was no form of AI in their facilities and they are willing to be trained and 55.83% of them agreed that AI would increase healthcare services, while 43.66% of the studied thought that it will reduce the human factor.

After the educational intervention, the results of the current study confirmed the second research hypothesis, which stated applied artificial intelligence educational program has an effect on nurses' positive attitudes levels towards artificial intelligence. Pre- test the findings revealed that AI is exciting was considered the high mean score among nurses attitudes toward using artificial intelligence (3.08 ±1.41), followed by artificial intelligence can provide new economic opportunities for my hospital (3.01 ±1.37) and artificial intelligence can have positive impacts on nurses' wellbeing (2.94 ±1.34). Those findings might be related to that artificial intelligence can speed up the healthcare process, and can help reduce the number of medical errors, AI can deliver massive amounts of clinically relevant, high-quality data in real time. As well, artificial intelligence helps the patient to get answers instantly without any restrictions of time or place, helps in performing tedious administrative tasks that can take a long time, and helps reduce human error. Additionally, AI can work 24/7 without physical stress; can predict surgical outcomes for patients, and helps in the field of public health and epidemiology. Moreover, AI can enhance patient engagement and treatment compliance; And predictive modeling to deal with patient flow, hospital capacity, and resource availability, and artificial intelligence software that helps predict, diagnose, and treat diseases, which in turn helps improve care and reduce workload.

These previous findings were supported by the results of **El-Sayed and El-Salim (2021)**, in Egypt, whose study aimed to assess nurse views and attitudes regarding the use of AI in health, and found that artificial intelligence is exciting gained average high scores for nurses' attitudes towards the use of AI (3.55 ± 0.91), followed by AI that can provide new economic opportunities for regulation (3.47 ± 0.90) while AI came in third place (3.39 ± 1.05). On the other hand, of both items, AI found to be evil and using AI to spy on nurses had the lowest average score (2.76 ± 1.11) and 65.4% of them had an overall positive attitude towards using AI in nursing. These results are in line with those of **Dicuonzo et al. (2023)**, whose similar study aimed to assess the transformation of healthcare using AI and the impact on the workforce and the organization, stated that AI has the potential to transform healthcare delivery.

Additionally, in the current study the total attitude positive score improved from pre 53.35 ±21.07 to 77.19 ±18.64 in immediate post intervention. As well, there were statistically significant differences among all items of attitudes scale (P= 0.001), in nurses' attitudes

towards artificial intelligence technologies. These results may be due to that artificial intelligence knowledge which increased in post intervention had direct effect on their attitudes. Moreover, it became of great importance nowadays due to the tendency of the health sector to use it in its various fields and seek to provide the necessary information on how to apply it in line with Egypt's Vision 2030, which aims to digitization of all society sectors. Furthermore, it indicated that, the educational intervention had a significant impact on the attitudes of nurses toward artificial intelligence technologies. These results were similar by an Egyptian study done by **Mohamed et al. (2023),**which aimed to evaluate the effect of the artificial intelligence program on nurses'. They mentioned that the mean score of the pre, post, and follow up phases of attitudes showed statistically significant differences (50.01±3.92, 83.58±2.12, and 79.58±2.21 at p =.000, respectively). There were also significant differences in head nurses' attitudes toward artificial intelligence technologies between pre- and post-intervention, pre- and follow-up, and post- and follow-up (p=000).

These previous results coincided with those of**Lee and Yoon (2021),** in their study toassess the use of artificial intelligence-based technologies in the healthcare industry in the **United States**, which revealed that, AI systems were improving the efficiency of nursing and activities in hospitals. On the same context, a study, done by **Swan (2021),** believed that artificial intelligence will transform nursing and healthcare by enhancing health promotion and illness prevention. In a previous study, **Topol (2019)** clarified that AI has already been used in nursing for the analysis of electronic nursing records, clinical decision support through the analysis of pressure ulcers and safety risks, nursing robots, and scheduling **(Topol, 2019).** Furthermore, this finding was supported by those of **Kwak et al. (2022),** who reported that positive attitudes towards AI initially expected its usage and application. As well, **Mehdipour (2019),** highlighted that nursing who use AI effectively, will be able to provide better, faster, and safer services.

Conclusion:

This study results revealed that the educational intervention had highly statistically significant positive effects on the studied nurses' knowledge, and attitudes regarding artificial intelligence.

Recommendations:

It is recommended to encourage nurses to enhancing their knowledge towards artificial intelligence through workshops and training programs. Appropriate information is needed about the benefits, barriers, and issues surrounding the implementation of artificial intelligence in nursing settings and the potentials of these technologies to increase health care processes and efficiencies. Participation and support of hospital policy from the beginning of the implementation of the artificial intelligence system are required. As well, providing further education and training are required to enable a seamless and safe integration of AI into nursing practice.

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