Effect of Implementing Nursing Educational Program on Perioperative Nurses' Knowledge and Attitude Regarding Robotic- Assisted Surgery

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Abstract

Background: Robotic assisted surgery is considered a major technological advancement in minimally invasive surgery and artificial intelligence integration. **Aim:** To evaluate the effect of implementing nursing educational program on perioperative nurses' knowledge and attitude regarding robotic-assisted surgery. **Design**: A quasi-experimental research design **Setting:** Operation Department of New Surgical Hospital at Tanta Main University Hospital. **Subjects:** All available nurses (80) who work directly with patients undergoing surgery. **Tools:** Two data collection tools were utilized. **Tool I:** Structure Interview Schedule for nurses, **Tool II:** General Attitudes towards Robots Scale (GAToRS)**. Results:** Highly significant improvement in total nurse's knowledge levels and attitude regarding robotic-assisted surgery since p value was (0.001) post implementing the program. It was determined that preprogram (95 %) had low level of knowledge compared to the majority (91.25 % and 87.50%) immediately and two-month post educational program. Also, preprogram the minority of the studied nurses (10 %) had a positive attitude compared to the majority (86.20 %) had a positive attitude post program. **Conclusions:** Implementation of the nursing educational program associated with significant improvement in the total mean score of nurse's knowledge and attitude. **Recommendations:** Training program should be conducted for nursing staff in the operating room regarding robotic assisted surgery.

Keywords: Attitude, Educational program, Knowledge, Robotic assisted surgery.

Introduction

Technology plays a fundamental role in recent advancements in the surgical field. A surgical robot is a tool under constant direction of the surgeon. The robot does not operate independently. Undoubtedly, the future will witness greater integration of AI and automation in surgical robots **(Power, 2024).** The da Vinci robot was utilized for over 13 million surgical operations worldwide at the end of 2023. Globally, over 8,200 da Vinci robots are in operation, reflecting the rapid expansion of robotic-assisted surgery **(Lengyel, Chinnadurai, Corr, Lumsden, & Bavare, 2024).** In October 2021, surgeons in Egypt at Ain Shams Specialized Hospital used robotic assisted surgery for the very first time **(Darweesh, Abdel-Rahman, & Diab, 2024).**

Robotic assisted surgery acquired worldwide acceptance over the past decade. Robot-assisted surgery (RAS) is an advanced form of minimally invasive surgery in which a surgeon utilizes a surgical robot to perform surgical procedures. RAS has been applicable in varies specialties which include general surgery, cardiac surgery, vascular surgery, thoracic surgery, urology surgery, neurosurgery, orthopedics surgery, ophthalmology, otolaryngology, oncology surgery, bariatric surgery, dental surgery, and plastic surgery **(Fairag et al., 2024).**

Benefits and advantages include keyhole incisions, reduced post-operative pain, less scar, less bleeding, shorter hospital stays, faster recovery, decrease incidence of surgical site infection, greater precision and dexterity, scaling motion, tremor filtration, improved visualization, reduced surgeons' fatigue during surgery **(Fairag et al., 2024).** Disadvantages of RAS are very expensive, lack tactile feedback, longer operative time to robotic surgery compared to traditional surgery. Potential for technical malfunction of robotic arms and power outages, software defects **(Lawrie et al., 2022).**

Ethical implication of artificial intelligence in robotic assisted surgery: - Currently, legal framework and malpractice in the medical field, specifically robotic surgery is complex **(Power, 2024).** Exploring the ethical dilemmas surrounding AI-powered decision-making in surgery. Accountability and responsibility are divided among key contributors such as the surgeon, software provider, and algorithm designer. **(Power, 2024).** Confidentiality and cybersecurity; Patient privacy and data security are concerns arising from the involvement of external parties beyond the treating team. Hospital data related to RAS needs protection from cyberattacks **(Vilanilam & Venkat, 2022).**

Key components of a robotic surgery system: - Software components; Da Vinci OS4 which operates the fourth generation da Vinci robot, My Initiative applications and video processor. Hardware components: the da Vinci system includes three major hardware components that include the surgeon's console, patient cart (robotic arm cart), and vision cart **(Rivero-Moreno et al., 2023).**

Role of nurse in robotic surgery: Nurses have a crucial role in robotic surgery extend across all phases, from pre-operative assessments to intra-operative assistance and post-operative patient monitoring **(Takagi et al., 2024).** Prepare the robotic system; make sure power and system cables, and auxiliary device cables are connected. Make sure all cables are intact. Robot battery has been charged in the past 24 hours. Also, prepare sterile robotic instruments and an endoscopic camera. Also, some laparoscopic instruments and open surgical instruments must be prepared in case of conversion to open surgery. Additionally, draping the surgical robot by sterile drapes (**Malik, 2022).** The operating room nurses have basic roles in setting up, turn-on, shut-down robotic system, docking and undocking, malfunction, errors management and troubleshooting **(Wang, Zeng, & Sheng, 2021).** Robotic surgery safety management protocols are the responsibility of all OR team members, including nurses **(Nyein & Condron, 2024).**

Significance of the study

In Egypt, implementation of robotic surgery into surgical field aligns with the rapid growth of the health sector in recent years, which contributes to achieve governmental plans for sustainable development in compliance with Egypt's Vision 2030. It was found that nurses have deficiencies in education, inadequate training, and restricted access to information as obstacles in their role, resulting in greater stress **(Moloney, Coffey, Coffey, & Brien, 2023).**

The aim of the Study

Evaluate the effect of implementing nursing educational program on perioperative nurses' knowledge and attitude regarding robotic-assisted surgery.

Research Hypothesis

1. Perioperative nurses' knowledge about robotic assisted surgery exhibited improvement after the implementation of the nursing educational program.
2. Perioperative nurses' attitude about robotic assisted surgery is exhibited to be positive after the implementation of the nursing educational program.

Subjects and Method

Research design; A quasi-experimental research design was utilized in current study.

Setting: The study was conducted at Operation Department of New Surgical Hospital at Tanta Main University Hospital.

Subjects: All available nurses (80) from the above-mentioned setting who work directly with patients undergoing surgery.

Tools of the study: Two tools were utilized for data collection as the following: **Tool (I): Structure Interview Schedule for nurses**

about robotic assisted surgery Questionnaire. It involved two parts

Part (A): Nurses socio-demographic characteristics as nurses' code, age, gender, marital status, education level, occupation, years of experience and previous training about robotic-assisted surgery.

Part (B): Nurses' Knowledge Assessment Sheet: This tool was developed by the researcher based on a review of relevant literature. **(Zbigniew Nawrat., 2023; Suryawanshi, Shah, Khanna, Ghodki, Bhati, & Ashok, 2023)** to evaluate nurses' knowledge before and after implementation of nursing educational program regarding robotic-assisted surgery.

Total scoring system of knowledge

Three levels of scoring for questions were done as the following; Correct and complete answer scored (2), Correct and incomplete answer scored (1), Don't' know or incorrect answer scored (0). The total scoring system of nurse's knowledge was calculated and classified as the following:

- **High** → >80% of the total score
- **Moderate** → ≥ 60% to 80% of the total score.
- **Low** → < 60% of the total score.

Tool (II) General Attitudes towards Robots Scale (GAToRS)

General Attitudes towards Robots Scale developed by **(Nomura, Suzuki, Kanda & Kato, (2006), and Syrdal, Nomura & Dautenhahn, 2013)** and adopted by the researcher. It is useful tool in understanding attitudes towards new technologies such as Robots and artificial intelligences. GAToRS were composed of 20 statements focused on attitudes towards robots, technology and artificial intelligence, divided into four subscales which included Personal Level Positive Attitude (comfort and enjoyment around robots), Personal Level Negative Attitude (unease and anxiety around robots), Societal Level Positive Attitude (rational hopes about robots in general), Societal Level Negative Attitude (rational worries about robots in general).

Scoring system; each item is scored according to a 5-point Likert scale ranging from 1-5, 1 (Strongly disagree), 2 (Disagree), 3 (Neutral), 4 (Agree) and 5 (Strongly agree)**.** The subscale scores were calculated by averaging the scores of the items in the subscale. Total Scoring System: Based on cut of value 60%, the nurses' attitude is determined as negatively ≤60 and positive attitude >60.

Method

1. Administrative process:

Official letters from the Faculty of Nursing were submitted to the relevant authorities in the targeted area for approval. Written formal approval hospital permission to carry out the study was approved by the director of the Operation Department of New

Surgical Hospital, in Tanta Main University Hospital

2. Ethical and legal consideration

- Ethical and legal approval was obtained from Faculty of Nursing Scientific Research Ethical Committee (Code. No 424-3-2024).
- An Informed consent was obtained from all nurses in this study after explaining the aim of the study and the right to withdrawal at any time.
- Confidentiality and privacy were taken into consideration regarding data collection. Names were substituted with assigned code numbers.

3. **Tools development:** Two tools were used. Tool (I) Part (A): Nurses' socio-demographic characteristics. Tool (I) Part (B): Nurses' Knowledge Assessment Sheet. Tool (II) General Attitudes towards Robots Scale (GAToRS).
4. **Validity of Tools:** The content of all tools was examined by seven jury of experts in Medical-Surgical Nursing and General Surgery for transparency, comprehensibility and applicability and modifications were done. The calculation indicated a value of (98%).
5. **The reliability** of all tools was calculated by Cronbach's Alpha test: it was 0.852 for Tool I (Part A)، 0.893 for Tool I (part B), 0.905 for Tool II and 0.874 for the sheet in total.
6. **A pilot study** was carried out on 10% of operating room nurses to test the feasibility and applicability of the tools and to detect any obstacles that occurred during data collection period. Modifications were made following experts' review by the researcher before the main study. The pilot study was included in the total sample of the study.
7. The data collection for the current study was implemented a full 6 months from August 2024 to January 2025.
8. The educational program was performed through four phases (Assessment, planning, implementation and evaluation).

Assessment phase, the studied nurse's knowledge and attitude were assessed by using Tool I and Tool II.

Planning phase

A. **preparing the environment;** specific field suitable room for interview questionnaire, keeping suitable and comfortable chairs, maintaining good ventilation and calmness during teaching program implementation and using audiovisual materials that were necessary as PowerPoint presentations and videos by using laptop and projector.

B. Creating content of educational program: Illustrative colored educational booklet was organized and expressed in both Arabic and English using simple language with illustrated figures as a reference manual for the nurses under study.

Multiple methods were utilized such as booklet, videos, power point and group discussion which were prepared by the researcher.

Implementation phase, the nursing educational program regarding robotic assisted surgery was designed and conducted by the researcher for nurses implemented in 4 sessions.

- **The First session:** knowledge about the meaning of robotic surgery, causes, benefits, advantages, and disadvantages, conditions treated with robotic surgery, and risks.
- **The second session:** knowledge about the difference between robotic and traditional surgery and specialty applications of robotic technology.
- **The third session:** knowledge about the ethical considerations of artificial intelligence in RAS, components of robotic surgical systems, equipment, and anaesthesia.
- **The fourth session:** knowledge about the description of robotic-assisted surgery, preparation for surgery, surgical team roles, nursing roles pre-, during, and post-robotic surgery, robotic-assisted surgery safety, infection control measures, and pain management.

Evaluation phase: The researcher evaluated nurses' knowledge and attitude immediately after, and two months after implementation of an educational program by using Tool (I) parts (A) and (B) and Tool (II). A comparison between pre- and post-educational programs was conducted to determine the effect of implementing educational programs.

Methods of data analysis

The collected data was organized, tabulated and statistically analyzed by using (IBM SPSS Statistics for Windows, Version 26, Armonk, NY: IBM Corp.). Measures of central tendency and dispersion, including the range, mean, and standard deviation, were applied to the quantitative data. Qualitative data were expressed as frequency and percentage. A Pearson correlation test was performed to explore the relationship between two normally distributed quantitative variables, and the reliability of the study tool was confirmed via Cronbach's Alpha. Significant level:

- $p > 0.05 \rightarrow$ non-significant
- $p < 0.05^* \rightarrow$ Significant
- $p < 0.001^{**} \rightarrow$ Highly significant

Results

Table (1) Distribution of the studied nurses according to their socio demographic characteristics. It illustrated that the majority (90 %) of the studied nurses were in the age group from (21-<30) years old; also, the table demonstrates that more than two-thirds (66.3 %) of the studied nurses were females, and more than half (51.3 %) of the studied nurses were married.

Regarding occupation and educational level, more than two-thirds (71.3 %) of the studied nurses were surgical nurses; in addition, more than two-thirds of them (68.8 %) had bachelor's degree. Regarding experience and previous training, more than two-thirds (71.3%) of the studied nurses had (1-<5) years of experience in the operating room.

Table (2): Distribution of the studied nurses regarding their total knowledge level about robotic-assisted surgery throughout periods of the study. It showed that there was a statistical significance improvement in the level of knowledge among studied nurses in relation to robotic assisted surgery immediately post, two-months post educational program implementation than pre-program since p = (0.001**). Also, it was found that the mean of total knowledge of studied nurses **18.56 ± 29.39, 198.74 ± 14.98, 190.04 ± 15.88** at pre, immediately post and after two months respectively.

Figure (1) Distribution of the studied nurses regarding their total knowledge level about robotic-assisted surgery throughout periods of the study, it showed that statistically significant improvement has occurred in total level of knowledge for studies nurses as pre implementation of the educational program the majority **(95%)** had low level of knowledge, and the minority studies nurses **(5%)** had a moderate level of knowledge. Moreover, immediately after implementation of the educational program the majority **(91.25%)** of studies nurses had high level of knowledge and the minority studies nurses **(8.75%)** had a moderate level of knowledge.

Post two months post implementation of the educational program the majority **(87.50%)** of studies nurses had high level of knowledge. Moreover, the minority studies nurses **(12.50%)** had moderate level of knowledge.

Table (3): Distribution of the studied nurses regarding their general attitudes level towards robots scale throughout periods of implementing nursing educational program. It illustrated that there was a statistical significance improvement regarding general attitude level towards robots among studied nurses immediately post implementing of the

educational program than pre-program since p = (0.001**). Also, it was found that the mean of general attitude level towards robots of studied nurses **27.86 ± 16.25, 91.75 ± 15.58** at pre, immediately post implementing of the educational program respectively.

Figure (2) Distribution of the studied nurses regarding their general attitude level towards robots scale throughout periods of implementing nursing educational program. It showed that statistically significant improvement has occurred in general attitude level towards robots for studies nurses as pre implementation of the educational program the majority **(90%)** had negative attitude level, and the minority studies nurses **(10%)** had a positive attitude level. Moreover, immediately post implementation of the educational program the majority **(86.20%)** of studies nurses had a positive attitude level and the minority studies nurses **(13.80%)** had negative attitude level.

Table (4): Percentage comparison **and correlation between total knowledge level of the studied nurses and their general attitude level towards robots scale throughout periods of implementing nursing educational program. It** demonstrated that there was a highly statistically improvement strong positive correlation between nurses' total knowledge and their general attitude level pre, and immediate post program since p <0.05.

Figure (3): Percentage comparison and correlation between total knowledge level of the studied nurses and their general attitude level towards robots scale throughout periods of implementing nursing educational program. It showed that there was a highly statistically significant strong positive correlation between nurses' total knowledge and their general attitude level pre and immediate post program

Table (1): Distribution of the studied nurses regarding their socio-demographic characteristics.

Characteristics	The studied nurses (n=80)	
	N	%
Age (in years)		
- (21-<30)	72	90
- (30-<40)	8	10
Range	(23-38)	
Mean ± SD	26.78 ±3.46	
Gender		
- Male	27	33.7
- Female	53	66.3
Marital status		
- Single	39	48.8
- Married	41	51.3
Occupation		
- Surgical nurse	57	71.3
- Anesthetic nurse	14	17.5
- Supervised nurse	8	10
- Head nurse	1	1.3
Educational level		
- Technical institute	19	23.8
- Bachelor's degree	55	68.8
- Postgraduate studies	6	7.5
Experience in operating room (in years)		
- (1-<5)	57	71.3
- (5-<10)	20	25
- (10-<20)	3	3.7
Range	(1-15)	
Mean ± SD	4.18±2.469	
Previous training about robotic assisted surgery		
- Yes	0	0
- No	80	100

Table (2): Distribution of the studied nurses regarding their total knowledge level about robotic-assisted surgery throughout periods of implementing nursing educational program

Total knowledge level	The studied nurses (n=80)						χ^2 P
	Pre		Immediately		Post 2 months		
	N	%	N	%	N	%	
- Low	76	95	0	0	0	0	226.166 0.001*
- Moderate	4	5	7	8.75	10	12.50	
- High	0	0	73	91.25	70	87.50	
Range Mean ± SD	0 – 142 18.56 ± 29.39		148 – 210 198.74 ± 14.98		144 – 210 190.04 ± 15.88		

<60% Low (60-80)% Moderate >80% High

* Significant at level P =0.001*

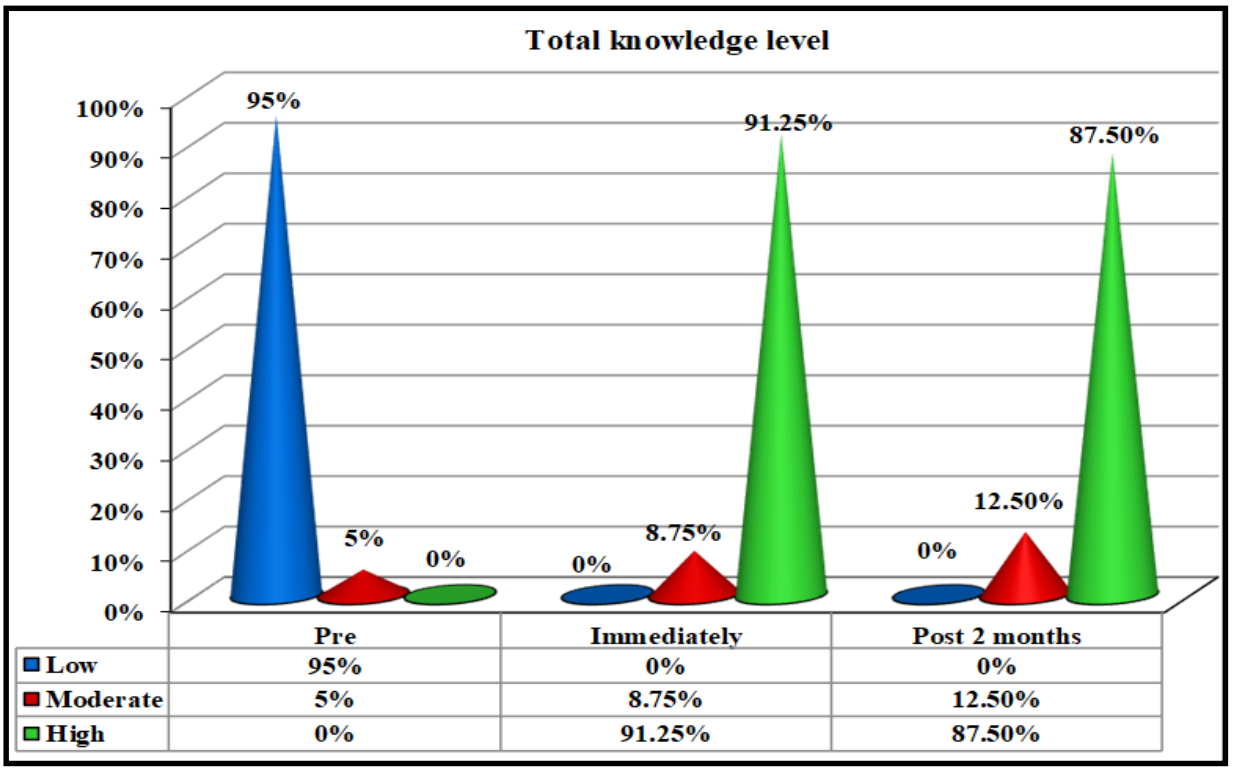

Figure (1) Distribution of the studied nurses regarding their total knowledge level about robotic-assisted surgery throughout periods of implementing nursing educational program.

Table (3): Distribution of the studied nurses regarding their general attitude level towards robots scale throughout periods of implementing nursing educational program.

General attitude level	The studied nurses (n=80)				χ^2 P
	Pre		Immediately		
	N	%	N	%	
- Negative	72	90	11	13.80	93.156
- Positive	8	10	69	86.20	0.001*
Range	20 – 81		49 – 100		
Mean ± SD	27.86 ± 16.25		91.75 ± 15.58		

* Significant at level P =0.001*

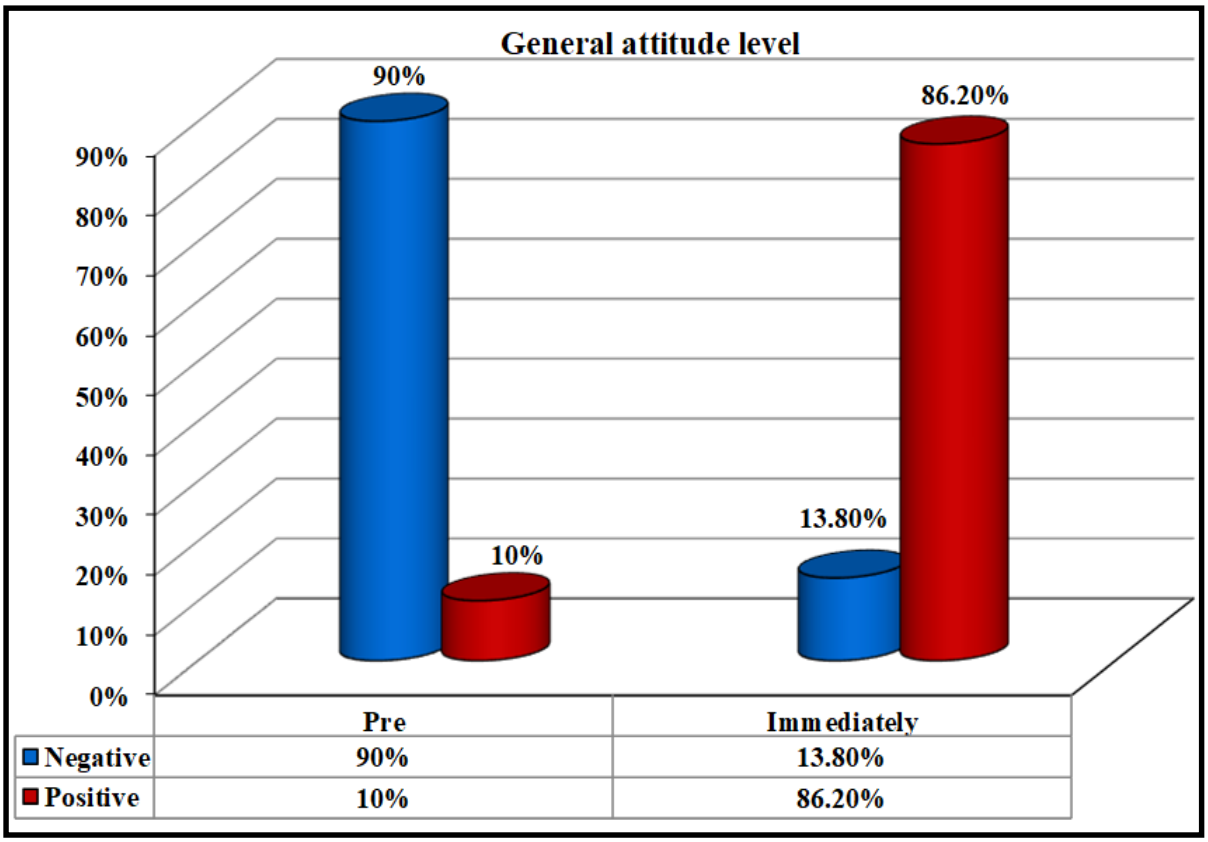

Figure (2) Distribution of the studied nurses regarding their general attitude level towards robots scale throughout periods of implementing nursing educational program.

Table (4): Percentage comparison and correlation between total knowledge level of the studied nurses and their general attitude level towards robots scale throughout periods of implementing nursing educational program.

Total knowledge level	The studied nurses (n=80) General attitude level				χ^2 P
	Negative		Positive		
	N	%	N	%	
Pre					
▪ Low	68	85	8	10	0.468 0.494
▪ Moderate	4	5	0	0	
▪ High	0	0	0	0	
r P	0.361 0.023*				
Immediately					
▪ Low	0	0	0	0	0.002 0.966
▪ Moderate	1	1.25	6	7.5	
▪ High	10	12.5	63	78.75	
r P	0.435 0.017*				

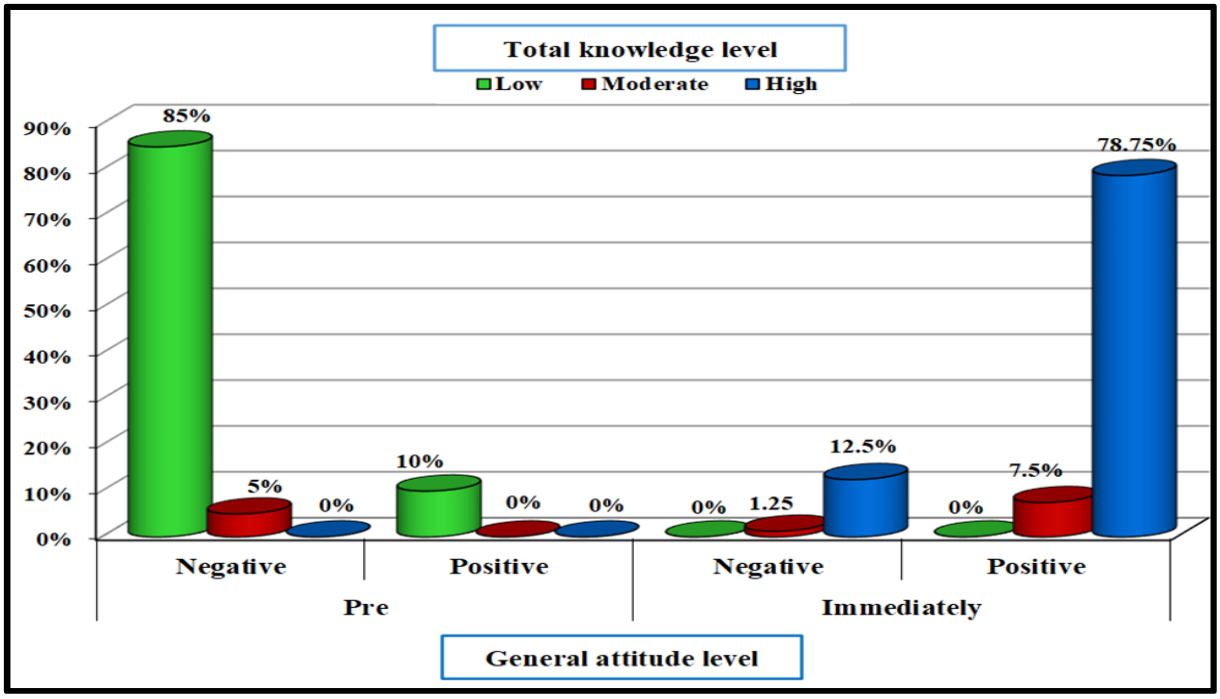

Figure (3): Percentage comparison and correlation between total knowledge level of the studied nurses and their general attitude level towards robots scale throughout periods of implementing nursing educational program.

Discussion

Robotic-assisted surgery acquired worldwide acceptance over the past decade and gained significant popularity so that it is representing a significant technological advancement in the surgical field (**Ragusa et al., 2024).**

The integration of robotic surgery and nursing digital era is pioneering in healthcare, so professional operating room nurses must continuously adapt to emerging technologies to optimal outcomes. Nurses play a major role in robotic surgery extend across all phases, from pre-operative assessments to intra-operative assistance and post-operative patient monitoring **(Takagi et al., 2024).** Robotic surgery nurses need to identify components of robotic system, understand the procedural steps of use it, prepare robotic system before to surgery, be familiar with intraoperative emergency management, understand the cleaning protocol for the robot and troubleshoot error messages. It was important for hospitals to have a robotics nurse specialist. **(Gudeloglu & Parekattil, (2021).** Therefore, this study was conducted to evaluate the effect of implementing educational program on nurse's knowledge and attitude regarding robotic assisted surgery.

Concerning to socio-demographic characteristics of the studied operating room (OR) nurses, the results of the current study revealed that most studied OR nurses were in the age group between (21-<30) years. This result could be due to high work pressure in OR. Young studied OR nurses may have more physical power and able to adapt with high-pressure nature of the work and anticipated that nurses of a younger age are more enthusiastic and more accepting of new technologies. These results were agreed with **Ji Yong Shin & Eun Hee Jang, (2023)** who reported more than half of operating room nurses were in the age group between (23-<30) years. But this finding disagreed with, **Darwish, EL Berry, Elfiky, Ali, & Abd El Mageed,** (**2023)** who reported that, more than half of OR nurses ages from 40 to 50 years.

Concerning to gender, the present study showed that more than two-thirds of the OR nurses were female. This may be due to higher proportion of the nurses in Egypt was females and may be also related to nursing education in Egyptian universities were restricted for female before recent years. This finding was in the same line with, **Thomas Porto & Catal., (2021); Sınmaz, Kara, Seyhan, & Özbaş (2025)** who reported that, the most the studies nurses in operating field were females. Conversely, this result disagrees with **Lawrie et al., (2022)** who reported that, most of the studies nursing staff in operating room were males.

Concerning to marital status, the present study illustrated that more than half of studies OR nurses were married. These results were agreed with **Thomas Porto & Catal., (2021)** who reported that, more than half the studies nurses in operating theatre were married. Conversely, this result disagrees with **Altınbaş, Uslu, Kamaş, Van Gıersbergen, (2024)**

who reported that, more than half the studies surgical nurses were single.

In relation to educational level, the present study revealed that more than two-thirds of the studied OR nurses had bachelor's degree. This result could be due bachelor's degree studied nurses have high educational level, critical thinking skills and more proficient to adapt and use of new technology. This finding was in the same line with, **Thomas, Porto, & Catal, (2021)** who reported that, educational background about more than two-thirds have obtained a bachelor's degree. In contrast, this result was contradicted by **Darwish et al., (2023)** who illustrated that the minority of the studied nurses in surgical field had bachelor's degree

Concerning to total knowledge regarding robotic surgery which including the meaning, causes of using robotic surgery, advantages and disadvantages of robotic surgery, conditions treated with robotic surgery, risks, the difference between robotic and traditional surgery, and specialty applications of robotic technology, the ethical considerations of artificial intelligence in RAS, components of the robotic surgical system, equipment, anaesthesia, a description, preparation for surgery, surgical team roles, the nursing role pre, during, and post robotic surgery, robotic-assisted surgery safety, infection control measures, and pain management. The present study demonstrated that low percentage of studies nurses had good total knowledge regarding robotic-assisted surgery before implementing the education program. This inadequacy of total nurses' knowledge might have been because above than two thirds of studied nurses had from 1 to 5 years of experience in the operating room, all studies nurses had no experience about robotic surgery, lacked up-to-date knowledge, there was a noticeable lack of interest and motivation, unavailability of educational books, learning materials, absence training programs and courses about robotic surgery.

On the other hand, the implementation of educational program had a positive effect on nurses' knowledge as the most of study subjects had excellent and high knowledge after implementing the educational program. This enhancement in knowledge reflects success of the educational program, learning sessions, using a colored educational booklet with clear attractive photos, videos and PowerPoint presentation that prepared by the researcher. Also, this finding may be related to more than two third of studies OR nurses had bachelor's degree, nurses' commitment to gaining new knowledge and their regular participation in the program sessions that was evident in the higher knowledge scores observed in the participating OR nurses.

This result was agreed with **Patel, (2022)** who reported that more than two third of OR nurses had low level of knowledge before giving informational booklet about robotic surgery and improved post giving it with significance at the level of 0.05. It was concluded that the mean post-test knowledge score was higher than the mean pre-test score following the

distribution of the knowledge booklet on robotic surgery. Furthermore, **Gudeloglu & Parekattil., (2021)** documented the more than half of OR nurses did not have any knowledge at all prior implementation of nurses training program on robotic surgery than post implementation.

This result is congruent with **Yeşilyurt, & Durmaz, (2023)** who declared that more than two third of the surgical nurses their knowledge level about robotic surgery was partially sufficient and about third quarter of them got knowledge from the internet, A statistically proven increase in knowledge levels regarding robotic operating room nursing (p=0.035). The outcomes of current study were in line with **Vigo et al., (2022)** who reported that the effect of an organized educational protocol on enhancing the performance of a team both junior surgeons and expert nurses which denotes that increasingly active role of operating room nurses. A four-phase training strategy was applied over 4 years, comprising theoretical knowledge, practical skills training, and team communication skills improvement.

Also, these results were agreed with **Gudeloglu & Parekattil., (2021)** who illustrated that after the program about robotic surgery, about third quarters of the trainees confirmed that robotics training program positively influenced professional growth. Generally, the majority of them acknowledged the value of the program, they would endorse the robotic program to others healthcare professionals. **Møller et al., (2024)** who performed study in Denmark titled "Training and education of operating room nurses in robot-assisted surgery: a systematic review" enforce the present study results as they reported that lack of extensive research regarding the training of OR nurses in robot-assisted surgery, with the existing literature primarily highlighting surgeon education. Further research is required to create evidence-based training programs for OR nurses in robotic surgery. This result was accepted with **Melnyk et al., (2021**) who reported that implementation of a simulation-based training program leads to significant improvements in the operative team's confidence, knowledge, and crisis management related to robotic surgery. In addition to **Bergonzini et al., (2024)** who reported that the most response of operating room nurses was totally adequate knowledge about robotic surgery**. Raheem et al., (2017)** who performed study titled "Robotic nurse duties in the urology operative room" enforce the present study results as they reported that robotic nurse require comprehensive knowledge and practical skills in robotic systems, particularly in troubleshooting in managing troubleshooting procedures and robotic failures. Nurses in robotic surgery have different specialties, including nurse coordinator, scrub nurse, and circulating nurse, with each role having specific job descriptions.

Conversely, this result disagrees with **Kang et al., (2016)** who reported that there were not enough educational programs or educational opportunities for nurses on RS. Also, **McBride et al., (2019)** who reported that the most

operating room staff reported have knowledge of RAS, while most nursing staff had no knowledge. These results contradicted **Darwish et al., (2023)** who revealed that the level of acceptance, understanding, and use of information associated with robotic surgical procedures among OR nurses was low.

Regarding their general attitude level towards robots scale throughout periods of implementing nursing educational program. The present study demonstrated that the minority of studies nurses had positive attitude and the majority of them had negative attitude toward robotic-assisted surgery before education program implementation. The negativity in general nurses' attitude might be because poor of nurse's knowledge about robotic assisted surgery before implementation of program, all studies nurses had no prior experience about robotic surgery and unfamiliarity with new technology in OR.

On the other hand, the implementation of educational program had a positive effect on nurses' attitude as most of the studied nurses had positive attitude toward robotic surgery after implementing the educational program. This positive change in attitude demonstrates higher success to educational program, learning sessions that was done by the researcher and good knowledge post implementation program has positive effect on attitude.

These results were agreed with **Azhar et al., (2018); McBride et al., (2019); Stai et al., (2020); Barkati et al., (2023)** who found that most participants have a positive perception, positive view, and favorable attitude about RAS than negative, About half of the study participants reported a positive level of trust in the application of robotic-assisted surgery. **Sultan et al., (2022)** who performed study in Saudi Arabia titled "Medical Students' Attitude Towards Robotic Surgery: Cross-sectional Survey" enforce the present study results as they reported that Most participants exhibited positive attitude and optimistic expectations regarding this technology..This finding was agreed with **Uslu et al., (2019); Okgun Alcan et al. (2019)**, who revealed that nurses in Turkey have already experienced enhancement, a favorable and positive change in attitude and perception, expressed greater openness, positive view of nurses about robotic surgery. These outcomes were in agreement with **Darweesh et al., (2024)** who reported that most of surgeons at Ain Shams University Hospitals demonstrated exhibiting excellent practice and attitude about robotic surgery.

Also, these results were agreed with the study conducted in Korea by **Kang et al. (2016)** Who revealed that nurses practicing in robotic surgery settings, despite feeling burdened, reported satisfaction and a sense of pride in contributing to a technologically advanced surgical team.

Additionally, these results were supported by **Kang et al. (2016); Gudeloglu & Parekattil., (2021)** who showed that prior to the program about robotic surgery, more than two

thirds of the trainees reported feeling uneasy and discomfort when operating the surgical robot. After the program, all participants conveyed a sense of confidence and ease in dealing with the robotic system.

While these results were congruent with **Darwish et al., (2023)** who illustrated that the majority of studied nurses had moderate stress level and more than half of them burnout was moderate. **Chan et al., (2022)** who performed study titled "Awareness, perception, knowledge, and attitude toward robotic surgery in general surgical outpatient clinic in Singapore, Asia: Cross-sectional Study contradicted with the present study results as they reported that the majority of the participants showed poor acceptance and not prefer robotic surgery. Also, these outcomes contrasted with **Göransson et al., (2008)** who illustrated that the frequency of positive and negative attitudes, were similar toward using AI and robot technology in operating room.

Concerning the correlation between nurse's total knowledge and general attitude level towards robots. The study demonstrated a highly significant positive correlation between the total knowledge among nurses and their general attitude level regarding robotic assisted surgery pre, immediately post program. According to the researcher, this may be due to studies nurses who had high knowledge post implementation of educational program about RAS helped them to change their attitude from negative to positive. This finding was accepted with, **Thomas Porto & Catal., (2021)** who revealed that OR nurses who had received training and education before starting work with the robotic team were more familiar and more adapted than nurses not participated training with the difference being statistically significant $p < .001$. Also, this finding was declared with **Balázs Szabó et al., (2024)** who confirmed that there was a strong positive correlation between knowledge of surgical robots and attitude with ($p < 0.001$).

Concerning the Relation between sociodemographic characteristics and total knowledge; this study demonstrates that there was not statistically improvement relation regarding nurses' sociodemographic characteristics and their total knowledge. This outcome corresponds with **Balázs Szabó et al., (2024)** who confirmed that there was non-significant correlation between age and the score on the surgical robot knowledge questionnaire in the sample ($p = 0.184$).

Concerning the Relation between socio-demographic characteristics of the studied nurses and their general attitude score towards robots scale, this study demonstrates that there was not statistically significant relation regarding nurses' sociodemographic characteristics and their general attitude. This finding was disagreed with **Balázs Szabó et al., (2024)** who reported that there was statistically significant difference between gender and attitude of trust towards surgical robots as $p = 0.038$*.

Conclusion

Based on the findings of the current study, it can be concluded that

significant improvement in the total Level of knowledge and attitude to studies nurses after implementation the educational program.

Recommendations

It was recommended that training programs should be provided for all nurses about robotic assisted surgery. Further studies should be implemented on large sample size obtained from different hospitals in Egypt to evaluate effect of implementation nursing educational program regarding robotic surgery among patients undergoing surgery.

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