Effect of Training Program on Nursing staff Knowledge and Practices related to Post-Operative Delirium in Older Adults Patients

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Abstract

Background: Postoperative delirium is a fatal complication that occurs in older adults after surgery. It is prevalent in healthcare settings and is often under-recognized and misdiagnosed due to a lack of knowledge among healthcare providers. **Aim:** To evaluate the effect of the training program on nursing staff knowledge and practices regarding post-operative delirium among older adult patients. **Methods:** A quasi-experimental research design with one group pretest-posttest was employed. A purposive sample of 80 eligible nurses was recruited to participate in the study from the surgical and intensive care units affiliated to Mansoura University Hospital. The data pertinent to the study was collected using the Nurses' Demographic Characteristics and Work-Related Data questionnaire, the Delirium Knowledge Questionnaire, and the Delirium Observational Checklist. **Results:** The majority of the studied nurses had poor knowledge and practices related to postoperative delirium (81.3% and 100%, respectively). After implementing the training program, the studied nurses' total mean scores of knowledge improved from 14.48±2.94 to 27.28±4.94. Similarly, the nurses' total mean scores of practices increased from 28.18±3.90 to 63.32±6.23, with a statistically significant difference observed in overall mean scores of knowledge and practices (p<0.00) pre- and post-program. **Conclusion:** The proposed training program is an effective teaching approach that enhances nurses' knowledge and practices regarding postoperative delirium. **Recommendations:** An in-service educational program should be developed for nurses who care for elderly patients to improve their knowledge and skills regarding postoperative delirium. Nursing institutions should also emphasize the education of postoperative delirium and integrate it into the undergraduate nursing curriculum to raise nursing students' awareness regarding this serious complication.

Keywords: Nursing staff knowledge and practices; Older adults patients; Post-operative delirium (POD); Training program.

Introduction

Postoperative delirium (POD) is a life-threatening health problem and a highly prevalent complication affecting older adults who undergo surgery in clinical settings, with an incidence rate of approximately 5% to 52% among hospitalized surgical patients. This condition appears in the post-anesthesia care unit and may continue up to 30 days post-surgery. Delirium is a common health problem that can cause a significant burden not only on healthcare systems, increasing hospital stays and driving up healthcare expenditures, but also putting affected patients at risk, leading to cognitive impairment, a higher chance of developing dementia, and even death (**Mulkey, Olson, & Hardin, 2019; Mossie, Regasa, Neme, Awoke, Zemedkun, & Hailu, 2022**).

After a surgical procedure, a patient might undergo sudden mental confusion or neurological disturbances, referred to as postoperative delirium (POD). This is a clinical syndrome, rather than a disease or disorder, defined by the American Psychological Association (APA) as "a disturbance in a patient's attention and awareness that occurs in a short time, represents a sudden change from their usual level of awareness, fluctuates in severity throughout the day, and may develop into another cognitive disturbance." POD can present itself in different ways among different patients, with symptoms that include unexpected disorientation, memory problems, difficulties in concentration and thinking, sleep disturbances, mood swings, anxiety, depression, hallucinations, or seeing or hearing things that are not present (**Pereira & Lopes, 2018; Hayhurst, Alvis, & Girard, 2020**).

As a common complication that can occur after surgery, postoperative delirium (POD) can affect individuals of all ages. However, certain patient groups are more prone to POD due to complex combinations of risk factors (**Buchan et al., 2020**). These factors can be classified as pre-operative, intra-operative, and postoperative. Pre-operative factors include age over 65, male gender, impaired vision and hearing, co-morbid diseases, irregular electrolytes, alcohol abuse, smoking, anxiety, depression, and more. Intra-operative factors include shock, blood transfusion, dehydration, and certain types of operations like emergency, hip, cardiac, and vascular surgery. Postoperative factors include severe pain, sedatives, anti-cholinergic drugs, anesthesia, hepatic and renal failure, irregular sleep-wake cycles, and more. Identifying these risk factors can be crucial for the early diagnosis, prevention, and management of POD (**Ormseth, LaHue, Oldham, Josephson, Whitaker, & Douglas, 2023**).

Early diagnosis and management of POD can be challenging. Post-operative delirium (POD) can have a severe impact on health, leading to life-threatening negative outcomes. The longer the duration of delirium, the more severe it becomes. If left untreated or undiagnosed, POD can worsen memory and movement and even cause falls, which can result in additional hospital stays or the need for constant care. However, up to 40% of POD cases can be prevented, and the best way to

manage POD is by taking steps to prevent it from occurring in the first place. (**Hughes et al., 2020; Mulkey, Olson, & Hardin, 2019**).

Advanced screening, assessment, and management strategies should be integrated early in elderly preoperative care to prevent delirium and limit the long-term adverse effects that patients may experience after surgery. Effective interventions should include risk assessment, early diagnosis, and risk reduction.Risk assessment involves identifying patients who are at risk of developing delirium. Early diagnosis is essential to catching postoperative delirium quickly through the use of effective assessment tools and scales. Risk reduction can be achieved by incorporating targeted pharmacological and non-pharmacological interventions into the treatment plan (**Gracie, Caufield-Noll, Wang, & Sieber, 2021**; **Mossie, Regasa, Neme, Awoke, Zemedkun, & Hailu, 2022**).

Non-drug interventions have been proven to be effective in preventing POD and powerful tools in this fight. Advanced management strategies such as the Hospital Elder Life Program (HELP) and ABCDEF Bundle have shown promising results. The HELP preventive program for POD focuses on reassuring patients by regularly reorienting them to time, place, and identity; boosting socialization by encouraging interaction with family and staff; supporting daily routines by ensuring regular meals, proper hydration, and decreasing interruptions in the sleep-wake cycle; reducing sensory overload through managing noise; and

providing helpful devices such as glasses or hearing aids. Additionally, early mobility is encouraged by promoting physical activity (**Jin, Hu, & Ma, 2020; Deeken et al, 2022**).

Similarly, the ABCDEF bundle of care for postoperative delirium (POD), used in intensive care units, has demonstrated positive impacts on brain function outcomes. This bundle of care provides cognitively stimulating activities that can be summarized by the following letters: (A) assessing and ensuring adequate pain control; (B) regular breathing exercises and supplemental oxygen; (C) choosing light sedation and avoiding drugs that trigger delirium, such as anti-cholinergic and benzodiazepines; (D) conducting routine assessments for delirium and performing non-drug interventions; (E) initiating early mobilization activities and range-of-motion exercises; and (F) involving family in the care process. Recent research has showcased the success of these strategies, exhibiting a significant drop in POD cases among patients receiving these interventions daily (**Janjua, Spurling, & Arthur, 2018**).

Despite the significant efforts made by healthcare professionals across the globe to develop advanced management strategies for postoperative delirium (POD), recent evidence suggests that this condition is often underappreciated and unnoticed in clinical practice. This failure to recognize or adequately manage POD is partially attributable to a lack of knowledge and skills related to screening tools, delirium risk factors, clinical presentation, and proper management (**Mabrouk, Harfoush, Hatab, & El-Saied, 2022; Ghezeljeh, Muhaibes, Haghani, &**

Mubdir, 2023). As a result, healthcare providers, including nurses, may fail to recognize, diagnose, and manage POD effectively. Recent evidence also highlights that there is a high percentage (69%) of nurses who have insufficient knowledge about POD (**Van Velthuijsen, et al., 2018; Wingfield, 2020; Hoch, Bauer, Bizer, Arnold, & Benzinger, 2022**). The growing awareness of the seriousness of POD, coupled with the fact that it remains poorly diagnosed and clinically unrecognized, has resulted in the development of tools for early detection, standard guidelines, and programs targeting different clinical settings such as intensive care units, emergency rooms, and surgical wards and intended for different healthcare providers, including physicians and nurses (**Helfand et al., 2021**).

Nurses play a pivotal role in clinical settings, providing direct care in a timely manner for patients undergoing surgery, enabling them to detect postoperative delirium at early stages, monitoring those at high risk, evaluating any changes in the patient's condition, and providing preventive measures. It's worth mentioning that therapeutic interventions may have little effect if delirium has already developed, but preventive interventions can reduce the prevalence, disease duration, and functional impairment. Therefore, early detection of POD is crucial in clinical settings (**Bozkul, Arslan, & Çelik, 2023).**

Empowering nurses' knowledge and practical skills regarding pre-operative and post-operative care for elderly patients, as well as increasing their awareness of the unique characteristics of aged populations in the operating room, can lead to better patient outcomes and prevent complications after surgery. Thenceforward, educational programs that provide nurses with knowledge and practices concerning POD screening tools, risk factors, prevention, and advanced management can also facilitate early detection and appropriate management, ultimately improving patient outcomes (**Piyawattanapong, Leethong-in, Thiengtham, Sommongkol, Phetcharat, & Kaewkot, 2019; Amsalu, Messele, and Adane, 2021**).

First and foremost, recent studies reported that nursing staff have an education, knowledge, and practice gap regarding "consensus definition, causes, risk factors, clinical presentation, diagnosis, case identification, prevention, and treatment of POD," and a lack of consensus around best practices concerning the management of delirium by nursing staff has been identified as contributing factors to under-assessment and potentially inappropriate management, which presents challenges to health care settings (**Ewens, Seaman, Whitehead, Towell-Barnard, &Young, 2021; Docherty, 2022**).

In recognition of the importance of education on nurses' knowledge and practice regarding POD and in response to the "National Institute on Aging's" call to form collaborative networks to advance delirium research (**Oh et al., 2020**), we decided to

design a training program regarding postoperative delirium among older adults and evaluate its effect on nurses' knowledge and clinical practices.

Significance of the study

Post-operative delirium (POD) is the most prevalent acute cognitive dysfunction in older adults who undergo surgery. It can be life-threatening and often goes unnoticed and unrecognized by medical professionals. It is confused with other syndromes, leading to morbidity and mortality and adding to the economic burden on healthcare institutions. However, evidence-based nursing interventions have been shown to reduce the incidence and severity of POD. Unfortunately, most nurses working in surgical and ICU units lack knowledge about delirium screening tools, risk factors, and interventions. This lack of knowledge is a significant factor contributing to the under-recognition of POD and its devastating effects on patients (**Iglseder, Frühwald,& Jagsch, 2022; Ghezeljeh, Muhaibes, Haghani, & Mubdir, 2023**).

Aim of the study

The current study aimed to evaluate the effect of the training program on nursing staff knowledge and practices regarding postoperative delirium among older adult patients. Research hypotheses:

H1: Nurses who participated in the training program will exhibit higher knowledge scores related to postoperative delirium compared to their pre-training knowledge scores.

H2: Nurses who participated in the training program will exhibit higher practice scores related to postoperative delirium compared to their pre-training practice scores.

Subjects and methods

Research design

A quasi-experimental research design utilizing a one-group pretest-posttest approach was employed to evaluate the effectiveness of the training program on nurses' knowledge and practices.

Study setting

This study was conducted in the surgical departments and intensive care units (ICU) affiliated with Mansoura Main University Hospital, a teaching hospital located in Egypt.

Subjects

A purposive sample of 80 eligible nurses was recruited from the aforementioned setting to participate in the current study based on the following criteria:

Participants' inclusion criteria

All nurses who provided direct preoperative and postoperative care for patients undergoing surgery, who provided intensive or critical care for patients post-surgery, and nurses who agreed to participate in the study with varying ages, genders, years of experience, and levels of education were eligible for participation.

Participants' exclusion criteria:

Nurses who were unwilling to participate or complete the study were excluded.

Sample size

The sample size for this study was calculated using research software (https://clincalc.com). Based on the results of a similar previous study done by **Mabrouk, Harfoush, Hatab, & El-Saied, (2022)**, who found a significant improvement in total nurses' knowledge from 6.7% before

the study to 90.0% after the study. The final sample size required for the current study was calculated to be 81 nurses, with a Power (1-β error probability) of 0.80 and α error probability of 0.05.

$$N = \frac{p_0 q_0 \left\{ z_{1-\alpha/2} + z_{1-\beta} \sqrt{\frac{p_1 q_1}{p_0 q_0}} \right\}^2}{(p_1 - p_0)^2}$$

$$q_0 = 1 - p_0$$
$$q_1 = 1 - p_1$$

$$N = \frac{0.098 * 0.902 \left\{ 1.96 + 0.84 \sqrt{\frac{0.2*0.8}{0.098*0.902}} \right\}^2}{(0.2 - 0.098)^2}$$

$$N = 81$$

Where p_0 = proportion (incidence) of population, p_1 = proportion (incidence) of study group, N = sample size for study group, α = probability of type I error (usually 0.05), β = probability of type II error (usually 0.2), and z = critical Z value for a given α or β.

Tools of data collection

A structured self-administered questionnaire was used to evaluate demographic characteristics, and work related data, delirium-related knowledge and practices of the nurses under study. using the following tools:

Tool I: Participants' Demographic Characteristics and Work Related Data:

This tool was developed by the researcher after reviewing relevant literature (**Mabrouk, Harfoush, Hatab, & El-Saied, 2022; Deeken et al., 2022**). The tool includes information on nurses' age, sex, level of education, years of experience, place of work, working hours per day, and previous training related to postoperative delirium (POD).

Tool II: Delirium Knowledge Questionnaire

This tool was developed by Har et al. (2008). It is used to evaluate nurses' knowledge about delirium. This tool consists of 35 items that cover three main domains:

1st domain: It is composed of 10 closed-ended questions to assess nurses' knowledge about the clinical presentation, symptoms, and outcomes of delirium.

2nd domain: It combined 11 closed-ended questions to elicit nurses' knowledge about the causes and risk factors of delirium.

3rd domain: It consisted of 14 closed-ended questions to assess nurses' knowledge about delirium prevention and management strategies.

The scoring system for this tool was calculated as follows: the researchers prepared key answers and recorded the answers of the studied nurses. Each correct answer was scored one point, while an unknown, incorrect, or missed answer was given zero points. The scores for each question were added up to get the total score for the nurse's knowledge. The total scores ranged from 0 to 35 and were transformed into a percentage out of 100%. The scores were then classified into poor knowledge (0-10) (≥30%), moderate knowledge (11-21) (31-60%), and good knowledge (22-35) (> 60)**.**

Tool III: Delirium Observational Checklist:

The researchers developed this observational checklist based on recent relative literature (**Abdullah, Darweesh,& Mohammed, 2020; Jeong, & Chang, 2022; Alhalaiqa, Masa'Deh, Al Omari, Shawashreh, Khalifeh, & Gray, 2023; Bozkul, Arslan, & Çelik, 2023**) to evaluate nurses' skills and practices when providing postoperative care for

elderly patients in surgical unit and intensive care unit to prevent and manage POD. It was used as a monitoring and evaluative tool for the nurse's practice pre-and post-training. It consisted of 80 steps covering eight well-defined main practice domains including; assessment methods for POD; fluid and electrolytes balance; circulation and oxygenation; nutritional support; effective communication; sensation and pain management; skin care and patient safety; and sleep pattern.

The scoring system used in the checklist was based on a 2-point Likert scale, ranging from '0' to '1'. A score of '0' indicates that the skill was not properly done or not done at all, while a score of '1' reflects that the skill was executed correctly. To get the total score for a nurse's practice, the scores obtained for each skill were added up. The total score for the nurse's practice was 80. All scores were then converted into percentages (100%) and classified into three categories: scores below 60% were considered "poor practices", scores between 60% and 75% were considered "fair practices", and scores above 75% were considered "good practices".

Validity of the study tools
The study tools underwent a rigorous evaluation by seven experts from the fields of Medical-Surgical Nursing, Critical Care Nursing, and Gerontological Nursing to test face and content validity. This was done to ensure that the tools were clear, relevant, applicable, and comprehensive. The researchers made the recommended modifications based on the feedback received from the

experts. Furthermore, the final English version of the tools was translated into Arabic, which is the native language of the study participants.

Reliability of the tool
The internal consistency of the study tools was tested using Cronbach's alpha for tool II (r=0.86), and tool II (r=0.82), indicating good consistency of the designed tools.

A pilot study
A preliminary study was conducted on 10% of the overall sample size, which included (8 nurses), to evaluate the clarity, feasibility, and effectiveness of the study tool, besides estimating the time needed to fill out the questionnaire. Necessary modifications were made based on the feedback obtained from the participants before data collection. It is worth noting that the nurses who participated in the pilot study were excluded from the total sample of the study.

Fieldwork for data collection
The data collection process took four months, from the end of July 2023 until the end of November 2023. Data was collected according to the predetermined working schedule of the studied nurses. The framework of this study follows the phases of the nursing process, as follows:

1) Assessment phase
- after obtaining necessary approval from the Ethical Committee of the Faculty of Nursing and the director of the Main Mansoura University, the researchers proceeded to interview the nurses who agreed to participate in the study. These interviews were conducted in the teaching room at the surgical and ICU units, where the researchers explained the research

objectives and potential benefits of the current study to nurses.

- Confidentiality was ensured by the researchers, who confirmed that the data would be used only for for scientific research purposes. Oral and written consent was obtained from each nurse who agreed to participate in the study.

- The first phase of assessment was carried out before applying the proposed training program. This was done to obtain baseline data about nurses' demographic and work-related data, as well as their knowledge and practice level regarding POD (pre-test).

- The questionnaires were distributed to the participants, and they were requested to answer each question (using Tool I and II). It took around 20-30 minutes to fill out the questionnaire. In addition, the researchers observed the nurses' practice before implementing the training as a practice pretest using the observation checklist (Tool III). The observation time for each nurse was around 30 minutes.

1) Planning phase

- During the planning phase of the training program, the researchers developed the goal, objectives, content, teaching methods, and media. The main goal of the program is to empower nurses who care for older hospitalized patients with the knowledge and necessary skills to recognize and manage postoperative delirium (POD).

- The researchers designed the proposed postoperative delirium training program based on the findings of preliminary assessment data (pre-test), knowledge gap, and recent literature review (**Jeong & Chang, 2022; Mabrouk, Harfoush, Hatab, & El-Saied, 2022; Alhalaiqa, Masa'Deh, Al Omari, Shawashreh, Khalifeh, & Gray, 2023; Bozkul, Arslan, & Çelik, 2023**).

- The program consists of two parts; an educational part and a training part. The educational part includes general knowledge about POD, screening methods, early prevention, and management. The training part includes basic nurses skills that are provided for elderly patients postoperative to prevent and manage POD, such as assessment methods, fluid and electrolyte balance, etc.

- The researchers prepared an educational material (booklet) in a simple Arabic form with large-sized fonts and colored images to be distributed to the studied nurses in the implementation phase.

2) Implementation phase:

- The proposed training program was conducted in a group basis over a period of two weeks, with two sessions per week. The program consisted of four consecutive sessions (two educational and two practical), each session took 60 minutes.

- The program's 1st educational session covered the following; the purpose of the research study, and prevalence, impact, definition, causes, risk factors, clinical presentation, symptoms, and outcomes of POD.

- The 2nd educational session discussed assessment methods, preventive measures, and management strategies.

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- The 1st practical session, the researcher directly observed the nurses demonstrated skills regarding

steps of POD assessment, fluid and electrolytes measurement, circulation and oxygenation management, and ways of nutritional support.

- The 2nd practical session, the researcher directly observed the nurses demonstrated skills regarding steps of communication with postoperative patients, sensation and pain control, skin care, and sleep hygiene.

- Teaching methods employed during the program included integrated lectures, role-playing, group discussions, and real-life demonstrations and return demonstrations. Teaching materials included PowerPoint presentations, illustrated pictures, videos, and a burn rehabilitation booklet (handout).

3) Evaluation phase

The post-test evaluation was conducted for all the nurses who underwent the training program. Tools II and III were used to evaluate their responses to the training program and evaluate the improvement in their knowledge and practices related to postoperative delirium.

Ethical consideration

Written approval was obtained from the Ethics and Research Committee of the Faculty of Nursing, Mansoura University, Egypt (Ref. No. P. 0508). Every involved nurse provided informed written consent after receiving a clear understanding of the study's purpose and nature. The study researchers ensured the nurse's privacy, data confidentiality, and the right to withdraw at any time without any consequences.

Statistical analysis

Data were analyzed using SPSS version 24. The 0.05 and 0.01 levels were used as the cut-off value for statistical significance and the following statistical measures were used; Association between categorical variables was tested using the Chi-square test. When more than 25% of the cells have an expected count of less than 5, Fisher's exact test was used. Continuous variables were presented as mean ± SD (standard deviation) for parametric data. The two groups were compared with the Student t-test. Pearson's test is used to test the correlation between continuous parametric data while the Spearman correlation coefficient is used to test the correlation between continuous non-parametric data.

Results

Table (1): Displays percentage distribution of the studied nurses according to their demographic characteristics and work-related data: As shown, the majority of the studied nurses were females aged less than 30 years with a mean age of 28.53±5.8years. Concerning nurses' level of education and working place, 52.5% of them had bachelor's degrees in nursing and 71.3% of them worked in intensive care units. As for work experiences, 53.8% of the studied nurses had more than 5 years of experience in the nursing field. Additionally, none of them had received any previous training regarding postoperative delirium.

Table 2: Shows comparison between the mean scores of delirium related knowledge among the studied nurses pre and post implementing of the training program: As presented, pre-implementing the training program the studied nurses' total mean scores of delirium-related

knowledge was 14.48±2.94 and improved to 27.28±4.94 post-program implementation with a statistically significant difference between total knowledge mean scores pre- and post-program implementation (p=0.000). As for delirium-related knowledge domains, a statistically significant difference was found in the prevention and management strategies domain (p=0.000) followed by causes and risk factors of the delirium domain (p=0.000), and presentation, symptoms, and outcomes (p=0.000) pre and post implementing the training program.

Table 3: Displays comparison between the mean scores of delirium related practices among the studied nurses pre and post implementing of the training program: As shown, the studied nurses' total mean scores of delirium-related practices were 28.18±3.90 pre-implementing the training program, while post-training program their total mean scores of practice increased to 63.32±6.23 with a statistically significant improvement (p=0.000). As for delirium-related practices domains, a statistically significant difference was found in the fluid and electrolytes balance domain (p=0.000) followed by the circulation and oxygenation domain (p=0.000), assessment of delirium (p=0.000), skincare and safety domain (p=0.000), effective communication domain (p=0.000), and nutritional support domain (p=0.000) pre and post-implementing the training program.

Table 4: Shows comparison between the studied nurses regarding their level of knowledge and practices pre and post implementing of the training program: As illustrated, the majority of the studied nurses (81.3%) had poor knowledge regarding postoperative delirium before applying for the training program, while after program implementation the majority of the studied nurses (83.8%) had a good level of knowledge. Additionally, all studied nurses (100%) had a poor level of practice regarding postoperative delirium before the implementation of the training program, while after program implementation the majority of the studied nurses (86.3%) had a fair level of practice.

Table 5: Displays correlation between the studied nurses' knowledge and practices regarding postoperative delirium pre and post implementing the training program: As, illustrated, a statistically significant positive relation was found between total scores of knowledge and total scores of practices pre implementing the training program (Pearson p=0.002, Spearman's p= 0.007, respectively), and post implementing program (Pearson: p=0.000, Spearman's p= 0.000, respectively).

Table 6: Displays correlation between demographic characteristics and work related data of the studied nurses and their knowledge and practices level regarding postoperative delirium post implementing of the training program: As clarified, a statistically significant improvement in delirium-related knowledge scores after implementation of the proposed program was observed among studied nurses who are females, aged more than 30 yrs., and have bachelor education (p= 0.000, p= 0.052, p=

0.000 respectively). Moreover, a statistically significant improvement in delirium-related practice scores after implementation of the proposed program was noticed among studied nurses who were working in the intensive care unit and worked more than 8 hrs per day (p=0.000, p=0.000, respectively).

Table (1): Percentage distribution of the studied nurses according to their demographic characteristics and work related data (N= 80)

Items	N	%
Age (in year):		
Less than 30	60	75.0
More than 30	20	25.0
(Mean±SD) =		= 28.53±5.8
Sex:		
Males	6	7.5
Females	74	92.5
Marital status:		
Single	18	21.3
Married	62	77.5
Level of education:		
Nursing technical diploma	38	47.5
Bachelor in Nursing	42	52.5
Working place:		
Intensive care unit	57	71.3
Surgical unit	23	28.8
Working hrs /day		
6-8hrs	31	38.8
More than 8hrs	49	61.3
Years of experience in nursing field:		
Less than 5 years	37	46.3
More than 5 years	43	53.8
Previous postoperative delirium training for older patients :		
No	80	100
Yes	0	0

*Significant, at $P \leq 0.05$, using Chi-Square (X^2).

Table 2: Comparison between the mean scores of delirium related knowledge among the studied nurses pre and post implementing of the training program

Delirium related Knowledge	Pre-program implementation	post-program implementation	Significance
Clinical presentation, symptoms, and outcomes of POD (10 Q)	3.97±1.22	8.25±1.47	t-20.762, p= 0.000
Causes and risk factors of POD (11Q)	5.06±1.32	8.88±1.72	t=-16.905, p= 0.000
Prevention and management strategies of POD(14Q)	5.45±1.68	10.15±2.14	t= -15.778, p=0.000
Total knowledge means score (35Q)	**14.48±2.94**	**27.28±4.94**	**t=-21.652, p=0.000**

Table 3: Comparison between the mean scores of delirium related practices among the studied nurses pre and post implementing of the training program

Delirium related practices	Pre-program implementation	Post-program implementation	Significance
Assessment of delirium (10 Q)	4.75±0.91	8.05±0.80	t= -29.097, p=0.000
Fluid and electrolytes balance (10 Q)	3.51±1.10	8.45±1.14	t= -29.530, p=0.000
Circulation and oxygenation (10 Q)	3.91±0.94	8.15±1.38	t= -26.759, p=0.000
Nutritional support (10 Q)	4.02±0.94	7.7±0.87	t= -26.284, p=0.000
Effective communication (10 Q)	3.68±0.95	7.78±1.08	t= -29.854, p=0.000
Sensation and pain management (10Q)	3.07±0.82	7.65±0.85	t= -38.871, p=0.000
Skin care and safety (10 Q)	2.93±0.60	7.80±1.02	t= -37.285, p=0.000
Sleep pattern (10 Q)	2.96±0.66	7.73±1.13	t= -32.088, p=0.000
Total practices mean score (80Q)	**28.18±3.90**	**63.32±6.23**	**t= -55.963, p=0.000**

Table 4: Comparison between the studied nurses regarding their levels of knowledge and practices pre and post implementing of the training program

Program phase	Items	Poor level		Moderate/Fair level		Good level	
		N	%	N	%	N	%
Pre-training program	Total knowledge level	65	**81.3**	15	18.8	0	0.0
Post-training program	Total knowledge level	0	0.0	13	16.3	67	**83.8**
Pre-training program	Total practices level	80	**100**	0	0.0	0	0.0
Post-training program	Total practices level	10	12.5	69	**86.3**	1	1.3

Table 5: Correlation between the studied nurses' knowledge and practices regarding postoperative delirium pre and post implementing the training program

Program phase	Items	Nurses practices Pre-training program	Nurse practices Post-training program
Pre-training program	Nurses knowledge	Pearson correlation r=0.334 ** P=0.002 Spearman's rho r= 0.300** P=0.007	
Post-training program	Nurses knowledge		Pearson correlation r=0.461** P=0.000 Spearman's rho r= 0.416** P=0.000

* Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

Table 6: Correlation between demographic characteristics and work related data of the studied nurses and their knowledge and practices level regarding postoperative delirium post implementing of the training program

Items	N	Delirium related Knowledge (post-test)						Chi square	Delirium related practices (post-test)						Chi square
		Poor		Moderate		Good			Poor		Fair		Good		
		N	%	N	%	N	%		N	%	N	%	N	%	
Age in years															
< 30 yrs.	60	0	0.0	7	11.7	53	88.3	**0.052***	8	13.3	52	86.7	0	0.0	0.208
≥30 yrs.	20	0	0.0	6	30.0	14	70.0		2	10.0	17	85.0	1	5.0	
Sex															
Male	6	0	0.0	0	0.0	6	9.0	**0.0.00***	2	33.3	4	66.7	0	0.0	0.270
Female	74	0	0.0	13	17.6	61	91.0		8	10.8	65	87.8	1	1.4	
level of education															
Technical diploma	38	0	0.0	13	34.2	25	65.8	**0.000***	6	15.8	31	81.6	1	2.6	0.384
Bachelor	42	0	0.0	0	0.0	42	100		4	9.5	38	90.5	0	0.0	
Type of the unit															
Intensive care unit	57	0	0.0	8	14.0	49	86.0	0.297	1	1.8	55	96.5	1	1.8	**0.000***
Surgical unit	23	0	0.0	5	21.7	18	78.3		9	39.1	14	60.9	0	0.0	
Total work/ hrs															
6-8hrs	31	0	0.0	6	19.4	25	80.6	0.382	10	32.3	21	67.7	0	0.0	**0.000***
More than 8hrs	49	0	0.0	7	14.3	42	85.7		0	0.0	48	98.0	1	2.0	
Years of experience in nursing field:															
< 5 years	37	0	0.0	8	21.6	29	78.4	0.183	5	13.5	32	86.5	0	0.0	0.632
≥ 5 years	43	0	0.0	5	11.6	38	88.4		5	11.6	37	86.0	1	2.3	

Discussion

Post-operative delirium is a common complication among elderly patients who undergo surgical procedures. It is associated with negative health outcomes and has a high mortality rate. Despite global efforts to detect and prevent it early, healthcare professionals often fail to recognize, misdiagnose, and leave it untreated. This is mainly due to a lack of education and knowledge among healthcare providers. Consequently, POD is underestimated and mistreated in various healthcare settings, leading to its high prevalence (**Hughes et al., 2020**).

In light of this context, there is an urgent requirement for education and in-service training programs for healthcare professionals regarding postoperative delirium. Such programs can help in better understanding the condition, leading to earlier identification, reduction of preventable risk factors, and better use of evidence-based interventions for managing delirium in the acute phase. This, in turn, can improve patient outcomes, reduce healthcare burden, and enhance the quality of nursing care (**Igwe, et al , 2023**).

Given the value of the critical role of nurses' knowledge and practice in delirium prevention and management, and belief in the importance of continued education in improving nurses' perception, awareness, and recognition of the magnitude of this complication. Therefore, the current study aimed to evaluate the effect of the training program on nursing staff knowledge and practices regarding

postoperative delirium among older adult patients.

By looking at the basic demographic characteristics and work-related data of the nurses under the study, the current study results showed that the majority of them were young adult females under 30 years of age, had a higher degree of education (Bachelor's degree), and had worked for more than 5 years in caring for patients in surgical and intensive care units. These characteristics finding may be explained by the fact that, in Egyptian society, women are more likely than men to pursue nursing careers, and young nurses are more likely to provide direct patient care. Additionally, highly educated nurses are often assigned to intensive care units. These findings are consistent with earlier studies in Saudi Arabia by **Aldawood et al. (2023)**, in India by **Grover et al. (2022)** and **Biyabanaki et al. (2020)**, and in Yemen by **Abdullah et al. (2020)**, which reported that the majority of nurses were females under the age of 30, had higher education, and had worked for more than 5 years.

When it comes to in-service training regarding postoperative delirium, the present study findings revealed that none of the participants had received any previous training on POD. This lack of training can be attributed to a lack of awareness of the severity of the problem. As a result, education and training related to POD are often neglected in hospitals. This viewpoint is further supported by a study conducted in Egypt by **Mabrouk, Harfoush, Hatab & El-Saied (2022)**, which confirms that training for nurses on

postoperative delirium is often neglected in hospitals.

Lack of postoperative delirium knowledge is predominant among the studied nurses according to the current study results estimates. Before applying to the training program the majority of the studied nurses had poor knowledge. This lack of knowledge can be attributed to the absence of in-service education and training opportunities. These findings are consistent with previous studies conducted by **Ismail (2021) and Abdullah, Darweesh & Mohammed (2020)**, which also found that most nurses had a poor understanding of delirium.

Regarding the effect of the training program on nurses' knowledge, the main findings showed that the total knowledge scores of the participating nurses had significantly improved from poor to good after the implementation of the proposed training program. The difference between the knowledge scores before and after the program was statistically significant, which indicates that the training program is effective in increasing nurses' knowledge levels. The study proves that continued education is an empowering tool that can help identify knowledge gaps in healthcare settings and enable a better understanding of current health issues. Similar results were found in other studies conducted in Saudi Arabia by **Aldawood et al. (2023)**, in Egypt by **Mabrouk et al. (2022)**, in Korea by **Jeong & Chang (2022)**, in North Carolina by **Docherty, (2022)**, in Turkey by **Yıldırım et al. (2022)**, and in Australia by **Ho et al. (2021)**. These studies also found that there was a significant improvement in nurses' overall knowledge regarding delirium after they participated in educational programs.

In addressing the relationship between the studied nurses' characteristics and their ability to acquire knowledge, the study findings revealed that the knowledge level of participants after the program significantly differed based on their age, sex, and level of education. This can be justified as the majority of the nurses were young, highly educated females, which enhances their ability to comprehend, concentrate, and remember information better than others. Similarly, a study conducted in Egypt by **Mabrouk et al. (2022)** and another in **China by Zhou et al. (2023)** also found a statistically significant relationship between nurses' knowledge post-program and their educational level. However, a study conducted in Saudi Arabia by **Aldawood et al. (2023)** found no statistically significant difference between knowledge and nurses' demographic characteristics including age, sex, and education which may be due to different participants characteristics.

The current study findings reveal that poor practices related to POD are prevalent among the studied nurses. The majority of the studied nurses showed poor practices before undergoing the training program. This could be attributed to the limited scope of practices, workload, lack of organizational support for continued learning on POD, and absence of delirium identification training during their basic nursing education. Moreover, nursing practices largely relied on established traditions and apprenticeship models, adhering to existing practices. This finding of the

present study is consistent with previous research from different parts of the world, including studies done in India by **Grover et al. in 2022**, Yemen by **Abdullah et al. in 2020**, and Philadelphia by **Clyne in 2019**, all of which found that the majority of the studied nurses had poor practices related to POD.

Regarding the impact of the training program on nurses' practices, the main results indicate that the total practice scores of the studied nurses concerning Postoperative Delirium (POD) significantly improved after the implementation of the proposed training program when compared to their pre-training practices. The difference between the practice scores before and after the program was statistically significant. This is consistent with the findings of similar studies conducted in Uganda by **Murungi et al. in 2023**, in Jordan by **Alhalaiqa et al. in 2023**, and in Korea by **Jeong & Chang in 2022**, which also reported improved nurses' practices after educational programs. These findings suggest that the training program that covers the knowledge gap related to assessment, prevention, and treatment for POD can provide nurses with essential skills to competently care for older adults and increase their awareness of avoidable complications.

The evidence-based educational program has been successful in bringing positive changes in clinical practice (Van Velthuijsen, et al., 2018). Our study findings confirm this evidence as well. The current research shows that there is a positive correlation between the knowledge and practices of nurses before and after the program. The researchers declare that the strong correlation between nurses' knowledge and their ability to develop new skills and put them into practice based on that good practice is the result of theoretical understanding. Additionally, connecting the traditional practices with relevant scientific knowledge on geriatric patients post-operatively could enhance overall effectiveness, equipping nurses with a deeper understanding, which in turn fosters their level of practice. This point of view is supported by relevant studies (**Alhalaiqa, et al, 2023; Bozkul, Arslan, & Çelik, 2023**). However, the study done by **Abdullah et al., 2020**, showed that there is a negative and non-significant correlation between the total nurse`s knowledge score and their total practice score regarding care for patients with delirium. Such discrepancies may arise due to mismatching between educational and practical content.

Finally, the current study findings proved that the proposed training program was successful and effective in raising nurses' awareness and recognition of post-operative delirium and enhancing their knowledge and practices in this area which was supported by recent and relevant studies as discussed in the previously-mentioning sections.

Conclusion

Based on the findings of the current study, it can be concluded that the proposed training program regarding postoperative delirium is a successful and effective teaching approach that should be applied as a standardized teaching resource and routinely used in caring for older adult patients who are at risk for developing delirium after surgery. This is based on the noticeable

significant improvements in the studied nurses' knowledge and practices after the application of the training program, which emphasized the importance of ongoing education and training in empowering the nurses' knowledge and skills and improving the quality of health care.

Recommendations

On the light of the current study findings, the following recommendations are suggested:

- In-service education and training programs are recommended for nurses who care for older patients to improve their awareness, knowledge, and practices regarding effective approaches for early detection, prevention, and management of postoperative delirium.

- Incorporating delirium screening and assessment tools into routine nursing care for older adults undergoing surgery for early detection and prevention of this complication.

- Continuous support and motivation of the gerontological nurse are needed for surgical elderly patients to guarantee their permanent incorporation of delirium prevention regimens into a daily routine.

- Directors of surgical and intensive care units should use and apply postoperative delirium educational materials (posters and brochures) to meet nurses' continuing education needs for the best outcomes.

- Educational nursing institutions should put sufficient emphasis on the education of postoperative delirium and integrate it into the undergraduate nursing curriculum to raise nurses' awareness of this serious complication

- Further research using a longer follow-up period and large sample size from different healthcare settings is needed to explore the long-term effects of training programs on nurses' knowledge and practice and help in the generalization of the study results.

- Future studies should be conducted to evaluate the effect of nurses' education on the prevalence of postoperative delirium among elderly patients.

- Distribute a developed structured teaching program booklet to most of the nurses in different settings to enhance their knowledge about geriatric patients' delirium care and their concerns.

Limitations

The current study was conducted at a single hospital in Mansoura University with a relatively small number of nurses, so the study findings can't be generalized.

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