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Effect Of An Educational Program On Nurses' Knowledge And Practice Regarding Care Of Central Venous Line In Intensive Care Unit

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Abstract

Background: *Improving nurses' expertise and practice via specialized educational programs is essential for the safe and successful management of Central Venous Lines. Such measures can markedly diminish problems and enhance patient outcomes in critical care environments. The study examined how an educational program affected nurses' central venous line care knowledge and behaviors.*

Subjects and method: *The research design employed in this investigation was quasi-experimental. An intensive care unit was utilized in the research at Port Said general hospital, Central EL-Zohour hospital, and Port Fouad hospital, all of which are affiliated with the Egypt Health Care Authority in the Port Said Governorate of Egypt. Samples of 65 nurses that are highly convenient.* ***Tools:*** *Data was collected using two instruments. Tool 1: Questionnaire evaluation sheet with the relevant sections: Nurses' demographic information, nurses' understanding of central lines, nurses' awareness of bloodstream infections (BSI), and nurses' comprehension of care components. Instrument 2: An Observational Checklist for Nursing Practices.*

Results: *According to the findings of the study, the total mean scores of nurses' knowledge and practice levels increased to a level that was highly statistically significant after the training program was implemented and then evaluated. There was found to be a significant correlation among the levels of knowledge that nurses possessed and their demographic information, as well as between the levels of practice that nurses had and their demographic information. After the educational program was implemented, knowledge and practice results correlated positively.*

Conclusion: *This study found that most critical care nurses' central venous line administration knowledge and practice improved following the instruction session.*

Recommendations: *Establishment of ongoing educational initiatives for ICU nurses about central venous line management to sustain and improve their expertise and practice, including evidence-based methods into hospital standards and guaranteeing compliance through consistent oversight.*

Keywords: *Educational Program, Nurses', Knowledge, Practice, Central Venous Line, Intensive Care Unit*

INTRODUCTION

Nurses are primary caretakers tasked with assessing insertion sites, changing dressings, maintaining lines, and monitoring for problems associated with central venous lines (CVLs). Their everyday procedures directly affect the safety and results for patients with central lines. Evidence indicates that improper handling, inadequate aseptic methods, and insufficient current understanding substantially contribute to infections associated with central venous lines, particularly central line-associated bloodstream infections (CLABSIs) (Timsit et al., 2022). Therefore, providing nurses with the appropriate skills and awareness is essential for proficient central venous line maintenance.

In contemporary medicine, central venous lines are crucial for administering several substances, including fluids, blood products, medicines, parenteral nutrition, and hemodynamic monitoring, particularly in critically sick patients. Although central venous lines offer therapeutic benefits, they pose significant risks, including bloodstream infections, thrombosis, and catheter malfunction.These problems not only augment morbidity and death but also result in extended hospitalizations and increased healthcare expenditures (O'Grady et al., 2023).

Despite established procedures and guidelines from organizations such as the Centers for Disease Control and Prevention (CDC, 2023), research indicates a discrepancy between recommended practices for

central venous line management and actual nurse performance. This gap frequently arises from insufficient training or obsolete information. Consequently, organized educational initiatives are essential to inform nurses on evidence-based guidelines and standardized infection control protocols (Marschall et al., 2023).

Multiple studies have shown that well-structured teaching programs markedly enhance nurses' understanding and compliance with optimal procedures for central venous line management. These programs often encompass theoretical instruction, practical training, and performance evaluations. They enhance patient safety results, decrease infection rates, and bolster nurse confidence and competency (Aloush & Alsaraireh, 2022). Education not only augments information but also results in enhanced clinical conduct.

It is critical to bridge the gap between classroom learning and real-world experience in nursing programs.The primary objective is information acquisition, but the ultimate purpose is to achieve behavioral change and therapeutic competence. Educational programs that integrate adult learning concepts, simulation-based training, and consistent evaluation often result in enhanced retention and application of skills in clinical environments (Gorski et al., 2023). This underscores the need of ongoing professional development and practical learning in enhancing central venous line care procedures. This study examines the effect of a teaching program on nurses' understanding of central venous line management, taking into account the gravity of CVC-related complications and the pivotal role nurses play in preventing them.The project aims to determine the efficacy of structured training in enhancing nursing performance and thereby decreasing the incidence of CLABSI by assessing pre- and post-intervention results. To improve patient safety and care quality, the findings may guide future policy and educational measures.

The availability of guidelines and training opportunities, several barriers can hinder the proper implementation of best practices in central venous line care. These barriers include high patient-nurse ratios, lack of resources, time constraints, and variability in institutional policies. Moreover, nurses may experience knowledge decay over time without periodic refresher courses, especially in high-turnover settings like intensive care units (Zingg et al., 2022).

Research Hypothesis

For the purpose of achieving the goal of the study, the following research hypothesis was developed:

- The introduction of a program that educates nurses about CLABSI will result in an increase in their level of understanding.
- The establishment of an educational program that is pertinent to CLABSI will be the means by which the field of nursing will be improved.

METHODS

The study used a quasi-experimental one-group pre- and post-test design. June 3–December 3, 2023, was the study's data collection period.. The program required three months to be implemented, one month for the immediate post-test, and one month for the follow-up. Therefore, the pre-test required approximately one month. The investigation was done in the ICU of the port Said general hospital, the Central EL-Zohour hospital, and the Port Fouad hospital, all of which are affiliated with the Ministry of Health. A. The convenient sample was employed to conduct this study, which included all available nurses (65) in the aforementioned contexts.

Tools:

Tools for the collecting of data: It included two tools:

TOOL (I): Questionnaire assessment sheet:

The researcher derived the content of the questionnaire from relevant literature. The following were among its four primary components:

Part I: Nurses Demographic Data:

The research asked nurses eight demographic questions, including age, gender, credentials, years of practice, and infection control besides CLABSI prevention training.

Part (II): Nurses' Understanding of Central Line Management

The test tested nurses' central line skills. Based on the CDC's CVC-RI central venous catheter-related infection prevention guidelines (O'Grady et al., 2011), the 13 questions included catheter insertion location, central line indications, problems, and classifications.

Part (III): Knowledge of Nurses Concerning Blood Stream Infection (BSI).

The standard for preventing infections associated with intravascular catheters was used for its adaptation (CDC, 2012). Included in the fifteen questions were topics such as the following: the origin of the infection, the reasons for hospital-acquired infections, and the microorganisms associated with bloodstream infections, the symptoms and indicators of bloodstream infections, risk factors for bloodstream infections.

Part (IV): Nurses' Knowledge Regarding Components of Care:

It consisted of 49 questions and was used to test nurses' understanding of CLABSI care components (Kadium, 2015). This part was divided into sex small parts. Part one about central line change and change of administration set and consists of 14 questions. Part two asked about dressing change regimen and consists of 8 questions. Part three asked about optimal site selection for insertion of central line and consists of 5 questions. Part four asked about hand washing procedure and consists of 5 questions. Part five asked about using chlorhexidineinsk in preparation and consists of 5 questions. Finally, part sex asked about maximum barrier precaution and consists of 12 questions.

TOOL (II): A Checklist for Observation:

Measurement of nurses' practices regarding the management of central venous catheters was accomplished by the utilization of the instrument that was created by Bindler and Ball (2012) and utilized in pre-post and follow-up assessments. A total of twenty-three things are included in the paper, all of which are related to different parts of practice.These include keeping the central venous catheter changed routinely, changing intravenous fluid administration sets at specific intervals, changing sets for total parenteral nutrition and blood administration, using a separate port for total parenteral nutrition administration, and practicing good hand hygiene (or using an alcohol hand rub). The use of a central venous catheter injected with antibiotics.Transparent dressings compared to gauze dressings. Apply antibacterial ointment at the insertion site or access port, and implement thorough protective protocols during insertion. Proposed implantation site (subclavian, Conduct a routine flush using 0.9 percent normal saline. Methodical administration of antibiotics; nurse intervention for exudation.

Scoring system: -

One point was given for every correct answer and zero points for every incorrect one in a knowledge-based scoring system that was put in place.The evaluation method allocated one point for each completed phase and zero points for each uncompleted step. Knowledge was considered sufficient if it met or exceeded 60%, and unsatisfactory if it fell below 60%. Kadium, 2015. The practice level was considered good when it met or surpassed 75 percent, and unsatisfactory when it fell below 75 percent (Kadium, 2015).

Validity and Reliability

The alignment of a measure with established theory and knowledge of the construct being evaluated, as well as the comprehensiveness of the measurement in encompassing all facets of the concept, were evaluated by a panel of nine experts, five of whom specialized in Anesthesia and Intensive Care Medicine and Medical-Surgical Nursing, including a professor from Port Said University., 2 assistant professors at Port Said University, 2 lecturers at Port Said University, and a lecturer in the faculty of medicine at Port Said University). Reliability is the process of ensuring that the results of a test are consistent across various observers, time, and sections of the test. This was assessed using the Cronbach's alpha test. The Questionnaire assessment document and the Observational Checklist were rated 0.84 and 0.86, accordingly.

Fieldwork

Assessment phase

The researcher conducted interviews with nurses in the critical care department in a room adjacent to the department. During these interviews, the researcher provided an introduction to the study, clarifying its purpose and emphasizing the importance of privacy, safety, and the confidentiality of the gathered data. Following this introduction, the researcher handed out questionnaires to the nurses and requested that they complete them, which took approximately 10- 15 minutes (pre-test).

Implementation phase:

A care program consisting of seven sessions was put into place, with four sessions focusing on theoretical understanding and three sessions putting an emphasis on practical skills. Each of the nurses was placed into one of 10 distinct groups. Lectures were set to take place on three different days of the week, two

hours each day, from nine in the morning until eleven in the morning. After taking into consideration the availability of the nurses, the time was modified to accommodate their availability.

Theoretical session:

The initial session addressed the program's curriculum, objectives, and provided an introduction to CLABSI. The nurses will be able to discern various components of the program, articulate the objectives of the educational initiative, and elucidate the program's introduction.

The second session concentrated on the definition of a central line, its indicators, and the many types of central lines. At the conclusion of the course, the nurses will be capable of defining a central line, enumerating its indications, and elucidating the many types of central lines. The initial session addressed the program's curriculum, objectives, and provided an introduction to CLABSI. By the conclusion of this session, the nurses will be capable of recognizing various components of the program, identifying the objectives of the educational initiative, and articulating the program's introduction.

The third session concentrated on the definitions of nosocomial infections and CLABSI. The session addressed the description and pathophysiology of CLABSI, its origins, risk factors, signs and symptoms, related microorganisms, and the chain of infection. At the conclusion of the session, nurses will be capable of: defining nosocomial infections and CLABSI, elucidating the pathophysiology of CLABSI, examining the causes of CLABSI, and enumerating the signs and symptoms of CLABSI.

The fourth session encompassed the definition and components of CLABSI care, including hand hygiene, maximum barrier precautions, optimal selection of central line insertion sites, dressing change protocols, central line replacements, administration set changes, and the application of chlorhexidine for insertion site disinfection. By at the end of the fourth session, the nurse will have a good grasp of CLABSI care, including optimal catheter site selection, hand hygiene, and maximal sterile barrier precautions. She will also have a better understanding of chlorhexidine skin antisepsis and how to prevent contamination from healthcare providers or the environment.Neglecting these procedures markedly elevates the danger of introducing germs and resulting in avoidable CLABSIs. Examine the ideal insertion site for the catheter, outline the dressing change protocol, review the procedures for central line and administration set replacement, and elucidate the role of chlorhexidine in the disinfection of the insertion site.

Every nurse received the information booklet as an addition to their resources. Additionally, information was disseminated to the nurses via a PowerPoint presentation. The communication connection between the researcher and the study group was maintained.

Practical sessions: The routine central venous catheter replacement, intravenous fluid administration set change, complete parenteral nutrition adjustment, and blood administration set change were performed in the sixth session. TPN administration requires a specific port and handwashing or alcohol-based hand sanitizer.

The six sessions focused on antibiotic-impregnated CVCs. Comparing transparent and gauze bandages. Antibacterial ointment at the insertion site or access port and strict insertion practices are required. Standard flushing with 0.9% normal saline, thorough antimicrobial therapy, and nursing interventions for exudation at subclavian implantation site.

The content of the seven sessions focused on the application of antibiotic lock solution for catheter lumen sterilization, the utilization of single-port central venous catheters instead of numerous ports, and the implementation of adhesive materials in place of sutures. Indicators and manifestations of central venous catheter infection, use Sterile gloves for insertion and dressing. Systematic administration of anticoagulants.

The demonstration and re-demonstration methods were employed during practical sessions. The media utilized included a brochure, a tangible object, and a video. Every nurse was provided with a copy of the practical booklet upon the conclusion of the practical sessions.

Evaluation Phase:

The final assessment and follow-up for the nurses' education and practice were both conducted using the same format as the pre-test in order to evaluate the efficacy of the program that was put into place.

Statistical analysis

Following the conclusion of the process of data collecting, the information was tallied, gathered, categorized, and statistical analysis was carried out on it. An analysis was carried out with the purpose of determining the influence that an educational program had on the knowledge and practices of nurses working in the critical care unit in relation to the care of central venous lines. The analysis was carried

out with the help of the Statistical Package for the Social Sciences (SPSS) version 20. The program was designed to examine the performance of nurses before, during, and after its implementation. Percentages, averages, and standard deviations were included in the tables and charts along with numerical data. Percentages, means, standard deviations, Pearson correlation coefficients, chi-square tests, and analysis of variance (ANOVA) were all part of the statistical study.

Ethical considerations:

The researcher clearly outlined the objectives and aims of the research to the participating nurses and obtained their written consent. The confidentiality and anonymity of the nurses' data would be upheld throughout the investigation, as was underscored. The nurses were informed that they had the option to participate or decline and that they could disengage from the study at any time. Furthermore, each nurse provided oral consent prior to participating in the investigation.

RESULTS:

Table (1) The distribution of the sample's demographic features, which totaled sixty-five individuals.

Table 1 demonstrated that the average age of the nurses was 23.93 years (± 2.99), with 78.5% being female. Additionally, 64.6% of the nurses held a Bachelor of Nursing degree, and their average work experience

Personnel Characteristics	(N)	(%)
Age (year)		
Mean ± SD	23.93 ± 2.994	
Gender		
Male	14	21.5
Female	51	78.5
Level of education		
Nursing Diploma	-	-
Nursing technical institute	23	35.4
Bachelor of Nursing	42	64.6
Post-graduate student master–doctorate	-	-
Years of Experience		
Mean ± SD	3.24 ± 2.12	
The number of working hours per day in intensive care		
6 hours	-	-
8hours	25	38.5
12 hours	40	61.5
22 hours	-	-
Did you attend training courses about infection control?		
Yes	50	76.9
No	15	23.1
Number of course (Mean ± SD)	**3.38±2.54**	
Did you attend training courses about infection control related central venous catheter ?		
Yes	37	56.9
No	28	43.1
Number of course (Mean ± SD)	**1.35±0.483**	

was 3.24 years (± 2.12). Furthermore, 61.5% of them worked for 12 hours. Notably, between 56.9% and 76.9% attended training courses related to infection control and central venous care.

Table (2) Comparison between total nurses' knowledge throughout educational program phases (n=65)

Total nurses' knowledge	Pre		Post		FU		Test Statistics	
	N	%	N	%	N	%	Cochran's Q	P value

Satisfactory knowledge (60 ≥)	13	20	60	92.3	55	84.6	64.48	0.000**
Unsatisfactory knowledge (<60)	52	80	5	7.7	10	15.4		

A highly statistically significant P value, P < 0.001

Table (2) shows nurses' extensive central venous line expertise. The table shows a considerable improvement in nurse knowledge after the care implementation, with a significant difference among pre-post and follow-up periods.

Table (3) Comparison among total nurses' practice throughout educational program phases (n=65)

Total nurses' practice	Pre		Post		FU			
	N	%	N	%	N	%	Cochran's Q	P value
Satisfactory practice (75 ≥)	17	26.2	62	95.4	58	89.2	82.71	0.000**
Unsatisfactory practice (<75)	48	73.8	3	4.6	7	10.8		

Table 3 displays the comprehensive care that nurses provide for central venous lines. After the educational program was put into place, the table reveals that nursing practice significantly improved, with a notable difference among the pre-post and follow-up periods (p-value <0.001).

Table (4) the following table presents the correlation among the total nurses' knowledge score and the total practice score regarding central venous catheters across the various phases of the educational program.

Variable			Total practice score		
			Pre	Post	Follow up
Total knowledge score	Pre	R	0.840	0.440	0.517
		P	0.000**	0.000**	0.000**
	Post	R	0.716	0.762	0.831
		P	0.000**	0.000**	0.000**
	Follow up	R	0.485	0.516	0.677
		P	0.000**	0.000**	0.000**

Table (4) demonstrates a positive relationship (p=0.00) among nurses' overall knowledge and practice scores throughout training phases.

DISCUSSION

ICU nurses are essential in preventing CLABSIs through meticulous central venous line care, including aseptic techniques, daily site assessments, and prompt line removal. Improved patient safety and decreased infection risks are direct results of their constant commitment to practices supported by evidence. In terms of the demographics of nurses, the existing study found that most of them were female. Furthermore, more than two thirds were Bachelor of Nursing with Mean experience, worked for 12 hours, and majority of participants had attended training courses for infection control and infection control related central venous catheter. This result due to a predominance of women in the nursing profession. Additionally, more than two-thirds of the participants held a Bachelor's degree in Nursing, suggesting a relatively high level of academic preparation among the study sample. The average clinical experience reported further indicates that the participants were not novice nurses but had gained sufficient time in practice to engage in central line care.

This outcome corresponds to Elaziz and Bakr (2022) stated that the majority of nurses working in ICUs were Women and held a bachelor's degree in nursing. This reflects broader national and international trends where nursing continues to be a female-dominated profession with increasing educational qualifications. Also, on similarity with Ali and Mahmoud (2021), it was reported that most ICU nurses worked 12-hour shifts and had several years of clinical experience. The authors discussed how prolonged working hours could affect performance, especially in high-risk procedures like central venous catheter care.

This finding aligns with Gad and Abdelaziz (2023), which indicated that a majority of ICU nurses participated in infection control training programs, including those specifically addressing central venous catheter management. Nonetheless, the study observed that, despite training, practice levels remained inadequate, indicating deficiencies in teaching content or subsequent reinforcing.

It may be deduced from the fact that there is a statistically significant difference between the pre-post and follow-up measures of educational program implementation that organized training programs are effective in increasing the information available to nurses. A recent study has demonstrated that there is a statistically significant improvement in the level of knowledge that nurses possess after the implementation of care. The use of these strategies makes it easier to promote therapy that is supported by evidence and improves the quality of care that is provided to patients in intensive care units who are suffering from severe conditions. This discovery supports the conclusions of Venkatesan and Manikandan (2019), which revealed that previous to the intervention, most assessed individuals had insufficient knowledge on central venous catheter management. Subsequent to the intervention, almost two-thirds of the examined nurses exhibited adequate understanding. To substantiate this result, El-Sol and Badawy (2017) found that the nurses' knowledge experienced a notable transformation before and after the deployment of the selected educational module. This study shows that the training program greatly improved nursing practices. We found a substantial difference amongst pre-, post-, and follow-up testing. Our findings match Bayoumi and Mahmoud (2017)'s findings that their training considerably improved nurses' practices. Our findings match Deshmukh and Shinde (2014), who found that organized training raised nurses' post-test scores, indicating improved performance. The present study showed that nurses' knowledge and practice were positively correlated before, during, and after the program was implemented. Prior to, during, and after the instructional session, Abbady et al. (2019) discovered a statistically significant correlation between scores on measures of knowledge and practice. At every point in the process of implementing nursing education standards, Zeyada et al. (2021) discovered that nurses' overall knowledge was correlated with their total practice domains. Our findings are in agreement with this.

CONCLUSION

This study found that most critical care unit nurses greatly enhanced their knowledge and competence in caring for central venous lines. On the practice assessments given to nurses before and after the educational session, there was a statistically significant change. The mean results on measures of knowledge of the nurses before and after the educational session were significantly different.

Acknowledgments

Conflict of interest: None

Consent to participate: The nurse's consent was obtained prior to the study's enrollment. They ensured that all data collected was confidential and solely used for research purposes.

Data availability: All data available at the article.

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Authorship:

Amal Karem Abd Azem: contributed to conceptualizing, conduct the intervention and collecting the data, writing the article.

Amany Mohammed shebl: contributed to writing the original draft, contributed to editing the manuscript.

Mona Abed El-Rahman: Contribution at prepare the tool and writing the manuscript, contributed to data curation, contributed to data analysis.

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