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Evaluating the Impact of a Teaching Program on Nurses' Performance during CVP Measurement in Intensive Care Units: A Quasi-Experimental Study

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Abstract

The intensive care unit (ICU) is a specialized area of hospitals dealing with the diagnosis, management, and follow-up of critically ill patients. Moreover, Critical Care Nurses (CCNs) should have strong analytical, interpersonal, and decision-making skills. Objectives: This study aimed to assess the effect of the teaching program on CCNs' performance during the measurement of central venous pressure (CVP). Design: A quasi-experimental design was used. Methods: The study was conducted in the critical care units at Al-Assad University Hospital, Damascus from June to September 2020. All available registered nurses working in the previous ICUs were included. An observational checklist sheet was developed by the researcher after reviewing the related literature. Each nurse was observed once for each procedure during different shifts. The researcher developed and designed the teaching program based on the nurses' needs according to their performance during the initial assessment. Results: The results showed that the performance of the nurses improved after the program. The best performance was for nurses in the age group between 20 and 24 years, nurses with a master's degree, and nurses with less than five years of experience, while the level of knowledge and practice of the studied nurses was average and poor before the teaching program. Overall, this study found a statistically significant relationship before and after

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the implementation of the program. Conclusion: There has been an obvious improvement in nurses' knowledge and performance after the teaching program. It is essential to help nurses expand their knowledge and practices to provide high-quality care and promote patient safety.

Keywords: Intensive Care Unit, Patient, Care, Safety

Introduction

The measurement of central venous pressure (CVP) has become an indispensable tool for the management of seriously ill or injured patients. The information gained from measuring CVP is helpful in several clinical contexts, especially when bound with other assessments including blood pressure, pulse, and urine output (Roger, Muller et al. 2017, Bano, Qadeer et al. 2018).

Today, CVP measurement is a nursing responsibility. Therefore, critical care nurses should be able to measure the CVP competently and identify the factors affecting its readings(Hill and Smith 2021).

CVP monitoring is considered one of the significant components of invasive hemodynamic monitoring. It refers to the measurement of the right atrial pressure or the pressure of the great veins within the thorax. It is used to monitor the right ventricular function (Patel 2021).

The accuracy of CVP measurement may be affected by technical factors such as the use of incorrect techniques, which may introduce errors in pressure measurement and lead to therapeutic mismanagement of critically ill patients. The best way to deal with these errors is to understand how they can happen and thereby, minimize this risk through knowledge and careful attention to technique (O'Dwyer 2011).

Identifying the physiological factors affecting CVP may help the critical care nurse in interpreting CVP readings. The following are among the physiological factors: venous blood volume and venous compliance which are the main determinants of venous pressure.

The position of the body is among the factors affecting blood distribution, venous return, and CVP. Literature mentioned that CVP can be measured correctly at a backrest position up to 45 degrees. A review of clinical studies indicates that backrest elevation up to 60 degrees doesn't affect the measurement of intracardiac pressure or cardiac output (Hill 2018, Lesmana, Ose et al. 2019, Kolikof, Peterson et al. 2020, Hill and Smith 2021).

Intensive care nurses face the challenge of caring not only for critically ill patients but also for complex machinery. To improve the delivery of care to the patients, an understanding of the machines and their effects is essential and increases the nurses' confidence and allows them to focus on the patients

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and associated problems while maintaining safe and informed care (Sannino and Pisani 2018).

Hemodynamic monitoring is now considered to be essential in the management of critically ill patients. Highly sophisticated monitoring equipment has been developed which provides precise measurement of hemodynamic parameters. The critical care nurse needs to have an understanding of the functions, benefits, and potential complications of hemodynamic monitoring; as pneumothorax, bleeding, sepsis emboli, and technological advances continue at an ever-increasing rate, nurses must also continue to develop their understanding of the complex data that are subsequently generated (Li, Wang et al. 2017, Bano, Qadeer et al. 2018, Hill and Smith 2021).

The close monitoring and observation of critically ill patients is an essential feature of the role of the nurses working in intensive care units. CVP measurement is a nursing responsibility; therefore, the critical care nurse needs to be technically and clinically competent in the CVP measurement (Endla, Kabdal et al. 2017, Hill and Smith 2021).

Before the CVP measurement, the nurse should assess and observe for signs and symptoms indicating the need for CVP measurement, including low or labile blood pressure, widely diverse intake and output, and fluid administration at a rapid rate. In addition, she should identify the client who is potentially at risk for fluid imbalance and assess the signs and symptoms of fluid volume excess or deficit, requiring CVP measurement to correlate the patient's clinical picture with the CVP value (Magder 2007, Von Rueden 2020) .

Moreover, critical care nurses should assess all factors that could affect the CVP reading, including the patient's diagnosis, hydration status, administered medications, and obesity. In addition, the nurse should prepare herself and wash her hands before measuring the CVP. She should explain the procedure to the patient to promote understanding and reduce anxiety. Also, she should prepare the needed equipment for CVP measurement and put the patient in the supine position (O'Dwyer 2011, Bano, Qadeer et al. 2018, Hill 2018).

During the procedure, the critical care nurse should place the zero level of the water manometer at the level of the hemostatic axis. Then, she should turn the water manometer stopcock open to the intravenous fluids to permit fluid to fill the water manometer. After that, she should open the intravenous (IV) tubing roller clamp so that fluid flows from the IV fluid bag into the water manometer. The critical care nurse should fill the manometer above the level of the expected CVP reading and should understand that if the fluid is allowed to overflow the top of the manometer, contamination can result. Under-filling the water manometer will result in an inaccurate CVP

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measurement. Ensure that there are no air bubbles in the manometer. Then, allow the IV fluid to drip rapidly into a client for several seconds, with the stopcock closed to the manometer to assure the patency of the CVP line. The nurse should consider that if the fluid does not flow freely, the CVP reading will be inaccurate (Al-Metyazidy and Younis , O'Dwyer 2011, Urden, Stacy et al. 2013, Aloush 2018, Bano, Qadeer et al. 2018, Hill 2018, Hill and Smith 2021).

Then, the water manometer stopcock should be opened to the patient and closed to the IV solution to allow fluid to flow into the patient until the fluid column equalizes with the pressure in the right atrium. The fluid column should be observed closely because if the manometer is allowed to empty, air may enter the patient. Take the reading when the fluid level stabilizes at the end of expiration. After that, raise the manometer above the patient to allow the IV fluid to infuse into the patient. Finally, turn the manometer stopcock off to the manometer to allow intravenous fluid infusion (Ahmed, Eltayeb et al. 2016, Huang, Tsao et al. 2021).

After CVP measurement, the critical care nurse should regulate the IV fluid rate, record in the nurse's notes or on the flow sheet the CVP reading, the central line access site, and report any abnormal values to the physician. Additionally, document the treatment modalities initiated for abnormal values. Return the manometer to the bedside intravenous pole, and wash hands (Promnoi 2012, Endla, Kabdal et al. 2017, Atia 2020).

Normal CVP values vary between individuals but are usually between 5 and 12 CmH2O. The readings are influenced by myocardial contractility, vascular tone, and intrathoracic pressure. If the patient is ventilated, the CVP will be increased (Sathish, Singh et al. 2016, Mansour 2019, Ahmed, Esmat et al. 2021).

Significant of the Study

Critically ill patients admitted to an ICU experience, on average, 1.7 medical errors each day, and many patients suffer a potentially life-threatening error during their stay (Camiré Moyen et al., 2009; Gracia Serrano et al., 2019).

Nurses and all other health care professionals sometimes make mistakes in providing their care services, regardless of their level of expertise, knowledge, and precision. Nursing errors can occur at any point in time during nursing activities and procedures, and the outcomes may be subtle or severe (Peyrovi, Nikbakht Nasrabadi et al., 2016).

Like other parts of the world, there are negative patient health and healthcare outcomes in Syria. Therefore, special attention should be paid to the clinical skills and knowledge of nurses working in ICUs (Rezaee Ghaljeh et al., 2020). Therefore, this study was conducted to assess the effect of an

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educational program on nurses' practices regarding the implementation of patient care and safety measures in the intensive care units in Syria.

Methods

In this research endeavor, we employed a quasi-experimental design, characterized by a non-randomized sample selection and an absence of a control group, to explore the relationship between a teaching program and the enhancement of nurses' performance in the measurement of CVP. The study was carried out in the intensive care units of Al-Assad University Hospital, Damascus, with a focus on all available registered nurses, comprising a total of 48 participants who were actively working during the stipulated data collection period.

To facilitate the assessment of nurses' performance, we devised an observational checklist sheet meticulously tailored to the CVP measurement, which was informed by an extensive review of pertinent literature. Each participating nurse was meticulously observed during multiple shifts, allowing for a comprehensive evaluation of their proficiency in the procedure. The development of the teaching program was rooted in a rigorous analysis of nurses' initial performance assessments. The program was meticulously designed to address the specific needs and deficiencies identified during this evaluation. The study underscores the pivotal role of tailored educational interventions in improving nurses' proficiency and patient care in the high-stakes environment of intensive care units.

Pilot Study:

Prior to the initiation of the main research endeavor, a pilot study was executed to validate the research instrument. This preliminary assessment enlisted the participation of five experienced nurses currently employed in the same ICUs under examination, with a caveat that these individuals would not be included in the final sample of the primary study. The primary aim of the pilot study was to scrutinize the research tool's usability and appropriateness within the context of the intended investigation. Through meticulous evaluation, minor refinements were introduced to enhance the tool's clarity and relevance. Furthermore, in consideration of linguistic preferences, select terminology was refined to its Arabic equivalents.

Ethical Considerations

Several essential ethical considerations were observed during the data collection process:

- Official Permission: Prior to commencing the study, official permission was obtained from Al-Assad University Hospital, Damascus. The study's aims were comprehensively explained to the

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hospital's manager and the head of the intensive care unit. This step ensured alignment with institutional protocols and ethical standards.

- Tool Development: The observational checklist sheet used in the study was meticulously developed by the researcher following an extensive review of relevant literature. This ensured that the tool was appropriately designed to meet the study's objectives.
- Nurse Characteristics Recording: Demographic and professional characteristics of the nurses were recorded once at the outset of the data collection phase.
- Observation Procedures: Each nurse was observed once for each procedure during various shifts, allowing for a comprehensive assessment of their performance.
- Duration of Data Collection: The data collection phase spanned approximately three months, ensuring a sufficiently comprehensive dataset.
- Survey Distribution: The survey formats were personally distributed by the investigator, accompanied by a cover letter that clearly outlined the study's purpose, the confidentiality measures in place, and the hospital's formal approval.
- Participant Assurance: Nurses participating in the study were explicitly assured that their involvement would not result in any harm, risk, or discomfort. This assurance was critical in maintaining ethical standards and ensuring participants' well-being.

These ethical considerations were paramount in upholding the integrity and legitimacy of the data collection process.

Tools

The tool employed in this study was custom-developed by the researcher and comprises two distinct components: Demographic Data Collection (Table 1): The initial segment of the tool captures demographic information concerning the nurses under investigation.

Observational Checklist (Table 2): The core component of the tool, Table 2, is an observational checklist designed to assess nurses' performance concerning the implementation of patient care and safety measures during the CVP measurement procedure.

It is important to note that the tool was methodically formulated by the researcher following an exhaustive review of relevant literature. This meticulous development process ensured that the tool was comprehensive, suitable for the research objectives, and aligned with established practices in

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the field. (Roberts, 2017; Jones & Fix, 2019; Nunnery, 2019; Smith, 2019; Wilkinson Treas et al., 2019).

The research tool was subjected to a translation process, resulting in its adaptation into the Arabic language. This step was undertaken to ensure that the tool was accessible and comprehensible to the study participants, who primarily communicated in Arabic. The translation process aimed to maintain the tool's accuracy, consistency, and relevance, aligning it effectively with the linguistic and cultural context of the study.

Reliability Testing:

To assess the reliability and applicability of the safety measures observational checklist, two distinct methods were employed:

Interrater Reliability Assessment: The reliability of the checklist was evaluated using interrater reliability analysis. Three experts in the critical care nursing field were engaged to independently assess the checklist's items. The resulting reliability coefficient (r) for the safety measures observational checklist was determined to be 0.96, indicating a high degree of consistency among the expert raters.

Cronbach's Alpha Coefficient: To further ensure the internal consistency of the tool, Cronbach's alpha coefficient was calculated. The obtained value of 0.84 demonstrates a satisfactory level of internal consistency, affirming the reliability of the checklist in evaluating safety measures during CVP measurements.

These reliability assessments validate the tool's effectiveness and robustness in its intended application, providing confidence in the data collected and the study's findings.

Inclusion Criteria:

The study included all licensed nurses who were actively employed in the former Intensive Care Units (ICUs) at Al-Assad Hospital.

Exclusion Criteria:

The following categories of individuals were excluded from the study:

- Internship students.
- Nurses who were on vacation during the data collection period.
- Head nurses.

These inclusion and exclusion criteria were applied to ensure that the study focused exclusively on licensed nurses actively working in the specified ICUs, while excluding interns, nurses on vacation, and head nurses, as their roles or circumstances did not align with the study's objectives.

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Data Collection Process

The data collection process spanned from June 2020 to September 2020 and consisted of four distinct stages:

- Assessment: The initial stage involved observing each nurse's performance for each procedure at the onset of data collection. This step aimed to identify and pinpoint specific areas of weakness in the nurses' capabilities.
- Planning: Subsequently, a comprehensive teaching program was meticulously developed. The program was tailored to address the identified needs and deficiencies of the nursing staff, ensuring a targeted approach to skill enhancement.
- Intervention: The third stage revolved around the actual implementation of the teaching program. This encompassed the use of various educational tools such as PowerPoint presentations and hands-on training sessions, with the primary goal of enhancing the nurses' knowledge and performance.
- Reassessment: The final stage involved a thorough reassessment of the nurses' performance following the implementation of the teaching program. This post-intervention evaluation was instrumental in gauging the extent of improvement achieved.

The structured progression through these four stages enabled a comprehensive understanding of the impact of the teaching program on the nurses' performance during CVP measurements.

Statistical Analysis

The data were analysed using the Statistical Package for Social Science (SPSS version 20.0). Qualitative data were described using numbers and percentages (Armonk, NY: IBM Corp). The Kolmogorov-Smirnov test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, and standard deviation. The significance of the obtained results was judged at the 5% level.

The Educational Program

This research details an educational program designed to enhance the competencies of nurses over a two-week duration. The program is meticulously divided into four sequential phases, each addressing specific aspects of professional development. These phases are structured as Assessment, Planning, Implementation, and Evaluation (inclusive of Reassessment), providing a comprehensive framework for nurse training.

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The educational program comprises two fundamental components, offering a well-rounded approach to nurse education. Firstly, an educational pamphlet handout serves as a foundational reference, supplying participants with essential knowledge and resources. Secondly, an intensive eight-hour daily workshop forms the core of the program. The workshop entails a multifaceted approach, including didactic lectures, collaborative group discussions, and hands-on training scenarios. To ensure optimal learning outcomes, every participating nurse is mandated to attend a minimum of two hours of training sessions on a daily basis.

The program is strategically crafted in the Arabic language to ensure optimal understanding among the target audience, the nurses. Its primary objective is to augment nurses' proficiency in the crucial domain of Data CVP measurement. Employing an array of instructional strategies, the program seeks to impart contemporary knowledge through dynamic PowerPoint presentations and experiential learning via training sessions on manikins. This approach is designed to effect meaningful enhancements in nurses' knowledge base and practical skills.

The program's creation and development were meticulously orchestrated through a systematic four-phase approach. This approach was designed to optimize the educational and practical impact of the program on nurses' proficiency in CVP measurement.

Phase One - Initial Assessment:

In the inaugural phase, the researcher methodically evaluated nurses' CVP measurement performance using a purpose-designed checklist. This assessment was pivotal in identifying the baseline proficiency and shortcomings among the nursing staff

Phase Two - Program Development:

The second phase was characterized by the development and implementation of a teaching program, custom-tailored to the specific needs identified during the initial assessment. The objective was to address individual and collective areas of improvement.

Phase Three - Program Delivery:

The third phase featured the delivery of the program itself. This multifaceted approach encompassed dynamic PowerPoint presentations, practical demonstrations, and hands-on training sessions. These activities were meticulously curated to equip nurses with relevant knowledge and to elevate their practical skills in CVP measurement.

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Phase Four - Post-Program Assessment:

In the final phase, a comprehensive assessment was conducted to gauge the post-program impact on nurses' performance. This phase played a crucial role in quantifying and validating the extent of improvement achieved through the program.

Results

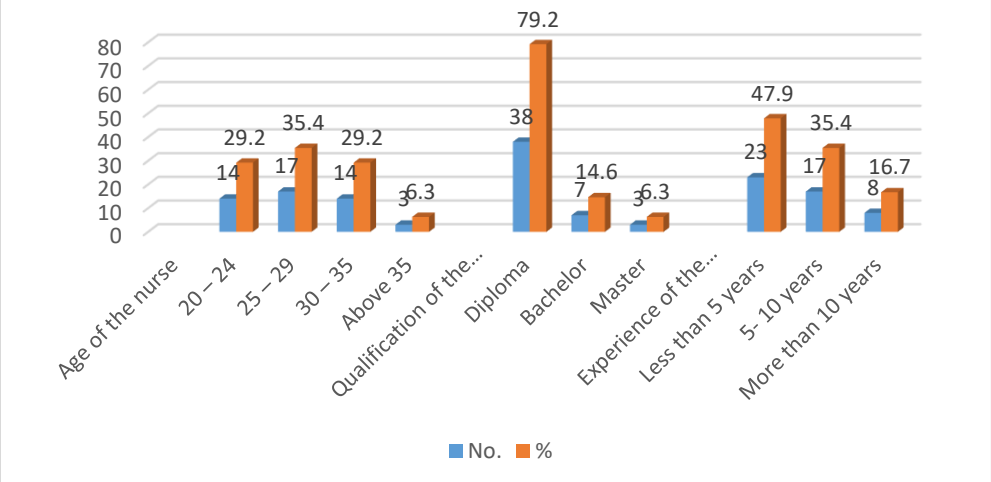
In this study, a total of 48 nurses were included, with an average age of 28 years.

The age distribution of the participants reveals that seventeen nurses, constituting more than 35% of the total sample, fell within the age group of 25-29 years. An equal number of nurses, 14 each, were distributed among the age groups of 20-24 and 30-35 years, collectively representing 29.2% of the participants. Three nurses, accounting for 6.3% of the sample, were aged over 35 years.

Regarding the qualifications, the majority of the nurses, 38 in number, approximately 80% of the sample, held a diploma degree. Seven nurses, comprising around 15% of the sample, possessed a bachelor's degree. Three nurses, constituting roughly 6% of the sample, had earned a master's degree.

Regarding the years of professional experience, a total of 23 nurses, or 47.9% of the participants, had less than five years of experience. Seventeen nurses, representing 35.4% of the sample, had accumulated between five to ten years of experience. Eight nurses, amounting to 16.7% of the sample, possessed over ten years of professional experience. The mean years of experience among the nurses were calculated to be 6 years. (Figure 1).\

Figure (1). The characteristics of the studied nurses



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This table provides a comprehensive account of the patient care and safety measures associated with the measurement of CVP. The study evaluates the proficiency of the participating nurses in adhering to these steps both before and after the educational program. Prior to the educational program, the results indicated a noteworthy deficiency in adherence to the prescribed CVP measurement steps. Among a total of twenty-one steps, the nurses exhibited suboptimal performance, correctly implementing only seven steps. The range of nurses correctly performing the remaining fourteen steps varied from 4.2% to 100%.

Remarkably, a marked improvement in nursing performance was observed across all CVP measurement steps after the educational program. The percentage of nurses correctly executing these steps ranged from 20.8% to 100%, reflecting substantial progress in adherence to patient care and safety measures. Nurses' scores, which represent their overall performance in implementing these measures, displayed a notable increase following the program. Scores improved from a pre-program range of 42 to 77, with a mean score of 53.92 ± 9.31, to a post-program range of 57 to 84, accompanied by a mean score of 75.44 ± 6.93.

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Table (2). The description and implementation of patient care and safety measures of the studied nurses according to the measurement of central venous pressure steps before and after the educational program

Central Venous Pressure CVP	Frequency (N= 48)															
	Before an educational program								After an educational program							
	Not done		Done incorrectly		Need more practice		Done correctly		Not done		Done incorrectly		Need more practice		Done correctly	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Assess the patient's respiratory and cardiac status	16	33.3	25	52.1	7	14.6	0	0.0	0	0.0	8	16.7	30	62.5	10	20.8
Assess the patient's need for measurement	12	25.0	24	50.0	12	25.0	0	0.0	0	0.0	1	2.1	23	47.9	24	50.0
Prepare all necessary equipment and supplies	0	0.0	25	52.1	16	33.3	7	14.6	0	0.0	0	0.0	10	20.8	38	79.2
Wash hands	16	33.3	22	45.8	10	20.8	0	0.0	0	0.0	6	12.5	18	37.5	24	50.0
Wear gloves	13	27.1	12	25.0	20	41.7	3	6.3	2	4.2	1	2.1	13	27.1	32	66.7
Explain the procedure	16	33.3	23	47.9	9	18.8	0	0.0	0	0.0	6	12.5	16	33.3	26	54.2
Maintain privacy	18	37.5	24	50.0	6	12.5	0	0.0	0	0.0	5	10.4	27	56.3	16	33.3
Begin the IV infusion	0	0.0	0	0.0	0	0.0	48	100	0	0.0	0	0.0	0	0.0	48	100
Check the patency of the catheter by flush back	19	39.6	21	43.8	6	12.5	2	4.2	0	0.0	3	6.3	22	45.8	23	47.9
If there is no flush back check the catheter for clot formation	7	14.6	14	29.2	25	52.1	2	4.2	0	0.0	0	0.0	14	29.2	34	70.8
If the catheter is patent, close the stopcock in the direction of the patient	0	0.0	0	0.0	5	10.4	43	89.6	0	0.0	0	0.0	2	4.2	46	95.8
Allow the solution to pass via the manometer line	0	0.0	0	0.0	0	0.0	48	100	0	0.0	0	0.0	0	0.0	48	100
Positioning the patient	0	0.0	12	25.0	28	58.3	8	16.7	0	0.0	0	0.0	8	16.7	40	83.3
Put the manometer at the fifth intercostal space mid-axillary line of the patient	0	0.0	25	52.1	20	41.7	3	6.3	0	0.0	2	4.2	21	43.8	25	52.1
Take the CVP reading when fluid stops fluctuating	0	0.0	24	50.0	16	33.3	8	16.7	0	0.0	1	2.1	28	58.3	19	39.6
Begin an I.V solution such as normal saline	0	0.0	5	10.4	15	31.3	28	58.3	0	0.0	0	0.0	0	0.0	48	100
Return the patient in comfort position	8	16.7	18	37.5	21	43.8	1	2.1	0	0.0	4	8.3	23	47.9	21	43.8
Return the equipment	0	0.0	26	54.2	22	45.8	48	100.0	0	0.0	0	0.0	13	27.1	35	72.9
Remove gloves	13	27.1	12	25.0	20	41.7	3	6.3	2	4.2	1	2.1	13	27.1	32	66.7
Wash hands	5	10.4	20	41.7	23	47.9	0	0.0	0	0.0	5	10.4	23	47.9	20	41.7
Documentation	5	10.4	18	37.5	19	39.6	0	0.0	0	0.0	0	0.0	9	18.8	39	81.3
The total score of Central Venous Pressure (21–84) **Min. – Max.** **Mean ± SD**	41.77 – 77 53.92 ± 9.31								57.0 – 84.0 75.44 ± 6.93							
t (p)	**47.844*(<0.001*)**															

t: Paired t-test

p: p-value for comparing between Before and After *: Statistically significant at $p \leq 0.05$

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Impact of Age on Nurses' Performance in CVP Measurement

In the context of age-based analysis, the study revealed significant variations in nurses' performance scores before and after the educational program in the measurement of CVP. Prior to the program, nurses in the age group 20-24 exhibited scores ranging from 52 to 61 out of a total score of 84. Following the program, their scores demonstrated a notable improvement, with a range of 77 to 79. Nurses in the 25-29 age group initially displayed scores ranging from 41 to 77 out of 84. Post-program, their scores ranged from 71 to 84, indicating a substantial enhancement in performance. The analysis underscores that nurses within the age groups of 20-24 and 25-29 exhibited the most significant improvements in performance, signifying the efficacy of the educational program in bolstering their proficiency in CVP measurement.

Nurses within the 30-35 age group exhibited scores ranging from 41 to 65 out of a total score of 84 before the program. Following the program, their scores demonstrated improvement, with a range of 61 to 84. For nurses aged more than 35 years, initial scores ranged from 41 to 42 out of 84 before the program. Post-program, their scores improved to a range of 57 to 59. The overall analysis revealed a statistically significant difference in scores before and after the program among nurses of varying age groups. This underscores the program's effectiveness in enhancing the performance of nurses across age categories in CVP measurement. ($P<0.001$) (figure 2).

In the context of age-based analysis, the study unveils intriguing patterns in nurses' scores before and after the educational program, particularly with respect to CVP measurement proficiency. Prior to the implementation of the educational program, distinct variations were discerned in the performance scores of nurses across different age groups. Notably, the age group spanning from 20 to 24 years achieved the highest minimum score, with a score of 52 out of a possible 84. In contrast, nurses in the 25-29 age group attained the highest maximum score, reaching an impressive 77. Conversely, nurses aged over 35 years garnered the lowest maximum score, amounting to 42.

Subsequent to the educational program, marked improvements in performance scores were noted across all age groups. The 20-24 age group exhibited the highest minimum score, a substantial 77, while the 25-29 age group achieved the highest maximum score, attaining a perfect 84. Conversely, nurses aged over 35 years showcased the lowest minimum and maximum scores, both within the range of 57 to 59.

The findings of this study underscore a statistically significant relationship between nurses' age and their performance in CVP measurement, both before and after the educational program. These results emphasize the program's efficacy in enhancing performance and mitigating age-related disparities in scores. ($p<0.001$) (figure 2).

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Figure (2). CVP measurement scores before and after the program according to nurses' age

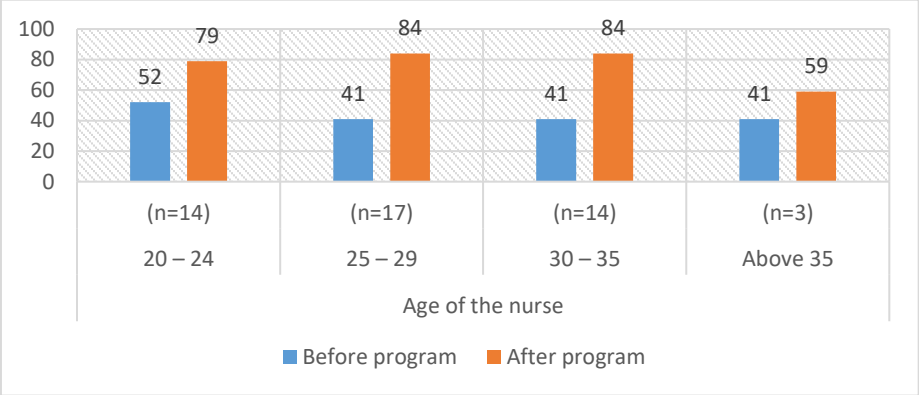
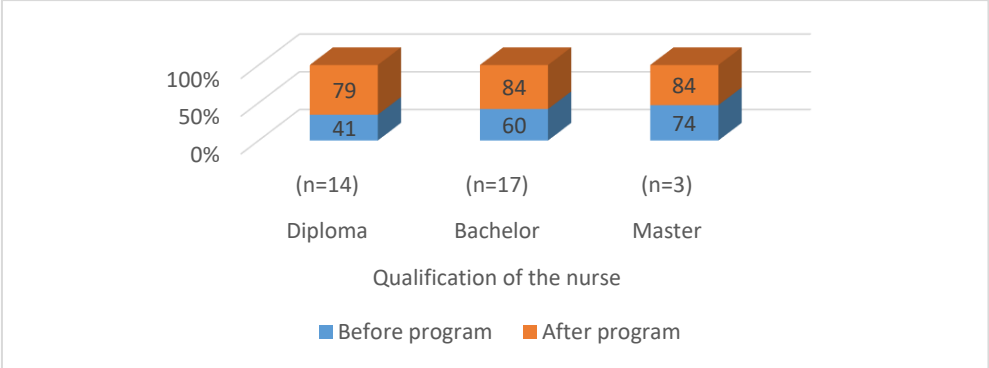


Figure 3. CVP measurement scores before and after the program according to nurses' qualifications



Impact of Educational Qualifications on Nurses' Performance in CVP Measurement

The findings presented here shed light on the performance scores of nurses holding a diploma degree in CVP measurement before and after the educational program. Prior to the program, the scores of nurses with diploma degrees exhibited variability, ranging from 41 to 61 out of a possible total score of 84. The calculated mean and standard deviation for this group were 50.47 ± 6.50, signifying the central tendency and spread of scores. Following the educational program, the performance scores of these nurses showcased a notable improvement, varying from 57 to 79. The mean and standard deviation after the program were calculated as 73.53 ± 6.52.

These results underscore the substantial enhancement in CVP measurement proficiency among nurses holding a diploma degree after participating in the educational program.

In this section, we present a comparative analysis of the performance scores of nurses categorized by their educational qualifications in the context

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of CVP measurement before and after the educational program. The scores of nurses with a bachelor's degree prior to the program ranged from 60 to 68. The mean score was 63.43, with a standard deviation of 2.88. After the program, the performance scores for this group improved, ranging from 80 to 84. The mean score increased to 82.14, with a reduced standard deviation of 1.35.

Prior to the program, nurses holding a master's degree achieved scores ranging from 74 to 77. The mean score was 75.33, with a standard deviation of 1.53. Following the program, the performance scores in this group reached a maximum of 84, with a mean score of 84.0 and a standard deviation of 0.0.

Collectively, the results reveal a statistically significant relationship between the implementation of the educational program and the performance scores of nurses in all educational qualification categories ($P<0.001$). This demonstrates the program's efficacy in enhancing CVP measurement proficiency across different educational backgrounds. (figure 3).

In the context of educational qualifications, this section delves into the performance scores of nurses in CVP measurement before and after the educational program. Before the program, an interesting trend emerged with regard to nurses' performance based on their educational qualifications. Nurses with a master's degree demonstrated the highest minimum and maximum scores, with values of 77 and 84, respectively. In contrast, nurses with a diploma had the lowest minimum and maximum scores, scoring 41 and 57, respectively. Following the program, an overall improvement in performance scores was noted across various educational qualifications. The highest scores, attaining a maximum of 84, were achieved by nurses with a master's degree. On the other hand, nurses with a diploma showed the lowest scores, with a minimum of 79.

Notably, a statistically significant relationship was identified across all performance measures in this procedure both before and after the implementation of the educational program ($p<0.001$). These findings underscore the program's efficacy in enhancing performance regardless of the nurses' educational qualifications. (figure 3).

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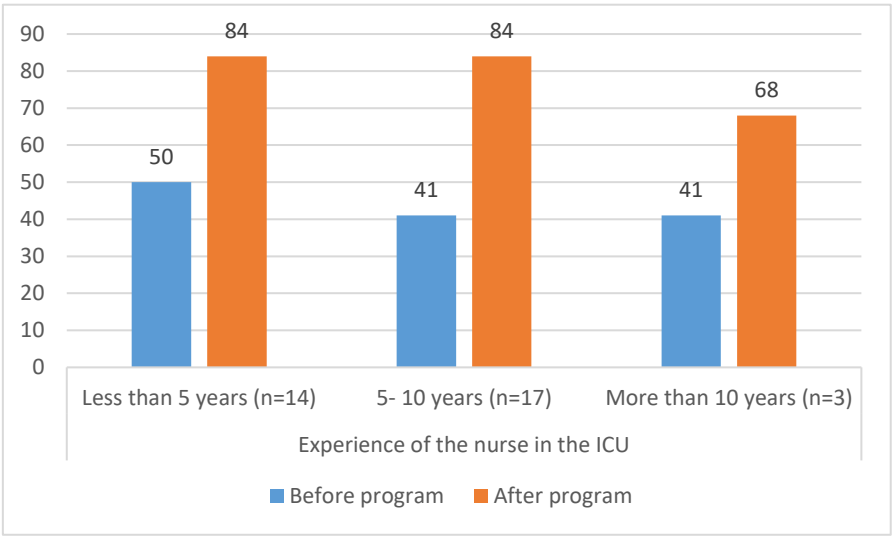
Figure 4. CVP measurement scores before and after the program according to nurses' experiences



Impact of nursing experience on CVP measurement scores before and after the program

This section delves into the performance scores of nurses in CVP measurement, with a focus on their years of nursing experience both before and after the educational program. Prior to the program, nurses with less than five years of experience exhibited performance scores ranging from 50 to 77 out of a total score of 84. The mean score was 59.61, with a standard deviation of 7.37. After the program, their performance scores improved, with a range of 77 to 84. The mean score increased to 79.52, with a reduced standard deviation of 2.15.

Before the program, nurses with five to ten years of experience had scores ranging from 41 to 65. The mean score was 51.71, with a standard deviation of 7.74. Following the program, their scores significantly improved, ranging from 69 to 84. The mean score also increased to 79.52, with a standard deviation of 2.15.

Before the program, nurses with more than ten years of experience had scores ranging from 41 to 44. The mean score was 42.25, with a standard deviation of 1.04. Post-program, their performance scores improved substantially, with a range of 57 to 68. The mean score increased to 79.52, accompanied by a standard deviation of 2.15.

The results underline a statistically significant relationship between nursing experience and performance scores in CVP measurement before and after the implementation of the educational program ($P<0.001$). This

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highlights the program's efficacy in enhancing performance across various experience levels. (figure 4).

Discussion

CVP measurement remains a crucial practice in the Intensive Care Unit (ICU), with critical care nurses taking on the responsibility for this vital task. Proficiency in CVP monitoring is imperative, and only healthcare professionals possessing the necessary knowledge and skills should undertake this procedure (Hill 2018, Hill and Smith 2021).

In this study, the observation of nurses during CVP measurement revealed disparities in the implementation of patient care and safety measures. The results of the study demonstrated a statistically significant relationship in the performance of nurses before and after the implementation of an educational program aimed at enhancing CVP measurement proficiency.

An age-based analysis of nurses' performance prior to the educational program revealed interesting trends. Nurses in the age group of 20-24 years exhibited the highest minimum scores, while nurses in the 25-29 age group achieved the highest maximum scores. Conversely, nurses in the age groups of 25-30, 30-35, and those aged over 35 obtained the lowest minimum scores. Furthermore, nurses aged over 35 demonstrated the lowest minimum and maximum scores.

Following the educational program, nurses in all age groups displayed enhanced performance. The highest minimum scores were achieved by nurses in the 20-24 age group, while the highest maximum scores were attained by nurses in the 25-29 and 30-35 age groups. In contrast, nurses aged over 35 continued to exhibit the lowest minimum and maximum scores.

Overall, this study established a statistically significant relationship in all aspects of the CVP measurement procedure both before and after the implementation of the educational program ($p<0.001$). These findings highlight the program's effectiveness in improving nursing performance and patient safety in CVP measurement, while also emphasizing the variations observed across age groups.

Regarding nurses' qualifications, this section delves into the performance of nurses in CVP measurement, categorized by their educational qualifications, both before and after the educational program. Prior to the program, the study unveiled a distinct pattern in nurses' performance based on their educational qualifications. Nurses with a master's degree exhibited the highest scores, while nurses holding a diploma degree recorded the lowest minimum and maximum scores. Following the implementation of the educational program, nurses across all qualification categories experienced performance enhancements. Notably, nurses with master's and bachelor's

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degrees achieved the highest scores, while the lowest scores were observed among nurses with diploma qualifications.

Collectively, this study established a statistically significant relationship in all aspects of the CVP measurement procedure both before and after the educational program ($p<0.001$). These findings underscore the program's effectiveness in improving nursing performance across various qualification categories, reducing initial disparities, and emphasizing the importance of educational interventions in healthcare settings.

Regarding the nurses' experience, this section explores the performance of nurses in CVP measurement, categorized according to their years of nursing experience, both before and after the educational program. Prior to the program, an interesting pattern emerged in nurses' performance based on their years of experience. Nurses with less than 5 years of experience achieved the highest minimum and maximum scores. In contrast, nurses with 5-10 years of experience and those with more than 10 years of experience recorded the lowest minimum scores. Additionally, nurses with more than 10 years of experience obtained the lowest maximum scores.

Following the implementation of the educational program, nurses across various experience levels exhibited enhanced performance. The highest minimum score was observed among nurses with less than 5 years of experience, while the highest maximum scores were attained by nurses in both the less than 5 years and 5-10 years of experience groups. In contrast, nurses with more than 10 years of experience continued to display lower scores.

This study established a statistically significant relationship in all aspects of the CVP measurement procedure both before and after the implementation of the educational program ($p<0.001$). These findings underscore the program's effectiveness in improving nursing performance across different years of experience, thus emphasizing the importance of ongoing education and professional development in healthcare settings.

The findings of our study align with the insights provided by Hill in 2018. Hill emphasized the importance of nurses possessing not only sound knowledge and practice but also their adherence to local policies and procedures for CVP monitoring, as well as stringent infection prevention and control protocols. Our study reinforces the significance of these principles in maintaining high standards of patient care and safety during CVP measurements.

The outcomes of our study were in concurrence with the findings reported by Gerard R. in 2019. This alignment reinforces the robustness and consistency of the observations made in our study, further substantiating the validity and relevance of our research within the existing body of knowledge.

It is noteworthy that the findings of this study diverge from those of prior research. Specifically, this study's results contrast with the observations

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made by Magder in 2005, where it was reported that the clinical application of CVP measurements indicated a high level of competence among nursing staff in CVP measurement. Similarly, the outcomes of the present study differ from those of Cox, Johnson, et al. in 2005, who reported high proficiency levels among the studied nurses in enhancing patient safety during CVP measurement.

These disparities emphasize the potential variations in clinical practice and nursing performance in CVP measurement across different settings and over time. It underscores the importance of ongoing research to understand and address such differences for the continuous improvement of patient care and safety.

This study's findings diverge from those reported by Magder in 2006. Magder's results indicated that most nurses possessed proficient skills and a strong understanding of CVP measurement techniques. In contrast, the current study's findings suggest variations in nurses' performance in CVP measurement.

These disparities underscore the variability in nursing skills and knowledge regarding CVP measurement across different studies and settings. It is crucial to acknowledge and investigate such differences to improve patient care and safety consistently.

Conclusion and recommendations

In conclusion, this study conducted a rigorous assessment of the influence of a comprehensive teaching program on the proficiency of nurses in CVP measurement within the critical care units of Syria. The findings revealed a prevalent deficiency in both the knowledge and performance of nurses in executing the CVP measurement procedure. This deficiency was further compounded by the absence of sufficient training programs, the burden of high patient volumes, time constraints, and various other contributing factors.

The study's results highlight the critical need for targeted interventions aimed at enhancing nurses' competence and performance in CVP measurement. These interventions should encompass the development and implementation of structured educational programs, optimized patient workload management, and effective time management strategies. Additionally, fostering an environment conducive to continuous professional development is imperative to address the identified deficits and improve the overall quality of care.

The study's implications extend beyond its specific setting, serving as a call to action for healthcare institutions worldwide to prioritize the education, training, and well-being of their critical care nursing staff. By doing so, healthcare organizations can ensure that nurses are adequately equipped to

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meet the demands of providing high-quality care in critical settings. However, the implementation of the program resulted in notable enhancements in nurses' performance and their adherence to the prescribed guidelines and protocols. The nurses exhibited heightened satisfaction with their improved capabilities and the availability of updated guidance.

Furthermore, the study unveiled noteworthy and diverse improvements in both the knowledge and performance of nurses, with variations influenced by age, qualifications, and years of experience. These improvements materialized subsequent to their active participation in the educational program.

This observation accentuates the necessity for customized support and training initiatives, which can be tailored to address the unique areas of deficiency specific to individual nurses. Such personalized approaches can lead to a holistic enhancement in performance and competence across the nursing workforce, fostering a comprehensive and equitable growth in the quality of patient care.

The study's implications are significant. It is imperative to prioritize efforts aimed at enhancing nurses' knowledge and practices. Additionally, raising awareness among nurses about the importance of quality care and patient safety is crucial. Inadequate knowledge and practices among nurses have far-reaching implications, adversely affecting the quality of care and patient safety. Therefore, it is incumbent upon healthcare institutions to provide the necessary support, educational programs, and training to equip nurses with the skills and knowledge required to deliver the highest quality care and ensure patient safety. (RN Thompson et al., 2007; Sharma, Sarin et al., 2014; Ahmed, 2019).

In relation to nurses' qualifications, the study unveiled a discernible pattern in the quality of care provision. Nurses with master's degrees consistently demonstrated the highest level of performance. Following closely were nurses with bachelor's degrees, and lastly, nurses with diplomas. This observation underscores the pivotal role of educational qualifications in shaping the capacity to deliver high-quality care. It reaffirms the importance of advancing one's education and training in nursing, as it is closely linked to the ability to provide superior care to patients.

In consideration of nurses' age, the study's findings elucidated a clear pattern in performance. Nurses falling within the age groups of 20-24 and 25-29 consistently excelled in their performance, demonstrating commendable outcomes. In contrast, nurses aged over 35 years consistently exhibited less favorable results. These findings underscore the role of age as a factor influencing nursing performance. The data suggests that younger nurses tend to perform more effectively in the context of the studied procedures,

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emphasizing the importance of considering age-related dynamics when optimizing the performance of nursing staff.

Furthermore, the study exposed a conspicuous discrepancy in performance among nurses, contingent on their accumulated years of experience. Nurses with less than five years of experience prominently displayed the highest level of performance, closely followed by those with five to ten years of experience. In contrast, nurses with more than ten years of experience consistently exhibited the least favorable performance. These findings illuminate the profound impact of experience on nursing performance. They accentuate the notion that, in the context of the studied procedures, less-experienced nurses tend to excel in their performance, and the expertise gained over more extended periods may not necessarily correlate with superior performance.

These observations underscore the pivotal role of qualifications, age, and experience in shaping nurses' performance. Their profound impact has far-reaching implications for the delivery of high-quality care. Understanding and recognizing these discernible patterns is of paramount importance for healthcare institutions committed to the pursuit of optimal patient care quality. By acknowledging and addressing the nuances associated with qualifications, age, and experience, healthcare institutions can better tailor their strategies and initiatives to maximize nursing performance, thus elevating the overall quality of care provided to patients.

Nursing staff should focus on participating in and attending educational and training programs to improve their knowledge and performance regarding all the necessary skills and procedures needed in the intensive care units. This is aimed at providing high-quality care for critically ill patients and also improving patient safety. By improving these methods and giving much more educational and training support, the quality of care and safety can be improved (Ahmed, 2019; Bayatmanesh Zagheri Tafreshi et al., 2019).

On the other hand, there was a lack of written policies and procedures, a lack of staff training, a lack of leadership for patient safety initiatives, a lack of improving reporting systems, and a lack of resources, knowledge, and practices of the nursing staff (Ahmed, 2019).

In light of the study's findings, several crucial recommendations emerge, serving as imperative guidelines for healthcare organizations:

- Development of Teaching and Training Programs: Healthcare organizations should prioritize the creation and implementation of comprehensive teaching and training programs for their nursing staff. These programs are instrumental in ensuring the provision of high-quality care, promoting patient safety, and keeping nurses updated with the latest advancements in healthcare.

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- Utilization of Experienced and Qualified Nurses: Nursing procedures, especially those critical to patient care and safety, should be entrusted to experienced and highly qualified nurses. This strategic allocation of responsibilities minimizes the occurrence of hazards and enhances the overall quality of patient care.
- Regular Updates on Safety and Prevention: To maintain a culture of safety and hazard prevention, healthcare institutions must provide their critical care nurses with regular updates. These updates should encompass the latest insights, protocols, and best practices in patient safety and infection control.
- Documentation of Serious Complications: It is imperative that nurses diligently document any serious complications that may arise during patient care. This documentation not only aids in the management of adverse events but also contributes to continuous quality improvement.
- Development of Policies and Procedures: Healthcare organizations should commit to the development and implementation of robust policies and procedures related to best practices and infection control within intensive care units. These guidelines are indispensable for maintaining the highest standards of care and ensuring patient safety.

These recommendations collectively represent a strategic roadmap for healthcare organizations, reinforcing their commitment to the provision of high-quality care, the promotion of patient safety, and the continuous improvement of healthcare practices within the critical care setting.

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