

Effect of Educational Intervention on Critical Care Nurses' Adherence to the Clinical Practice Guidelines for Preventing Venous Thromboembolism in Critically Ill Patients

Naglaa EL Mokadem*, Shimaa EL-Sayed

Assistant Professor of Critical Care Nursing, Lecturer of Critical Care Nursing, Critical Care Nursing Department, Menoufia University

*Corresponding author: naglaae@yahoo.com

Received August 16, 2019; Revised September 20, 2019; Accepted October 07, 2019

Abstract Background: Critically ill patients are at high risk for developing DVT. The prevalence of DVT and PE is underestimated in the ICU, as it is often clinically silent, especially in sedated and mechanically ventilated patients. ICU acquired thromboembolic events are difficult to diagnose, as they may mimic many other diseases. Identifying patient populations at risk for DVT and implementing evidence-based guidelines can decrease the number of unpleasant effects of this disease. Although the supporting evidence about the beneficial effect of the clinical guidelines has been in place for a long time, the guidelines have been greatly underused. Aim: To examine the effect of educational intervention on critical care nurses' adherence to the clinical practice guidelines for preventing venous thromboembolism in critically ill patients. Methods: Design: A quasi-experimental design (pre/post test) was used. Setting: The study was conducted at different ICUs at Menoufia University Hospital, Shebin El-Kom district, Menoufia Governorate. Sample: A convenience sample of 192 critical care nurses working at different ICUs who provide direct nursing care to critically ill patients at Shebin El-Kom, Menoufia University Hospital were recruited for this study. Nurses participated in the study were approached over an eight week period. One hundred and sixty-seven nurses participated in the study. Novel nurses who have less than 6 months experience in ICU were excluded because they did not have enough experience about clinical practice guidelines for DVT prevention. Three tools were used for data collection: a) Demographic sheet; b) Availability of DVT Prevention Clinical Practice Guidelines and c) The Clinical Nurses Practice Guidelines of DVT Prevention Observational Checklist (CNPNG). Results: Clinical practice guidelines for DVT prevention is not available in the ICUs and the participated nurses have not been oriented or received any information about the practice guidelines. As a consequence, they are not implementing the guidelines in their daily practice. Also, there was a statistically significant improvement in the critical care nurses' adherence to the clinical practice guidelines for preventing DVT post-intervention compared with pre-intervention. Recommendations: Accurate individualized assessment of VTE risk is critical to optimize prophylaxis. VTE risk assessment and prophylaxis recommendations should be integrated into hospital protocols, to be easier for nurses to comply with guidelines than if they are not standard practice.

Keywords: *venous thromboembolism, clinical practice guidelines, DVT prevention strategies, nursing intervention*

Cite This Article: Naglaa EL Mokadem, and Shimaa EL-Sayed, "Effect of Educational Intervention on Critical Care Nurses' Adherence to the Clinical Practice Guidelines for Preventing Venous Thromboembolism in Critically Ill Patients." *American Journal of Nursing Research*, vol. 7, no. 6 (2019): 974-982. doi: 10.12691/ajnr-7-6-10.

1. Introduction

Deep Vein Thrombosis (DVT) is an important cause of morbidity and mortality in critically ill patients. The risk of DVT and its prevention have been poorly characterized in this population [1]. Critically ill patients are at high risk of DVT as they are susceptible to both general risks factors of DVT as well as those specific to ICU patients,

such as advanced age, serious medical illnesses, recent surgical procedures, sepsis, paralysis, sedation, immobilization, vasopressors, trauma, heart failure, and central venous lines [2]. In addition, critical illness activates the coagulation cascade that may mediate the increased likelihood of DVT [3]. Moreover, the prevalence of DVT and Pulmonary Embolism (PE) is underestimated in the ICU, as it is often clinically silent, especially in sedated and mechanically ventilated patients. ICU acquired thromboembolic events are difficult to

diagnose as they can mimic several other diseases [4]. Pulmonary Embolism is estimated to occur in up to 50% of DVT cases and has a mortality rate of up to 30% [5]. Unfortunately, up to 30% of patients who survive the first occurrence of a DVT/PE develop another DVT within 10 years [5]. DVT/PE in critically ill patients can cause episodes of hemodynamic instability, hypoxia, and/or difficulty weaning from mechanical ventilation [6].

It has been estimated that the prevalence of DVT in neurosurgical patients is 22% to 35%. Ten percent to 30% of patients admitted to medical and surgical intensive care units developed DVT within the first week of admission and 60% of trauma patients developed DVT within the first two weeks of admission. [7]. The average incidence of DVT can be much higher in certain groups. VTE occurs in 24% of patients with an acute myocardial infarction, and the incidence of DVT after a stroke can be as high as 55% [8]. Cancer is a major thrombotic risk factor because of the hypercoagulable state induced by the malignancy and increased risk associated with cancer surgery and chemotherapy [9]. In Egypt, the incidence was 5 million cases of DVT (one to two per 1,000) in 2010. Ten percent (10%) of these resulted in pulmonary embolism and 10% died due to incorrect diagnosis. In critically ill Egyptian patients DVT incidence rates varied from 6.6% to 27.3% [10].

Venous thromboembolism prevention is a key safety measure and a major Key Performance Indicator (KPI) and identified as a high priority area. According to the American Heart Association (AHA), adequate prevention measures in high-risk patients can prevent DVT in one of 10 patients. Therefore, DVT prevention is highly beneficial for critically ill patients because of its potential for saving patients' lives and decreasing healthcare costs.

Interventions to prevent DVT begin at the time of admission and should be continued until patients' discharge. Nurses need to understand the importance of using clinical practice guidelines or protocols that can lead to improved outcomes for patients at risk and DVT preventive strategies. The role of critical care nurses in detecting and preventing DVT is important because observation and risk assessment of patients can result in early and prompt diagnosis and thus treatment with a consequent decrease in life-threatening complications. Accordingly, ICU nurses need to increase the effectiveness of assessment, apply timely preventive measures, and comply with the DVT prevention protocol.

Evidence based prevention interventions are categorized as mechanical and chemical (pharmacologic) prophylaxis. Evidence comparing mechanical prophylaxis with pharmacological prophylaxis for Venous Thromboembolism (VTE) prevention in critically ill patients is not consistent [11]. It has been reported that critically ill patients receiving pharmacological prophylaxis had a lower risk of death than did patients receiving mechanical prophylaxis [12]. Whereas, in a meta-analysis done to evaluate VTE prophylaxis in trauma patients revealed that a combination of mechanical prophylaxis and pharmacological prophylaxis is thought to potentiate the overall efficacy of VTE prevention [13].

Another meta-analysis done to examine VTE prevention in hospitalized patients indicated that pharmacological

prophylaxis combined with Intermittent Pneumatic Compression (IPC) devices was more effective than IPC alone [14]. Results of recent randomized clinical trials in critically ill patients also suggest that combination therapy is superior to either pharmacological or mechanical prophylaxis alone [11,15]. As a consequence, it has been decided to adapt the American College of Chest Physicians (ACCP) clinical practice guidelines for the DVT prevention recommended preventive measures in the current study because it includes both pharmacological and mechanical preventive measures.

The American College of Chest Physicians (ACCP) clinical practice guidelines for the DVT prevention recommended the application of elastic compression stockings, the use of Intermittent Pneumatic Compression (IPC) devices, special body positioning and exercise or calf muscle exercises, and frequent ambulation. A further method to prevent venous thrombosis in ICU patients is administration of subcutaneous unfractionated or Low Molecular Weight Heparin [16]. Despite the proven effectiveness of DVT prophylaxis guidelines, patients at-risk either do not receive any DVT prophylaxis or receive inappropriate prophylaxis in terms of type, dose, and/or duration. Unfortunately, effective DVT prophylaxis is available but underutilized [17] and there is inconsistency in the application of clinical practice guidelines.

Nurses' lack of knowledge may be a barrier to adhere to clinical practice guidelines for DVT prevention. However, there is evidence that practical guidelines, staff development programs and multi module programs led to improved nurses' adherence to clinical practice guidelines and substantial reduction of DVT [18]. Empowering critical care nurses with the guidelines would allow the nurse to take responsibility for assessing patients for DVT and provide appropriate prophylaxis. Aim of the Study

The aim of the current study was to examine the effect of educational intervention on critical care nurses' adherence to the clinical practice guidelines for preventing venous thromboembolism in critically ill patients

2. Hypotheses

1-There is a discrepancy between the critical care nurses' actual practices and the recommended venous thromboembolism prevention clinical practice guidelines.

2-After receiving the educational intervention, there is an improvement in critical care nurses' adherence to the venous thromboembolism prevention clinical practice guidelines.

3-There is a relationship between the critical care nurses' adherence to practice of the DVT prevention guidelines and the demographic characteristics of the studied nurses.

3. Methods

Research Design: A quasi experimental design (pre/post test) was used to test the study hypotheses.

Setting: The study was conducted at different ICUs (Cronary Care Unit, Medical, Surgical and Trauma ICUs)

at Menoufia University Hospital, Shebin El-Kom District, Menoufia Governorate.

Sample: A convenience sample of one hundred and ninety two critical care nurses working at different ICUs who provide direct nursing care to critically ill patients at Shebin El-Kom, Menoufia University Hospital were recruited for this study. Nurses who participated in the study were approached over an eight week period from the beginning of February 2019 to the end of April 2019. A total of one hundred and sixty-seven nurses participated in the study. Novel nurses who have less than six months of experience in ICU were excluded because they did not have enough experience about clinical practice guidelines for DVT prevention.

3.1. Tools of Data Collection:

I- Socio-Demographic Data Sheet to collect data about age, sex, level of education, years of experience and specialty.

II- Availability of DVT Prevention Clinical Practice Guidelines.

This is a semi-structured questionnaire designed by the researcher to measure critical care nurses' knowledge about the availability of the DVT prevention clinical practice guidelines in their units. This tool consisted of eight questions including the following: 1) Is there a clinical practice guideline for DVT prevention available in the unit? 2) If yes, do you have access to the clinical practice guidelines? 3) Have you been oriented to the clinical practice guidelines in your unit? 4) Did you receive any instructions about the clinical practice guidelines before? 5) Did you participate in the development of the clinical practice guidelines? 6) Are you familiar with the recent recommended DVT preventive measures? 7) If yes, how often do you practice these measures in your unit? 8) Is there a way to evaluate if nurses are implementing these preventive measures in ICUs?

The validity of the tool was tested for the content validity by a jury of three experts in the field of critical care medicine and critical care nursing specialty to ascertain accuracy.

III- The Clinical Nurses Practice Guidelines of DVT Prevention Observational Checklist (CNPG) was used to assess the critical care nurses practice regarding DVT prevention clinical practice guidelines. The CNPG consisted of nineteen items developed by the American College of Chest Physicians (ACCP) guidelines for the prevention of DVT (2012). The CNPG includes risk factors and preventive measures such as physical therapy which includes early movement and get up and walk around every 20 minutes, leg elevation, foot flexing, and active and passive range of motion exercises. Mechanical measures of DVT prevention focuses on: a) how often nurses apply Graduated Compression Stockings (GCS) and Intermittent Pneumatic Compression (IPC) and for what duration; and the does and side effect of the anticoagulant therapy, such as Low Molecular Weight Heparin (LMWH).

Every "Yes" carries one mark and every "No" carries a zero mark. The maximum score is 19 and are categorized as: Good practice: 13-19 (above 66.6%), Average practice: 6-12 (33.3 - 66.6%) Poor practice: 0-5 (below 33%).

4. Data Collection Procedure

4.1. Ethical Consideration

An official permission for conducting the study was obtained from the Faculty of Nursing, Research and Ethics Committee and Menoufia University Hospital directors after explaining the purpose of the study. An oral consent was obtained from the nurses who met the study inclusion criteria to participate in the study. The researcher explained the purpose of the study to the nurses. Nurses were assured that their participation in the study is voluntary and that they can withdraw from the study at any time.

4.2. Reliability of the Tools

The developed and validated tool was tested for reliability on a sample of 17 nurses. Test/retest reliability results using Cronbach Alpha revealed that all items are significantly differed and has a correlation coefficient above the threshold of significance ($r = 0.89$). On the other hand, the alpha value for the performance checklist in the sample was ($r = 0.87$) which indicates strong reliability of both tools.

4.3. Pilot Study

A pilot study was conducted on 10% of the study sample (17 nurses) to test the practicality and applicability of the questionnaire and to estimate the time needed to fill in the questionnaire. Nurses participating in the pilot study were excluded from the final data analysis.

4.4. Data Collection Procedure

The critical care nurses who enrolled in the study were interviewed individually by the researcher in the different ICUs to complete the study questionnaires. The Socio-Demographic sheet and the designed questions about the availability of the DVT prevention clinical practice guidelines were collected by the researcher. Also, the researcher used the observational check-list to record the critical care nurses' adherence to the DVT prevention clinical practice guidelines pre and post-intervention. All critical care nurses were observed during the three shifts on a daily basis. The average time needed for the completion of each observational checklist took about 25 – 35 minutes. Every nurse was observed at least three times. The first measurement time was two weeks after the educational session, the second time was after four weeks and the third time was after six weeks. The average score of the three measurements was calculated.

All critical care nurses were divided into small groups (10 groups), each group consisted of 16 to 17 nurses. Each group of nurses chose the most convenient time (10 a.m. to 11 a.m.) for the morning shift and (4 p.m. to 5 p.m.) for the afternoon shift. These times were determined by the nurses as the most suitable time during the day. The duration of the educational session ranged from 30 to 45 minutes.

The educational session contents explained the following items:

1- Physical Prophylactic which includes leg elevation and encouraging active and passive exercise as the most effective method in preventing venous stasis. Leg elevation allows the superficial and tibial veins to empty rapidly and to remain collapsed. When the patient is on bed rest, the feet and lower legs should be elevated 10 minutes for several times above the level of the heart. Active and passive leg exercises, particularly those involving calf muscles, should be performed to increase venous flow. Leg exercises such as foot flexing and stretching the legs should be performed every 20 minutes. Once ambulatory, patients were instructed to avoid sitting for more than two hours at a time and walk at least 10 minutes every one to two hours. Deep breathing exercises (inhale deeply through the nose for three seconds and exhale slowly through pursed lips for five to seven seconds) are beneficial because they produce increased negative pressure in the thorax, which assists in emptying the large veins. Drinking plenty of water (at least 8 to 10 glass per day) is recommended (if not contraindicated).

2- Mechanical Measures of thromboprophylaxis: Mechanical thromboprophylaxis should be used with high- risk patients of thrombosis. Mechanical methods of thromboprophylaxis act by reducing venous stasis in the leg. The major advantage of these methods is the avoidance of systemic anticoagulation and the risk of bleeding. Mechanical methods include Graduated Elastic Compression Stockings (GECS), (either thigh or calf length) and Intermittent Pneumatic Compression (IPC) devices.

Graduated Elastic Compression Stockings (GECS) reduce venous stasis by applying a graded degree of compression to the ankle and calf, with greater pressure being applied distally. Compression stockings are made of a special elastic fabric which are very tight at the ankle and are less tight as the stocking moves up the leg. This graduated tightness helps the leg muscles squeeze fluid up the leg, which improves blood flow from the leg back to the heart and decreases leg swelling and pain.

Compression stockings can be worn in the morning and removed at bed time. Nurses should make sure that the skin is dry. Talcum powder can help make the stocking glide on more smoothly. For knee length stockings, once on properly, the top of the stocking should be about one inch below the bend of the knee. When the stockings are removed, the skin is inspected for signs of irritation. The calves are examined for possible tenderness. Reporting any skin changes or signs of tenderness is a must. Stockings are contraindicated in patients with severe pitting edema because they can produce severe pitting at the knee.

Intermittent Pneumatic Compression (IPC) Devices: These devices can be used with elastic compression stockings to prevent deep vein thrombosis. These devices can increase blood velocity beyond that produced by the stockings. Nurses should make sure legs are dry or apply a light dusting of powder; pull the elastic stocking gently over the leg and remove all wrinkles; assess toes for circulation and warmth; check area at top of elastic stocking for binding; check pressure of elastic stockings regularly; remove elastic stockings regularly (every 8 hours for 30 minutes) for skin inspection, look for signs of irritation or calf tenderness and cleansing. Nurses identify

contraindication of elastic stockings such as skin ulceration, massive leg edema, recent skin graft, severe dermatitis and lower leg trauma.

3- Anticoagulant therapy: Subcutaneous low dose unfractionated heparin is effective for thromboprophylaxis in critically ill patients but its efficacy and safety profiles suggest it should only be used when Low Molecular Weight Heparin (LMWHs) are contraindicated. When using unfractionated heparin, a dose of 5000 units subcutaneously every eight hours is preferred to 5000 units twice daily. Periodic coagulation tests and hematocrit levels are obtained. Low Molecular Weight Heparin is indicated in all patients admitted to ICU, and could be used where heparin is contraindicated (previous heparin-induced thrombocytopenia).

5. Results

5.1. Characteristics of the Sample

One hundred and sixty-seven critical care nurses working at different ICUs at Shebin El-Kom Menoufia University Hospital were approached over an eight-week period from the beginning of February to the end of April 2019. Nurses' age ranged from 20 to 40 years old, 67.1% were females and 32.9% were males. Regarding the educational level, 42.4% were diploma nurse and 28.4% were nurses with a bachelor's degree; 43% have less than one year of experience and 28.7% have between 6 to 10 years of experience. More than half (52%) of the participated nurses are working in trauma ICU. See [Table 1](#).

Table 1. Socio-Demographic Characteristic of the Studied Sample

Socio-Demographic	Studied Sample N (167)	
	No.	%
Age (years):		
• Mean \pm SD	24.41 \pm 4.59	
• Range	20.0 – 40.0	
Age		
• 20-24	89	53.3
• 25-30	66	39.5
• More than 30	12	7.2
Gender		
• Male	55	32.9
• Female	112	67.1
Level of Education		
• Diploma	125	74.9
• Bachelor	42	25.1
Years of Experiences		
• Less than one year	72	43.1
• 1-5 years	34	20.4
• 6-10 years	48	28.7
• More than 10 years	13	7.8
Place of Work		
• Trauma ICU	87	52.1
• Medical ICU	33	19.7
• Surgical ICU	25	15.0
• Coronary Care Unit CCU	22	13.2

Table 2. Availability of the DVT Prevention Clinical Practice Guidelines

Questions	Responses	NO. (%)
1. Are there a DVT prevention clinical practice guidelines available in the unit?	Yes	9 (5.4)
	No	158 (94.6)
2. Do you have access to DVT prevention clinical practice guidelines?	Yes	0 (0.0)
	No	167 (100)
3. Have you been oriented to the DVT prevention clinical practice guidelines?	Yes	5 (3.0)
	No	162 (97.0)
4. Did you receive any instruction about the DVT prevention clinical practice guidelines before?	Yes	9 (5.4)
	No	158 (94.6)
5. Did you participate in the development of the DVT prevention clinical practice guidelines?	Yes	3 (1.8)
	No	164 (98.2)
6. Are you familiar with the DVT preventive measures?	Yes	9 (5.4)
	No	158 (94.6)
7. Do you practice these measures?	Yes	0 (0.0)
	No	167 (100)
8. Is there a way to evaluate how often critical care nurses implement these preventive measures?	Yes	7 (4.2)
	No	160 (95.8)

Table 3. The Differences between the Nurses' Actual Practice and the Recommended DVT Prevention Clinical Practice Guidelines

DVT Prevention Clinical Practice Guidelines	Studied Group (N=167)		Test of Significant	P Value
	Actual Practice	Recommended Practice		
	Mean ± SD	Mean ± SD		
Total Score of DVT Prevention Clinical Practice Guidelines	6.28±4.95	12.59±7.99	F=379.48	≤0.001 HS

Table 2 illustrated that the majority of the participating nurses (94.6%) did not have DVT prevention clinical practice guidelines in their units. All participating critical care nurses (100%) did not have access to the DVT prevention clinical practice guidelines. The majority of the critical care nurses (97.0 %) had not been oriented to the DVT prevention clinical practice guidelines, 94.6 % did not receive any instructions about the DVT prevention clinical practice guidelines and 98% did not participate in developing the DVT prevention clinical practice

guidelines. In addition, 94.6% of the participating nurses were not familiar with the standards of DVT preventive measures and 100% of the nurses do not practice the DVT preventive measures in the critical care units and 95.8% of the participating nurses reported that there was no way to evaluate the implementation of these measures.

Table 3 revealed that there was a highly statistically significant difference between the participating nurses' actual practice and the recommended DVT prevention clinical practice guidelines, F=379.48 (P ≤ 0.001)

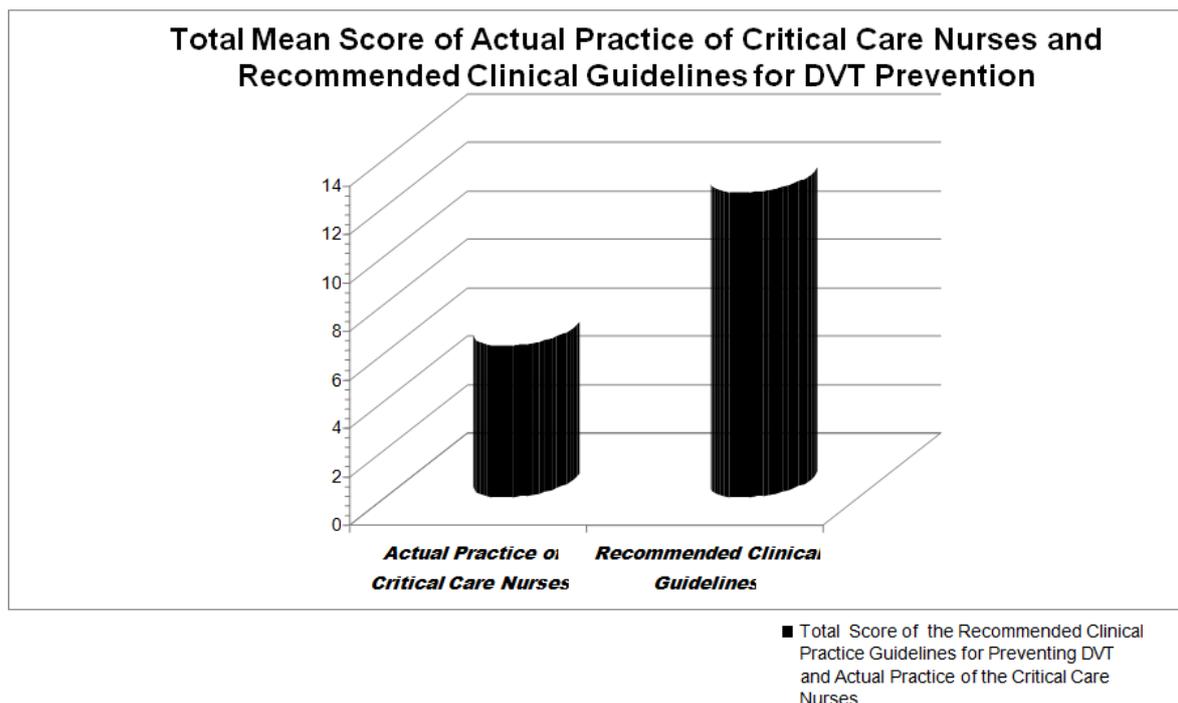


Figure 1. Mean Score of the Recommended Clinical Practice Guidelines for Preventing DVT and Actual Critical Care Nurses' Practice

Figure 1 showed that there was a statistically significant difference between the mean total score of the actual critical care nurses' practice and the recommended clinical practice guidelines for preventing DVT.

Table 4 showed that there was a statistically significant change in the critical care nurses' adherence to the clinical practice guidelines for preventing DVT after receiving the educational intervention compared with pre intervention ($P = \leq 0.001$). The mean score of the critical care nurses classified as good practice was 18.38 ± 1.20 post intervention compared with 15.66 ± 1.84 pre intervention. Also, the mean score of the critical care nurses classified as poor practice was 1.53 ± 1.52 post intervention compared with 1.71 ± 2.0 pre intervention. Whereas, there was a slight change in the mean score of nurses classified as average practice from 8.53 ± 1.63 pre intervention to 8.79 ± 2.03 post intervention.

Figure 2 showed that there was a statistically significant difference in the mean score regarding critical care nurses' adherence to DVT prevention clinical practice guidelines

post intervention. The mean score of good practice of the critical care nurses in the studied sample was 15.66 ± 1.84 pre intervention compared with 18.11 ± 1.56 post intervention. The mean score of the critical care nurses who were classified as poor practice was 1.71 ± 2.0 pre intervention compared with 0.85 ± 1.22 post intervention. There was a very slight change in the mean score of the critical care nurses classified as average practice from the pre to the post intervention, (8.53 ± 1.63 pre intervention and 8.50 ± 1.85 post intervention).

Table 5 shows that there was a highly statistically significant negative correlation between the total mean score of critical care nurses' adherence to practice of DVT prevention guidelines and age, level of education and years of experience post intervention. This indicates that novel nurses with few years of experience were more adhered to implement the DVT preventions clinical practice guidelines. Surprisingly, diploma nurses scored higher adherence than nurses with a bachelor's degree.

Table 4. Effect of the Educational Intervention on Critical Care Nurses' Adherence to the Clinical Practice Guidelines for Preventing DVT

Adherence to Clinical Practice Guidelines for Preventing DVT	Studied Group (N=167)		P Value
	Pre Intervention	Post Intervention	
	Mean ± SD	Mean ± SD	
Good practice	15.66 ± 1.84	18.38 ± 1.20	$P \leq 0.001$
Average practice	8.53 ± 1.63	8.79 ± 2.03	
Poor practice	1.71 ± 2.0	1.53 ± 1.52	

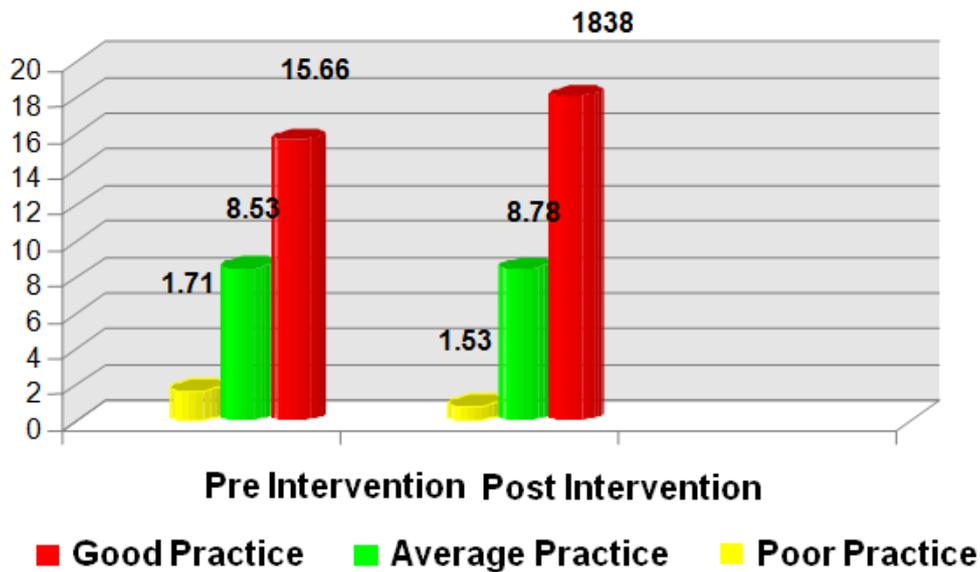


Figure 2. The Mean Score of Critical Care Adherence to DVT Prevention Clinical Practice Guidelines Post Intervention

Table 5. The Correlation between the Total Mean Score of Critical Care Nurses' Adherence to Practice of DVT Prevention Guidelines and Demographic Data

Demographic Variables	Total Score			
	Studied Sample			
	Pre Intervention		Post Intervention	
	Spearman Rho r	P Value	Spearman Rho r	P Value
Age	$r = -0.97$	≤ 0.001	$r = -0.96$	≤ 0.001
Level of Education (Diploma)	-0.90	≤ 0.001	-0.87	≤ 0.001
Years of Experience	-0.85	≤ 0.001	-0.82	≤ 0.001

6. Discussion

Critically ill patients who receive VTE prophylaxis have a significantly lower risk of death than do those who do not receive VTE prophylaxis [19,20]. In a recent study, the incidence of deep vein thrombosis (DVT) in critically ill patients without prophylaxis was 11% [21]. Evidence-based guidelines have been published and implemented; still, no single strategy or set of strategies has markedly improved the delivery of patient-specific VTE prophylaxis [22,23,24]. Identifying patient populations at risk for DVT and implementing evidence-based guidelines can decrease the number of unpleasant effects of this disease [25]. A gap exists between recommendations and actual clinical practice. As a result, many patients are unnecessarily exposed to the risk of a deep vein thrombosis or potentially fatal pulmonary embolism.

The current study hypothesized that there is a discrepancy between the critical care nurses' actual practices of DVT prevention clinical practice guidelines and the recommended guidelines. The findings of the current study revealed that the DVT prevention clinical practice guidelines are not available in the critical care units. The participating critical care nurses have not been oriented or received any information about the practice guidelines. As a consequence, they are not implementing the guidelines in their daily practice. A similar finding has been reported by Antony, et al. (2016) [26] who assessed knowledge and self-reported clinical practice on DVT prevention among staff nurses in India and found that 86% of the staff nurses working in the critical care units had poor practice and 14% had average practice on DVT prevention among hospitalized patients. The researchers concluded that the registered nurses' level of knowledge on the prevention of DVT was very low which strongly affect the practices of critical care nurses working in the ICU.

Similar findings were observed in the descriptive study conducted by Ahamad (2003) among 150 registered nurses working in Iran. Results revealed that only 34.2% of nurses had heard about the importance of preventing DVT. The similarity between these studies and the present study may be due to poor training and lack of continuing nursing education on DVT prevention strategies for staff nurses working in the critical care units.

Educational programs have been shown to improve prophylaxis rates. Evidence showed that after an educational initiatives program to improve compliance, 79% of patients were identified as being at risk for VTE, while the prophylaxis rate improved to 72% [27].

The present study hypothesized that there is an improvement in the critical care nurses' adherence with the clinical practice guidelines for preventing DVT after receiving the educational intervention compared with before the intervention. The findings of the present study revealed that there is a statistically significant improvement in the critical care nurses' adherence to the clinical practice guidelines for preventing DVT post the educational intervention compared with pre intervention.

The findings of the current study are similar to what was reported by [28; 29; 26] who studied the effectiveness of a planned teaching program on clinical practice regarding DVT prevention among Bachelor of Nursing

interns and found a statistically significant difference in the mean scores of a practice post teaching program. Also, the findings of the present study are similar to Songwathana et al., (2011) [7] who evaluated the nursing clinical practice guidelines for preventing DVT in critically ill trauma patients and found a statistically significant improvement in the clinical practice after the intervention compared with the pre intervention. In addition, Bhatti et al., (2012) [16] reported that there was a significant improvement in the nurses' practice and that 70 % of staff nurses had followed adequate DVT prevention clinical practice guidelines in their clinical practice in Singapore General Hospital.

However, the findings of the present study are different from what was reported by Yu, et al., (2007) [30] who found that there were no statistically significant differences of the total score post- intervention compared with pre intervention regarding nurses' compliance with prophylaxis guidelines for DVT prevention. The majority of the staff nurses (85%) had poor practices on DVT prevention. A possible explanation may be due to the increased number and complexity of guidelines which complicates implementation and leads to potential difficulties in clinical practice.

The present study hypothesized that there is a relationship between the critical care nurses' adherence to practice of DVT prevention guidelines and the demographic characteristics of the studied nurses. The findings of the current study revealed that novel nurses with few years of experience demonstrated greater adherence in the implementation of the DVT preventions clinical practice guidelines. The findings of the current study are different from a previous study which indicated that nurses with a bachelor's degree had more correct knowledge than the ones that graduated from the health care vocational high school. In addition, nurses with 6–10 years of experience had higher correct knowledge rates than other groups.

The findings of the present study can be explained by the fact that novel nurses with fewer years of experience are more flexible and open to learning new skills. Moreover, senior nurses with more years of experience with established attitudes are harder to change and are more resistance to changing. Surprisingly, and not in line with previous research, diploma nurses scored higher adherence than nurses with a bachelor's degree. A possible explanation of this finding is that the majority of the participants were diploma nurses (75%).

7. Limitations of the Study

First, the use of a convenience sampling method limited the representativeness and, ultimately, the generalizability of the findings. Second, with a single site study design, nurses were recruited from the ICUs of Menoufia University Hospital. Finally, the short duration of follow up is a major limitation of the present study.

8. Conclusion and Recommendations

Findings of the current study showed that there was an improvement in the critical care nurses' adherence with

the clinical practice guidelines for preventing DVT after receiving the educational intervention comparing with before the intervention.

9. Implications for Nursing Practice

- 1) Accurate individualized assessment of VTE risk is critical to optimize prophylaxis. VTE risk assessment and prophylaxis recommendations should be integrated into hospital protocols, so it will be easier for nurses to comply with guidelines than if they are not standard practice.
- 2) Screening patients for risk factors upon admission can alert critical care nurses to make patient VTE prevention a priority.
- 3) Clinical guidelines on DVT prevention must be available and accessible to nurses in the critical care units to enable nurses to practice these guidelines.
- 4) In services education, clinical teaching and an ongoing training program to prevent DVT should be available for critical care nurses in the units.
- 5) Monitoring critically ill patients for DVT and its fatal complications must be a day to day practice for the novel nurses who are caring for the patients at risk.
- 6) Education, combined with other quality improvement strategies and information technology approaches such as alerts and mandatory computerized clinical decision support, appear to offer the most effective approaches to promote best practice prophylaxis use and prevent patient harm resulting from VTE.

10. Implications for Future Research

There is evidence that long term intervention is more beneficial for sustained change and improvement, [31]. Therefore, expanding the follow up period is recommended to capture the sustainable improvement of the adherence among critical care nurses.

References

- [1] DeMuro JP, Hanna AF. (2013). Prophylaxis of Deep Venous Thrombosis in Trauma Patients: A Review. *J Blood Disorders Transf* 4:151.
- [2] Gould MK, Garcia DA, Wren SM, Karanicolas PJ, Arcelus JI. (2012). Prevention of VTE in nonorthopedic surgical patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest* 141: e227S-77S.
- [3] Cohen MJ, West M (2011). Acute traumatic coagulopathy: from endogenous acute coagulopathy to systemic acquired coagulopathy and back. *J Trauma* .70: S47-49.
- [4] Minet, C., Potton, L., Bonadona, A., Hamidfar-Roy, R., Somohano, C. A., Lugosi, M., Timsit, J. (2015). Venous thromboembolism in the ICU: main
- [5] Centers for Disease Control and Prevention. (2016). Characteristics, diagnosis and thromboprophylaxis. *Critical Care*, 19 (1). Venous thromboembolism (blood clots).
- [6] McLeod, A. G., & Geerts, W. (2011). Venous thromboembolism prophylaxis in critically ill patients. *Critical care clinics*, 27 (4), 765-780.
- [7] Songwathana P, Promlek K, and Naka K, (2011). Evaluation of a clinical nursing practice guideline for preventing deep vein thrombosis in critically ill trauma patients. *Australasian Emergency Nursing Journal*. Volume 14, Issue 4, November 2011, Pages 232-239
- [8] Geerts WH, Heit JA, Clagett P, et al. (2001). Prevention of thromboembolism. *Chest*; 119: 132S-175S.
- [9] Geerts WH, Pineo GF, Heit JA, et al. (2004). Prevention of venous thromboembolism: the Seventh ACCP Conference on Antithrombotic and Thrombolytic Therapy. *Chest*; 126(3 Suppl): 338S-400S.
- [10] Abdel-Aziz, A., & Elfawal, M. A. (2015). Incidence of deep venous thrombosis in stroke patients in medical intensive care unit Zagazig University Hospitals, Egypt. *Zagazig University Medical Journal*, 20(1), 88-96.
- [11] Gaspard D, Vito K, Schorr C, et al. (2016). Comparison of chemical and mechanical prophylaxis of venous thromboembolism in nonsurgical mechanically ventilated patients. *Thrombosis*. 2015; 2015: 849142. Epub 2015 Nov 22. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4670688/>. Accessed July 15, [level C]
- [12] Lilly CM, Liu X, Badawi O, Franey CS, Zuckerman IH. (2014). Thrombosis prophylaxis and mortality risk among critically ill adults. *Chest*. 146(1):51-57.
- [13] Barrera LM, Perel P, Ker K, et al (2013). Thromboprophylaxis for trauma patients. *Cochrane Database Syst Rev*. 3:CD008308. [level A].
- [14] Ho KM, Tan JA (2013). Stratified meta-analysis of intermittent pneumatic compression of the lower limbs to prevent venous thromboembolism in hospitalized patients. *Circulation*. 128(9): 1003-1020. [level A].
- [15] Wan B, Fu HY, Yin JT, et al (2015). Low-molecular-weight heparin and intermittent pneumatic compression for thromboprophylaxis in critical patients. *Exp Ther Med*. 10(6): 2331-2336. [level C]
- [16] Bhatti A, Ahsin S, Salim B, Mansoor J (2012). Knowledge, Attitude And Practices Of Healthcare Providers Towards Deep Vein Thrombosis Prophylaxis In Five Teaching Hospitals of Rawalpindi Ayub Med Coll Abbottabad ; 24(2): 136-139.
- [17] Galbraith, E. M., Vautaw, B. M., Gzybowski, M., Henke, P. K., Wakefield, T. W., & Froehlich, J. B. (2010). Variation in physician deep vein thrombosis prophylaxis attitudes and practices at an academic tertiary care center. *Journal of Thrombosis and Thrombolysis*, 30(4), 419-425.
- [18] Hunt B and Thomas A and Retter S. (2010). The Intensive Care Society: Standards And Guidelines Venous Thromboprophylaxis in Critical Care.
- [19] Lilly CM, Liu X, Badawi O, Franey CS, Zuckerman IH. (2014). Thrombosis prophylaxis and mortality risk among critically ill adults. *Chest*; 146(1): 51-57.
- [20] Ho KM, Chavan S, Pilcher D. (2011). Omission of early thromboprophylaxis and mortality in critically ill patients: multicenter registry study. *Chest*; 140(6):1436-1446.
- [21] Hong KC, Kim H, Jang YK, et al. (2012). Risk factors and incidence of deep vein thrombosis in lower extremities among critically ill patients. *J Clin Nurs*; 21: 1840-1846.
- [22] Douketis, J. D., Spyropoulos, A. C., Spencer, F. A., Mayr, M., Jaffer, A. K., Eckman, M. H., (2012). Perioperative management of antithrombotic therapy: Antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest*, 141(2 Suppl), e326S-50S.
- [23] Gharaibeh, L., Albsoul-Younes, A., & Younes, N. (2015). Evaluation of venous thromboembolism prophylaxis after the introduction of an institutional guideline: Extent of application and implementation of its recommendations. *Journal of Vascular Nursing*, 33(2), 72-78.
- [24] Krell, R. W., Scally, C. P., Wong, S. L., Abdelsattar, Z. M., Birkmeyer, N. J., Fegan, K., Hendren, S. (2015). Variation in hospital thromboprophylaxis practices for abdominal cancer surgery. *Annals of Surgical Oncology*. Advance online publication.
- [25] Passman, M. (2010). Mandated quality measures and economic implications of venous thromboembolism prevention and management. *The American Journal of Surgery*, 199(1S), 21-31.
- [26] [Antony M., Moly K., and Dharan R. (2016). Assessment of Knowledge and Self Reported Clinical Practice on Prevention of Deep Vein Thrombosis (DVT) Among Staff Nurses. *Journal of Nursing and Health Science (IOSR-JNHS)* e-ISSN: 2320-1959.p-ISSN: 2320-1940 Volume 5, Issue 1 PP 18-24.

- [27] Stinnett JM, Pendleton R, Skordos L, Wheeler M, Rodgers GM. (2005). Venous thromboembolism prophylaxis in medically ill patients and the development of strategies to improve prophylaxis rates. *Am J Hematol*; 78(3): 167-172.
- [28] Sahu, R., Menon, S., Anik, S., Rai, A., (2017). A study to assess the effectiveness of planned teaching program on knowledge and clinical practice regarding Deep Vein Thrombosis among B. Sc. Nursing intern's working in Jawaharlal Nehru Hospital and Research Centre Bhilai (C.G.) *Int. J. Nur. Edu. and Research.*; 5(3): 272-278.
- [29] Ah-Lee, J., Grochow, D., Drake, D., Johnson, L., Reed., P., Servellen, G., (2014). Evaluation of hospital nurses' perceived knowledge and practices of venous thromboembolism assessment and prevention. *Journal of Vascular Nursing*. Volume 32, Issue 1, Pages 18-24.
- [30] Yu HT, Dylan ML, Lin J, Dubois RW. (2007). Hospital's compliance with prophylaxis guidelines for venous thromboembolism. *Am J Health Sys Pharm*; 64: 69-76.
- [31] Collins, L. Mac Lellan, H. Gibbs, D. MacLellan, J. Fletcher. (2010). Venous Thromboembolism prophylaxis: The role of the nurse in changing practice and saving lives, *Australian Journal of Advanced Nursing*. Vol. 27, No. 3, 83-9.



© The Author(s) 2019. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).