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The Effect Of Nursing Intervention Program On The Incidence Of Venous Thromboembolism Among Critically Ill Patients

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Abstract
Background *Venous thromboembolism (VTE) is a serious and preventable complication among critically ill patients, often leading to increased morbidity and mortality.*
Aimed *to evaluate the effect of a nursing intervention program on the incidence of venous thromboembolism among critically ill patients.*
Design: *A quasi-experimental design.*
Setting: *the intensive care units at Ain Shams University Specialized Hospital, Cairo, Egypt.*
Methods: *A purposive sample of 60 critically ill adult patients at risk for VTE was recruited from the previously mentioned setting.*
Tools*: four tools were utilized, included: Structured Interview Questionnaire; VTE Risk Assessment Scale (Autar DVT Risk Assessment Scale, Wells Score for PE, VTE Manifestations Observational Checklist); Patients' Knowledge Assessment Questionnaire; and Patients' Practical Observational Checklist for VTE prevention. The nursing intervention program was implemented over one year, comprising four sessions (two theoretical and two practical).*
Results: *A strong positive correlation was found between knowledge and practice scores both pre-intervention and post-intervention. The nursing intervention program demonstrated large effect sizes for both knowledge (Cohen's d = 1.46) and practice (Cohen's d = 2.6), indicating substantial clinical significance.*
Conclusion: *Application of the nursing intervention program had a significant positive effect on improving knowledge, enhancing preventive practices, and reducing the incidence of venous thromboembolism among critically ill patients.*
Recommendations: *Develop and implement standardized protocols for VTE prevention to enhance patients' knowledge, practices, and reduce VTE incidence among critically ill patients.*
Keywords*: Critically Ill Patients, Nursing Intervention Program, Venous Thromboembolism*

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I. Introduction

Venous thromboembolism (VTE), encompassing deep vein thrombosis (DVT) and pulmonary embolism (PE), is a prevalent and life-threatening complication among critically ill patients. The risk of VTE is markedly elevated in this population due to factors such as immobility, mechanical ventilation, sedation, and invasive procedures like central venous catheterization. The consequences of VTE are profound, often resulting in increased morbidity, prolonged hospital stays, and higher mortality rates **(Vyas et al., 2025).**

The incidence of VTE in intensive care units (ICUs) remains high despite advances in medical care. Meta-analyses indicate a pooled VTE prevalence of approximately 10% among critically ill patients, with rates varying based on patient characteristics and prophylactic strategies. Notably, the risk of developing VTE is greatest during the initial days of ICU admission, underscoring the need for prompt and effective preventive measures **(Gao et al., 2022).**

Nursing practice plays a pivotal role in VTE prevention. Nurses are at the frontline of patient care and are responsible for assessing VTE risk, administering prophylactic interventions, and educating patients and families about VTE prevention. Their adherence to evidence-based guidelines and vigilance in monitoring for signs of VTE are critical components in reducing incidence rates **(Al-Mugheed et al., 2024).**

Educational interventions targeting patient have demonstrated significant improvements in the utilization of VTE prophylaxis. Multifaceted nurse-led programs, including audits, feedback, and ongoing education, have been shown to increase adherence to best practice and reduce the incidence of VTE among high-risk patients.

These interventions empower patients to take a proactive role in VTE prevention and ensure that critically ill patients receive appropriate care **(Tsaftaridis et al., 2024).**

The evaluation of nursing intervention programs should include outcome measures such as changes in VTE incidence, patient knowledge and practices, and adherence to prophylaxis protocols. Data-driven evaluation allows for the identification of successful strategies and areas requiring further attention. Challenges in VTE prevention among critically ill patients include balancing the risk of thrombosis against the risk of bleeding, especially in those with coexisting conditions or recent surgical procedures. Individualized risk assessment is essential for optimizing prophylactic strategies **(Abuzied et al., 2024).**

National and international guidelines provide valuable frameworks for VTE prevention in critical care settings. Adherence to these guidelines, combined with local adaptation and regular review, ensures that best practices are consistently applied. The integration of VTE prevention into care bundles, such as ventilator care bundles, has been associated with improved patient safety and reduced mortality. Comprehensive care bundles address multiple aspects of critical care, including VTE prophylaxis, sedation management, and infection control **(Hu et al., 2025).**

Significance of the study:

Globally, the precise number of patients affected by thromboembolism including both deep vein thrombosis (DVT) or pulmonary embolism (PE) is unknown, although as many as 900,000 people could be affected each year in the United States. Sudden death is the first symptom in about one-quarter (25%) of people who have a PE. Estimates suggest that 60,000-100,000 Americans die of DVT/PE (also called venous thromboembolism, or VTE), Among people who have had a DVT, one third to one half will have long-term complications (post- thrombotic syndrome) such as swelling, pain, discoloration, and scaling in the affected limb, and One-third (about 33%) of people with DVT/PE will have a recurrence within 10 years **(Centers for Disease Control and Prevention, 2023)**.

In Egypt, more 30% of all patients hospitalized for surgery or acute medical conditions are at high risk for developing DVT. However, only a small fraction of these patients receive appropriate DVT prophylaxis. More 50% of the studied patients had unsatisfactory level of knowledge towards risk factors for DVT. Major of the studied patients had immobility, fracture, obesity, stroke, malignancy and chemotherapy as risk factors for DVT **(Mousa, et al., 2022).**

Aim of the Study

The study aimed to evaluate the effect of nursing intervention program on the incidence of venous thromboembolism among critically ill patients.

Research Hypothesis:

H1: The mean score of knowledge regarding venous thromboembolism among studied patients will be improved.

H2: The mean score of practice regarding venous thromboembolism among studied patients will be improved.

H3: The nursing intervention program will result in a reduction in the incidence of venous thromboembolism among the studied high-risk critically ill patients.

Study design: A quasi-experimental research design was used to conduct the study.

Technical design: The technical design includes the setting, subject & tools that are used in the study.

Setting:

The research conducted at the intensive care units at Ain Shams University Specialized Hospital and located in the Abassia Region, Cairo. The Intensive Care Unit is well-equipped to handle critical cases. The study sample was collected from Intensive Care Unit (ICU) A, which consists of 18 beds; ICU B and ICU C, with ICU C comprising 12 beds; and the Coronary Care Unit (CCU), which includes 19 beds.

Sampling:

Sample type:

A purposive sample was used based on selected criteria.

Sample size

60 adult patients from both genders involved in this study from the above-mentioned setting who agreed to participate in the study.

The subjects were selected according to the following criteria:

Inclusion criteria
1. Adult Patients from both genders agree to participate in the study.
2. Patients who are newly admitted to the hospital
3. Patients at risk of venous thromboembolism
4. Free of venous thromboembolism
5. Patients are fully conscious and able to communicate verbally.

Tools of data collection:
Four tools were used for data collection:

Tool I: Structured Interview Questionnaire. It consists of the following three parts:
- **Part 1: Demographic characteristics** to cover the personal data and the characteristics of the studied patients such as age, gender, level of education, occupation, marital status, and place of residence.
- **Part 2: Medical History:** It concentrated on patients related past and current medical history which consisted of four main items (A) Current medical history included (Hormone-based medications, indwelling or invasive devices, and symptoms of dehydration, and laboratory investigation (pre/post-intervention program). (B) Past medical history included (Previous diagnosis with blood clotting disorder, used hormonal therapy, and chronic diseases). (C) Family history included blood clots (in the leg or lungs), pregnancy-related thrombosis, relatives diagnosed with a hereditary blood clotting disorder).
- **Part 3: Patient Habits:** it consisted of 5 main items (Smoking, consuming foods, fluids intake, physical activity, positioning).

Tool II: VTE Risk Assessment Scale: this tool consisted of three main parts, as follows.
- **Part (1): Autar DVT Risk Assessment Scale:** This part adopted from (Autar, 2003). It was used within the first 24 hours of admission to assess the patient at risk for DVT.
- **Part (2): WELLS Score for PE:** This part adopted from (Wells et al., 2000). It was used within the first 24 hours of admission & post program to assess the patient at risk for PE.
- **Part (3): Venous Thromboembolism Manifestations Observational Checklist:** This part consisted of two main sections: (1) Assessed patients' DVT leg manifestations adapted from (Ramadan et al., 2019 and Abo Seada et al., 2021) and (2) Assessed patients' PE manifestations adapted from (Dix & Tran, 2022) It is used at time of admission and post interventional program assessment.

Tool III: Patients knowledge assessment Questionnaire: This tool developed by the researcher after reviewing related literatures from (Al- Mugeed, 2017; Alyousef et al., 2022; and Khodier et al., 2022) which covered the patients' general knowledge on VTE (19 questions), risk factor of VTE (16 questions), non-pharmacological prevention of VTE (16 questions) and pharmacological prevention of VTE (10 questions).

Tool IV: Patients' Practical Observational checklist. This tool adapted from (Abo Seada et al., 2021), that covered the Two main sections included
- **Section (I) DVT prevention measures** which included; (A) Applying graduated compression (elastic) stockings (10 Items) and (B) Range of motion (ROM) exercise.
- **Section (II) PE prevention measures** which included deep breathing and coughing exercise.

Administrative design:
An official permission was obtained by submission of a formal letter from the administrators of Faculty of Nursing, Capital University to the Managing Director of Ain-Shams University Hospital to get an approval for data collection to conduct the study after explanation of purpose of the study.

Operational design:
There were three distinct phases to the study that needed to be finished: planning, pilot study, and field work.

Preparatory phase:
It includes reviewing related literature, and theoretical knowledge of various aspects of the study using books, articles, internet, periodicals and magazines to develop tools for data collection.

Pilot study:
A pilot study was carried out to test the study tools in terms of their clarity, applicability, and efficiency. It was conducted on 6 patients of the study sample, and then they were excluded from the study

sample. Data obtained from the pilot study was analyzed and accordingly the necessary modifications were made.

Validity:

The content validity of the tools was done by a panel of 5 experts and who reviewed the content of the tools for comprehensiveness, accuracy, clarity, relevance and applicability. Minor modifications were made.

Reliability:

It was conducted using Cronbach's Alpha coefficient worker test, which showed that each tool had mild to moderate reliability and that the tools' items were generally homogeneous.

Fieldwork:

According to the selected theoretical framework:

The actual field work started at the beginning of August 2024 and was completed and ended in August 2025. The study time took about 12 months. The researcher visited the selected setting regularly, four to five days per week.

Fieldwork includes four phases based on conceptual framework for Orem's theory.

I-Assessment phase (determining self-care agency deficit):

Upon admission, patients in both groups were evaluated using two : Initial assessment using Tools I, II, III, and IV to identify self-care deficits related to knowledge and preventive practices.

II- Designing Phase (planning supportive–educative system)

The intervention program was designed based on literature review and identified needs, with content presented in an instructional colored booklet written in simple Arabic language.

Implementation Phase (The researcher applies Orem's supportive–educative system by guiding, teaching, and supporting the patients)

The program comprised:

Theoretical Part (2 sessions, each 30 minutes):

- **1st Theoretical Session**: Introduction to VTE including definitions, causes, risk factors, physiological formation, classification, and manifestations.
- **2nd Theoretical Session**: VTE complications, diagnostic investigations, prevention and management, warning signs, and pharmacological treatment with precautions.

Practical Part (2 sessions, each 30 minutes):

- **1st Practical Session:** VTE manifestations observation, graduated compression stockings application, and range of motion exercises.
- **2nd Practical Session:** Deep breathing and coughing exercises, comprehensive re-demonstration of all procedures, and question/answer session.

Teaching methods included interactive lectures, group discussion, brainstorming, demonstration, re-demonstration, and the teach-back method. Media included PowerPoint presentations, anatomical diagrams, videos, illustrated booklet, actual compression stockings, and leg model.

IV- Evaluation Phase (measuring improvement in self-care agency & the program's impact on reducing incidence of venous thromboembolism (VTE) among high-risk critically ill patients): Immediate evaluation was conducted two days after completion of intervention sessions using Tools II (Parts 3), III, and IV.

Ethical consideration:

Before beginning the study, approvals were obtained from the faculty ethics committee and the dean. Every participant in the research gave their verbal consent. The shared subjects received clarification on the goals and advantages of the study as well as information about the study's instruments, which included the questionnaires they were required to complete. Concerning the study data's confidentiality, they were comforted.

Statistical Design:

The data obtained was analyzed, and presented in numbers, percentages, in the form of tables and figures as required and suitable statistical tests were used to test the significance of the results obtained.

The following statistical techniques were used:

Percentage, Mean value, Standard deviation, Chi-square (X2), Correlation test (r) and Proportion probability (P-value).

Significance of results

- When P> 0.05 it is a statistically insignificant difference.
- When P< 0.05 it is a statistically significant difference.
- When P< 0.01or P< 0.001 it is a high statistically significant difference.

The main findings of this study were summarized as follows:

Figure 1: showed 60 critically ill patients, with a slight male predominance (53.3% male, 46.7% female; male to female ratio 1.1:1). The mean age was 53.67 ± 4.68 years, with the majority (76.7%) aged 50-60 years, 18.3% aged 40-50 years, and 5.0% aged ≥60 years.

Table 1: Regarding education, 30.0% could not read or write, 23.3% had primary education, 26.7% had secondary education, and 20.0% had higher education. Most patients were married (73.3%), while 10.0% were divorced, 10.0% widowed, and 6.7% single. Concerning occupation, 63.3% were retired, 23.3% were housewives, 8.3% were employees, and 5.0% did not work.

Table 2: the Medical History and Patient Habits

All patients (100.0%) had indwelling or invasive devices. More than half (53.3%) reported symptoms of dehydration. Chronic diseases were present in 40.0% of patients. Regarding patient habits, 60.0% reported prolonged sitting, 33.3% consumed high-fat foods, 30.0% reported drinking enough fluids, 20.0% engaged in regular physical activity, and 13.3% were smokers.

Figure 2: Autar DVT risk assessment shows that more than half (51.7%) of the critically ill patients studied had a high level of Autar DVT Risk Assessment Scale risk, while 38.3% had a moderate level and only 10.0% had a mild level.

Table 3: Wells Criteria for Pulmonary Embolism

The Wells score for PE decreased significantly from 4.8 ± 2.1 pre-intervention to 0.68 ± 1.1 post-intervention (t = 14.9, p = 0.000). Clinical signs and symptoms of DVT decreased from 61.7% to 10.0% (p=0.000). Immobilization >3 days or surgery decreased from 95.0% to 10.0% (p=0.000). Heart rate >100 bpm decreased from 90.0% to 6.7% post-intervention.

Table 4 & 5: VTE Manifestations

All DVT manifestations showed highly significant reductions post-intervention (p≤0.01): calf pain (56.7% to 16.7%), tenderness (50.0% to 3.3%), skin warmth (66.7% to 3.3%), swelling (50.0% to 5.0%), erythema (38.3% to 1.7%), and skin color changes (16.7% to 1.7%). All PE manifestations were absent post-intervention with significant reductions for all items (p≤0.01).

Table 6: Knowledge Improvement

Pre-intervention, only 25% of patients had satisfactory knowledge, which increased to 86.7% post-intervention (McNemar χ^2=35, p=0.000). Mean knowledge scores improved from 16.53 ± 14.0 to 53.73 ± 17.6 (t=11.3, p=0.000). Significant improvements were observed across all knowledge domains (p=0.000 for all items).

Table 7: Practice Improvement

Pre-intervention, only 6.6% of patients had high practice levels, which increased to 83.3% post-intervention (Marginal Homogeneity χ^2=49, p=0.000). Mean practice scores improved from 8.55 ± 13.8 to 49.52 ± 13.3 (t=19.6, p=0.000). Significant improvements were observed in graduated compression stocking application, range of motion exercises, and deep breathing and coughing exercises (p≤0.01 for all components).

Table 8: Correlations

A strong positive correlation was found between knowledge and practice both pre-intervention (r=0.830, p=0.000) and post-intervention (r=0.955, p=0.000).

Table 9: Effect Size

The nursing intervention program demonstrated large effect sizes for knowledge (Cohen's d = 1.46) and practice (Cohen's d = 2.6).

Table (1): Frequency distribution of the patients studied regarding their demographic characteristics (n=60)

Demographic characteristics:		**No**	**%**
▪ Age (in years)	30- < 40Yrs.	0	0.0
	40- < 50 Yrs.	11	18.3
	50- < 60 Yrs.	46	76.7
	≥ 60 years	3	5.0
	$\bar{x}$ ± SD	**53.67 ± 4.68**	
▪ Educational level	Can't read & write	18	30.0

	Primary education	14	23.3
	Secondary education	16	26.7
	High education	12	20.0
▪ Marital status	Married	44	73.3
	Single	4	6.7
	Divorced	6	10.0
	Widowed	6	10.0
▪ Occupation	Doesn't work	3	5.0
	Employee	5	8.3
	Retired	38	63.3
	Housewife	14	23.3

Figure (1): Percentage distribution of the studied patient's regarding their gender (n=60)

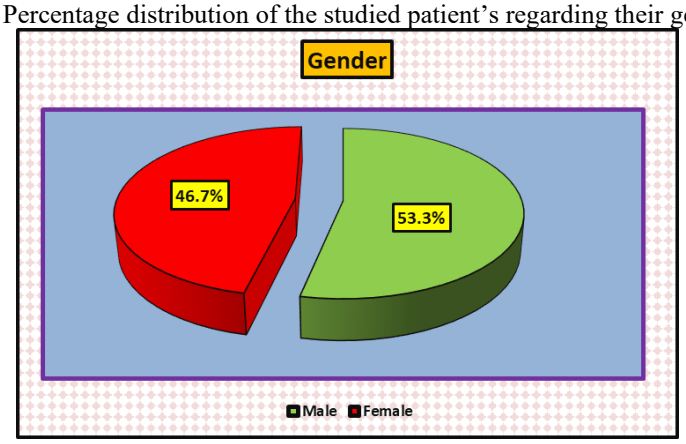

Table (2): Frequency distribution of the patients studied regarding their medical history (n=60)

Medical History:	Yes		No	
	No	%	No	%
Current Medical History				
▪ Currently taking any hormone-based medications.	7	11.7	53	**88.3**
▪ Any indwelling or invasive devices	60	**100.0**	0	0.0
▪ symptoms of dehydration such as excessive thirst, dry skin, or dry mouth	32	**53.3**	28	46.7
Past Medical History				
▪ Previously diagnosed with a blood clotting disorder	8	13.3	52	**86.7**
▪ Ever used any type of hormonal therapy	4	6.7	56	**93.3**
▪ Suffering from any chronic diseases	24	40.0	36	**60.0**
Family History				
▪ Family history of clots (leg/lungs)	4	6.7	56	**93.3**
▪ Female family members: pregnancy complications with thrombosis	6	10.0	54	**90.0**
▪ Relatives diagnosed with hereditary clotting disorder	12	20.0	48	**80.0**
Patient Habits				
▪ smoke	8	13.3	52	**86.7**
▪ high fat diet	20	33.3	40	**66.7**
▪ drink enough fluids	18	30.0	42	**70.0**
▪ regular physical activity	12	20.0	48	**80.0**
▪ sit for long periods in one position	36	**60.0**	24	40.0

Figure (2): Percentage distribution of the level of Autar DVT risk assessment among the studied patients (n=60)

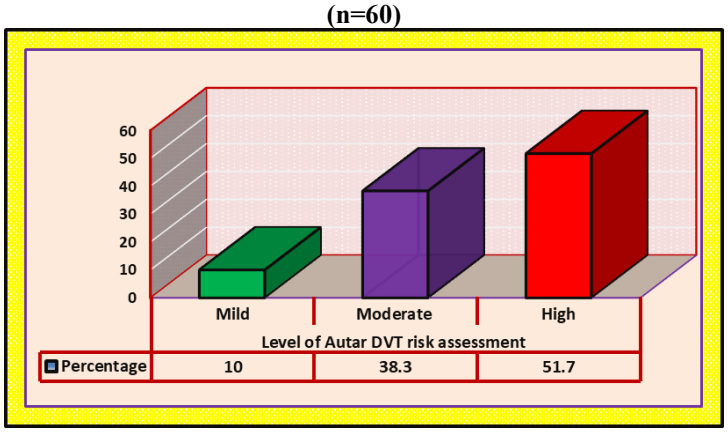

Table (3): Total mean score of the clinical features of the Wells criteria for pulmonary embolism among the patients studied during pre & post nursing intervention program (n=60)

Levels	Pre-test		Post-test		Marginal Homogeneity χ2	P Value
	No	%	No	%		
Mild	6	10.0	54	90.0	50	0.000**
Moderate	49	81.7	2	3.3		
High	5	8.3	4	6.7		

Levels	Pre-test Mean ± SD	Post-test Mean ± SD	T-test	P value
Low probability	0.75±0.82	0.0±0.0		
Moderate probability	4.9±1.4	5.0±0.7		
High probability	8.2±1.6	7.7±1.5		
Total	**4.8±2.1**	**0.68±1.1**	**14.9**	**0.000****

*Significant p ≤ 0.05 **Highly significant p ≤ 0.001

Table (4): Frequency distribution of DVT leg manifestations among the studied patient's pre- and post-intervention (n=60).

DVT leg Manifestations:	Pre				Post				McNemar χ2	P value
	Present		Absent		Present		Absent			
	No	%	No	%	No	%	No	%		
Calf Pain	34	56.7	26	43.3	10	16.7	50	83.3	20.6	0.000**
Tenderness in calf muscle	30	50.0	30	50.0	2	3.3	58	96.7	33.4	0.000**
Skin warmth of the leg (Pyrexia)	40	66.7	20	33.3	2	3.3	58	96.7	52.8	0.000**
Skin Swelling of limb	30	50.0	30	50.0	3	5.0	57	95.0	37.5	0.000**
Calf erythema	23	38.3	37	61.7	1	1.7	59	98.3	25.2	0.000**
Change skin color	10	16.7	50	83.3	1	1.7	59	98.3	8.1	0.004**

*Significant p ≤ 0.05 **Highly significant p ≤ 0.001

Table (5): Frequency distribution of Pulmonary embolism manifestations among the studied patient's pre- and post-intervention according to the PE Manifestations Observational Checklist (n=60).

PE Manifestations	Pre				Post				Mc Nemar χ2	P value
	Present		Absent		Present		Absent			
	No	%	No	%	No	%	No	%		
Shortness of breath	23	38.3	37	61.7	2	3.3	58	96.7	22.3	0.000**
Chest pain (worse with deep breath)	16	26.7	44	73.3	1	1.7	59	98.3	15.4	0.000**
Cough up blood	8	13.3	52	86.7	1	1.7	59	98.3	5.8	0.01**
Sudden back pain	22	36.7	38	63.3	1	1.7	59	98.3	23.7	0.000**
Sweating more than usual	22	36.7	38	63.3	1	1.7	59	98.3	23.7	0.000**
Lightheaded feeling (dizziness)	35	58.3	25	41.7	2	3.3	58	96.7	22.3	0.000**
Blue lips or nails	11	18.3	49	81.7	1	1.7	59	98.3	9.6	0.002**

Table (6): Frequency distribution of the studied patient's knowledge regarding venous thromboembolism during pre & post & nursing intervention program (n=60).

Levels	Pre-test		Posttest		McNemar χ2	P Value
	No	%	No	%		
Unsatisfactory	45	75.0	8	13.3	**35**	**0.000****
Satisfactory	15	25.0	52	86.7		

*Significant p ≤ 0.05 **Highly significant p ≤ 0.001

Table (7): Frequency distribution of the patient's studied practice regarding venous thromboembolism during pre & post nursing intervention program (n=60)

Level	Pre-test		Posttest		Marginal Homogeneity χ2	P Value
	No	%	No	%		
Low	55	91.7	8	13.3	49	0.000**
Moderate	1	1.7	2	3.3		
High	4	6.6	50	83.3		

*Significant p ≤ 0.05 **Highly significant p ≤ 0.001

Table (8) Correlation between the studied patient's knowledge and their practice regarding venous thromboembolism during pre & post implementation of nursing intervention program (n=60)

Variables:			Knowledge		Practice	
			Pre	Post	Pre	Post
Knowledge	Pre	R	1		0.830	
		P			0.000**	
	Post	R				0.955
		P				0.000**
Practice	Pre	R	0.830		1	
		P	0.000**			
	Post	R		0.955		
		P		0.000**		

***Significant p ≤ 0.05** ****Highly significant p ≤ 0.001**

Table (9) Effect size of implementation of nursing intervention program on the studied patient's knowledge & practice regarding venous thromboembolism during pre & post implementation of nursing intervention program (n=60)

	Interval	Mean	SD	t Test	P value	Cohen's d (dz)	Effect size
Knowledge	**Pre-test**	**16.53**	**24.020**	**11.3**	**0.000*****	**1.46 *****	**Large effect**
	Post-test	**53.73**	**17.666**				
	Total	**35.13**	**28.101**				
Practice	**Pre-test**	**16.97**	**11.411**	**20.2**	**0.000*****	**2.6 *****	**Large effect**
	Post-test	49.52	13.330				
	Total	33.24	20.488				

***Significant p ≤ 0.05** ****Highly significant p ≤ 0.01**

II. Discussion

The findings of this study provide strong evidence supporting the effectiveness of a theory-based nursing intervention program in improving knowledge, enhancing preventive practices, and reducing VTE risk among critically ill patients.

The demographic profile of the studied patients—predominantly male, middle-aged to older adults, with a considerable proportion having limited formal education—aligns with previous studies in critical care settings **(Elsayed et al., 2023; Mohamed & Ahmed, 2022).** The predominance of retired individuals and housewives reflects the typical social structure of middle-aged and older adults in Egyptian society.

The high prevalence of multiple concurrent risk factors among the studied patients places them at substantial cumulative risk for DVT. The combination of advanced age, overweight or obesity, restricted mobility, and recent trauma or surgery creates conditions conducive to thrombus formation according to Virchow's triad **(Autar, 2023).** This underscores the critical importance of systematic risk assessment upon ICU admission.

The pronounced improvement in patients' knowledge about VTE following the intervention (from 23.3% to 86.7% satisfactory knowledge) demonstrates the effectiveness of the structured educational program based on Orem's supportive-educative system. This finding is consistent with **Al-Mugeed (2023), Alyousef et al. (2023), and Khodier et al. (2022),** who reported significant knowledge improvements following structured educational interventions. The profound knowledge deficit identified at baseline is concerning but expected given the complexity of VTE pathophysiology and the generally low educational level of the sample.

The remarkable improvement in practical skills graduated compression stocking application, range of motion exercises, and deep breathing/coughing exercises—reflects the effectiveness of demonstration and re-demonstration teaching methods. These findings align with **Abo Seada et al. (2023) and Ramadan et al. (2022),** who reported significant improvements in practical skills following structured teaching. The hands-on approach allowed immediate error correction and skill reinforcement.

The strong positive correlation between knowledge and practice (r=0.955 post-intervention) validates the theoretical premise that enhanced understanding enables appropriate self-care behaviors, consistent with **Mohamed & Fashafsheh (2022) and Abo Seada et al. (2023).** This supports Orem's framework that enhancing self-care agency leads to improved self-care performance.

The large effect sizes for both knowledge (Cohen's d=1.46) and practice (Cohen's d=2.6) provide robust statistical evidence supporting the effectiveness of the nursing intervention program, confirming all three research hypotheses.

III. Conclusions

The nursing intervention program was highly effective in improving critically ill patients' knowledge and practices regarding VTE prevention and in reducing the incidence of VTE. The study demonstrates that critically ill patients, despite their acute condition and often limited educational background, can learn and perform complex preventive behaviors when provided with appropriate education and support. The findings support the integration of structured, theory-based patient education into routine critical care nursing practice.

IV. Recommendations

Based on these findings of the present study the researcher recommended.

- Integrate comprehensive VTE prevention content into nursing curricula, including theoretical knowledge and practical skills.
- Implement systematic VTE risk assessment using validated tools as routine components of ICU admission assessment
- Conduct multi-center randomized controlled trials with larger samples and longer follow-up periods.

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