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Assessment of Nurses' Knowledge and Practices Regarding the Prevention of Venous Thromboembolism in Pediatric Intensive Care Units

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Abstract

Background: Thrombosis in pediatric patients is a growing concern in pediatrics. Venous Thromboembolism, including both deep venous thrombosis and pulmonary embolism, has become an increasingly recognized condition, particularly among hospitalized children. **Aim:** To assess nurses' knowledge and practices regarding the prevention of venous thromboembolism in pediatric intensive care units. **Methods:** A descriptive research design was utilized for the conduction of this study. **Setting:** This study was conducted at pediatric intensive care units (coronary, medical, and surgical) at El-Demerdash children's hospital and Abu El-Reesh Japanese children's hospital. **Sample:** A convenience sample composed of 156 pediatric nurses. **Tools:** Two tools were used as follows. **1st tool:** An Interview Questionnaire Sheet; **a)** demographic characteristics of pediatric nurses, **b)** medical data of hospitalized pediatric patients, and **c)** Knowledge questionnaire sheet to assess nurses' knowledge. **2nd tool:** Observational checklist to evaluate nurses' practices. **Results:** The results illustrated that, less than half of the studied nurses had poor knowledge. In addition, less than two-thirds of the studied nurses had incompetent practices regarding the prevention of venous thromboembolism. Moreover, there was a moderate positive correlation between the studied nurses' total level of knowledge and practices. **Conclusion:** It can be concluded that, less than half of the studied nurses had poor knowledge, and less than two-thirds of the studied nurses had incompetent practices regarding the prevention of venous thromboembolism. **Recommendations:** Designing an educational program and in-service sessions for nurses on preventive measures for venous thromboembolism, based on evidence-based guidelines, to improve their knowledge and practice in this specialized area.

Keywords: *Nurses, knowledge, Practices, Prevention, Venous Thromboembolism, Pediatric Intensive Care Units*

Introduction:

Thrombosis in pediatric population has an increasing rate of incidence, especially in hospitalized children **(Bosch & Albisetti, 2020).** Venous Thromboembolism (VTE) is considered the third leading cause of vascular disease after Myocardial Infarction (MI) and stroke, worldwide **(Lonnberg et al., 2024).** VTE in children is a serious problem with high mortality rates and can cause acute and chronic related complications **(Lassandro et al., 2020).**

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There is now an overall awareness by pediatricians and pediatric nurses that VTE is no longer exclusive to the adult population **(Shoag et al., 2021).** Its occurrence has increased due to both greater exposure to risk factors and improved diagnostic techniques **(Lassandro et al., 2020).** VTE encompasses Deep Venous Thrombosis (DVT) and Pulmonary Embolism (PE) **(CDC, 2024).** DVT occurs when a clot forms in a deep vein and blocks blood flow, while PE occurs when a clot breaks loose and travels to the lungs, which can be life-threatening **(Waheed et al., 2023).**

VTE in pediatric patients occurs when one or more components of Virchow's triad are activated: venous stasis, endothelial injury, and hypercoagulability **(Lassandro et al., 2020).** Idiopathic VTE is rare and almost always associated with underlying diseases or risk factors **(Zhou et al., 2024).** More than 90% of children with VTE will have ≥2 predisposing factors, with most critically ill pediatric patients presenting multiple and simultaneous risk factors **(Shoag et al., 2021).** Inherited conditions include Factor V Leiden mutation, prothrombin gene mutation, and deficiencies of antithrombin III, protein C, and protein S. Acquired conditions include central venous catheters, immobilization, surgery, infections, and nephrotic syndrome. Other risk factors are malignancy, sickle cell disease, and hormonal therapy **(Jinks & Arana, 2019).**

Signs and symptoms vary with location and severity. DVT usually presents in the lower limbs with unilateral pain, swelling, and discoloration **(Shoag et al., 2021).** PE, though rare, should be considered in critically ill children with cardiovascular instability, chest pain, hemoptysis, tachypnea, hypoxia, tachycardia, or collapse **(Jinks & Arana, 2019).**

Diagnosis involves clinical evaluation, blood tests, and imaging. Family history is important, though inherited thrombophilia does not alter initial management **(Witmer & Raffini, 2020).** D-Dimer interpretation is limited in pediatrics **(Arachchillage et al., 2022).** Ultrasound is recommended for initial assessment, Doppler ultrasound for lower limbs, MRV for suspected extension, and CTPA for suspected PE **(Elias et al., 2024; Doshi & Ellison, 2021; Low et al., 2023).**

Complications include post-thrombotic syndrome and chronic thromboembolic pulmonary hypertension **(Rodriguez, 2022; Bastas et al., 2023; Gerges & Yacoub, 2020).** Prevention involves basic, mechanical, and pharmacological prophylaxis, especially for children aged ≥13 years with risk factors **(Pągowska-Klimek, 2020; Chen et al., 2020).**

Treatment relies on anticoagulation therapy with LMWH or warfarin, supportive measures such as compression and elevation, and sometimes interventional procedures like thrombectomy **(Van Ommen & Luijnenburg, 2024; Audu et al., 2019).**

Pediatric nurses play a crucial role in prevention, diagnosis, and treatment. They should implement preventive measures, monitor signs, collaborate with the multidisciplinary team, and educate families **(Nicholson et al., 2020; Mokadem & El-Sayed, 2019).** Nurses can significantly contribute to reducing morbidity and mortality if well-educated and empowered **(Nabil et al., 2022).**

Significance of the Study:

Blood clots can happen at any age. Although blood clots happen more commonly in adults, they can also happen in children. VTE affects an estimated 1 million Americans per year **(Mulpuri et al., 2024).** VTE can be life-threatening if not diagnosed and treated promptly **(Zhou et al., 2024).** About 1 in 10,000 children get blood clots, including as many as 1 in 200 hospitalized children **(Odent et al., 2020).**

The prevalence of VTE in pediatric population is relatively low, but it remains significant. Studies from the Netherlands, Canada, and the United States estimated an annual incidence of 0.07–0.14 per 10,000 children, 5.3 per 10,000 hospital admissions, and 24 per 10,000 neonatal intensive care admissions, with the highest rates seen in children with cancer and congenital heart disease **(Zhou et al., 2024).** In recent years, the incidence has increased 100–1000 times in hospitalized children, reaching ≥58 per 10,000 admissions **(Li et al., 2023).** Risk factors include

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intravenous catheter use, surgery, trauma, malignancy, and chronic inflammatory conditions, with most cases occurring in children <1 year and during adolescence **(Park et al., 2019).**

VTE also increases healthcare costs and leads to complications such as pulmonary embolism and post-thrombotic syndrome **(Audu et al., 2019).** There is limited data on VTE incidence in the Middle East, with actual rates likely higher due to under-diagnosis and underreporting. Incidence of PE in critically ill pediatric patients may be increasing due to central venous catheter use and cancer **(El-Gendy et al., 2022).**

There is now an overall awareness by pediatricians and pediatric nurses that VTE is no longer exclusive to adults **(Lassandro et al., 2020).** The increasing rates in children mandate that pediatricians and pediatric nurses, especially in hospitals, be fully aware of the signs and symptoms, management guidelines for acute treatment and prophylaxis, and the role of emerging anticoagulant therapies **(Shoag et al., 2021).** Therefore, this study aims to assess nurses' knowledge and practices regarding the prevention of venous thromboembolism in pediatric intensive care units.

Operational Definitions:

Deep Vein Thrombosis (DVT):

A medical condition characterized by the formation of a blood clot in a deep vein, usually in the legs, thigh, or pelvis, obstructing blood flow, leading to symptoms such as swelling, pain, and redness, and potentially causing complications if the clot dislodges and travels to the lungs **(Waheed et al., 2023).**

Pulmonary Embolism (PE):

A blockage in one of the pulmonary arteries in the lungs, typically caused by a blood clot that has traveled from the deep veins of the legs or other parts of the body to the lungs, presenting with symptoms like sudden shortness of breath, chest pain, and in severe cases, can be life-threatening **(Lonnberg et al., 2024).**

Nurses' Adherence:

Nurses' adherence refers to the extent to which pediatric nurses implement and follow clinical practice guidelines for preventing venous thromboembolism, as demonstrated by their knowledge of these guidelines and their application in clinical settings **(Dsouza et al., 2022).**

Aim of the Study:

This study aimed to assess nurses' knowledge and practices regarding the prevention of venous thromboembolism in pediatric intensive care units.

Research Questions:

The aim was achieved through the following questions:

- What is the level of nurses' knowledge regarding the prevention of venous thromboembolism in pediatric intensive care units?
- What is the level of nurses' practices regarding the prevention of venous thromboembolism in pediatric intensive care units?
- Is there a relation between the studied nurses' knowledge, nurses' practices and their demographic characteristics regarding the prevention of venous thromboembolism in pediatric intensive care units?

Subjects and Methods:

The subjects and methods for this study were portrayed under the four main items as follows: technical, operational, administrative, and statistical items.

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I) Technical Items:

The technical items included research design, settings, subject and tools for data collection.

Research Design:

A descriptive research design was utilized for the conduction of this study. This design allows for a comprehensive assessment of the current state of knowledge and practices, providing valuable insights for improving prevention measures.

Research Settings:

This study was conducted at pediatric intensive care units (coronary, medical and surgical) at El-Demerdash Children's Hospital affiliated with Ain Shams University hospitals, and Abu El-Reesh Japanese children's hospital affiliated with Cairo University hospitals. The researcher chose both setting to take a large study sample and to give critical significant result.

Research Subjects:

A convenience sample involved all available pediatric nurses (n=156), working at the previously mentioned settings from the first of January 2023 until end of June 2023 were recruited for this study. Novel nurses who have less than 3 months of clinical experience in PICUs were excluded because they did not have enough experience about clinical practice guidelines for VTE prevention.

Sample Size Calculation:

Fischer's formula below was used to calculate the sample size of the study; $n = (z)^2 p (1 – p) / d^2$. Where, n = Sample size (for a population > 10,000). Z = Normal deviation at the desired confidence interval. In this case, it will be taken at 95%, with a Z value of 1.96. P = Proportion of the population with the desired characteristic. Based on the literature review that examined similar outcomes, the proportion of the population was 0.75. Q = (1 - P) = Proportion of the population without the desired characteristic. D^2 = Degree of precision, which will be taken to be 10% **(Jung, 2014).** Therefore, $n = (1.96)^2 \times 0.75(1-0.75) / (0.1)^2$. Hence, the total sample size required from each hospitals = n = 77.03 approximately 78 participants. Hence, the total sample size required from each hospital is approximately 78 participants.

Tools of Data Collection: Two tools were used for data collection of this study:

1st Tool: An Interview Questionnaire Sheet: It consists of three parts as following:

A. Characteristics of pediatric nurses:

It included (11) items related to demographic characteristics of the studied nurses such as age, gender, residence, marital status, qualification, working experience in the hospital, working experience in the unit, job title, currently working unit in the hospital, previous VTE training, and the educational resource of training.

B. Clinical characteristics of hospitalized pediatric patients:

It composed of (6) questions such as age, gender, level of education, length of stay, current medical disease, and medical family history.

C. Nurses Knowledge questionnaire sheet:

The questionnaire sheet adapted from **El-Gendy et al., (2022)** and developed by the researcher after reviewing the recent related national and international literatures. It was written in simple Arabic language. It was designed for assessing the exact nurses' knowledge regarding the prevention of venous thromboembolism in hospitalized pediatric patients in PICUs. It included (10) domains. It composed of (54) multiple choice questions

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related to: definition (2 questions), pathophysiology (4 questions), types and sites (2 questions), risk factors (7 questions), signs and symptoms (2 questions), diagnostic investigation (4 questions), complication (2 questions), medical management (6 questions), types of prophylaxis (15 questions), and nursing interventions and care plan (10 questions).

Scoring system regarding nurses' knowledge:

The scoring system was as the following; each correct answer scored (one) mark and score (zero) for an incorrect response. The total score level was (54) marks, these marks were converted into a percentage score. The total score was divided into three categories as follows:

- **Poor knowledge:** (≤ 50% correct answers) (1 – 27 Questions).
- **Average knowledge:** (50 - < 70% correct answers) (28 – 38 Questions).
- **Good knowledge:** (≥ 70% correct answers) (39 – 54 Questions).

2nd Tool: Nurses Practices Observational Checklist:

The observational checklist adapted from **Malk et al., (2022)** and modified by the researcher to evaluate nurses' practices regarding the prevention of VTE among hospitalized pediatric patients in PICUs, applied by researcher. It consisted of three methods of prophylaxis as follows: General preventive measures (12 items); which includes nurses' role in; assessment, early ambulation, positioning and perform turning, range of motion exercise, leg exercises for lower limbs, performing deep breathing exercises, hydration, fluid intake, and patient education. Mechanical prophylaxis (3 items): which includes nurses' role regarding applying; compression elastic stockings, graduated compression stockings (GCS), and intermittent pneumatic compression (IPC). Pharmacologic prophylaxis (3 items): which focuses on nurses' role regarding; administering of prophylactic anticoagulant, and monitoring side effects of the anticoagulant medications.

Scoring System regarding nurses' practices:

It consisted of 18 items. The responses based on a three point likert scale; never scored (0), sometimes scored (1), and always scored (2) with total score of 36 points. The total score categorized into two levels as follows;

- **Competent practices:** when the percentage (≥ 85%)
- **Incompetent practices:** when the percentage (< 85%).

Validity:

The tools were tested for the content validity by a jury of three experts of professors and lecturers in the field of pediatric nursing and pediatric medicine from Helwan and Ain Shams University, who revised the tools for clarity, relevance, comprehensiveness, understanding of the tools and the necessary modifications were done.

Reliability:

The analysis for the internal consistency of the developed interview questionnaire sheet and observation checklists (Tool I & II) was established through Cronbach's Alpha test that was tool (I) = 0.893 & tool (II) = 0.892, which indicates strong reliability of the tools.

Ethical considerations:

An official permission for conducting the study was obtained from the Faculty of Nursing, Research and Ethics Committee, Helwan University. An official letter was issued from the Dean of the Faculty of Nursing to the directors of PICUs at El-Demerdash Children's Hospital and Abu El-Reesh Japanese children's hospital after explaining the purpose of the study. Informed oral consents were obtained from the studied nurses who met the study inclusion

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criteria to participate in the study after explaining the aims and nature of the study. The studied nurses were assured that the information collected would be treated confidentially, anonymity and used only for the purpose of the study and their benefits. Nurses were assured that their participation in the study and they have the right to withdraw from the study at any time without giving any reasons. As well, the results of this study will not have any effect on their job. Participants were also assured that their data will be treated confidentially and used only for the purpose of the study and their benefits.

II) Operational Items:

The operational items included a preparatory phase, pilot study, and field work.

Preparatory phase:

It included the following; reviewing of current and post local and international related literature, different studies related to VTE, and theoretical knowledge of its various aspects using textbooks, articles, evidence-based articles, internet periodicals and magazines in order to develop the tools of data collection.

Pilot study:

The pilot study had been undertaken before starting the data collection phase. It was performed on 10 % of the total sample (15 nurses) to test the clarity, feasibility, objectivity, applicability, comprehensiveness and to estimate the time needed to fill in the questionnaire. Simple modifications were done based on pilot results as rephrasing and rearrangement prior to data collection. Nurses participating in the pilot study were excluded from the final data analysis. This phase took one month from the beginning to the end of December 2022.

Fieldwork:

The actual field work was performed over a period of six months starting from the beginning of January (2023) to the end of June (2023) at the previously mentioned settings. An official permission to proceed with the proposed study was obtained from the head of the coronary, medical, and surgical intensive care units, as well as the hospital nursing director, after explaining the aim and nature of the study. The researcher was available in the study settings 2-3 days/week during morning/afternoon shifts. The researcher introduced himself to the nurses, explained the purpose of the study and its expected outcomes, and obtained their approval. Then, the researcher collected data about the demographic characteristics of the studied nurses using Tool (I) Part (A). Oral informed consent was obtained from each nurse in the study prior to any data collection.

After the finalization of the tools, the researcher assessed nurses' knowledge using Tool (I). Tool (I) Part (C) was designed to assess nurses' knowledge regarding the prevention of VTE in hospitalized pediatric patients in PICUs. The researcher introduced this tool to each nurse and asked them to fill it out. The time taken to fill out the tool was from 30 minutes to 45 minutes. The 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 times during the day.

Assessment of nurses' practices was evaluated using Tool (II) to determine nurses' practices regarding the prevention of VTE among hospitalized pediatric patients in PICUs. Direct observation was conducted by the researcher to appraise nurses' practical level. Each nurse was observed by the researcher throughout the different shifts, on average 6 hours a day, 2-3 days a week. The researcher filled out the observational checklists and documented nurses' practices related to the prevention of VTE.

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III) Administrative Items:

To carry out the study, the necessary approval was obtained from the directors of El-Demerdash Children's Hospital and Abu El-Reesh Japanese children's hospital. A letter was issued to the directors from the dean of the faculty of nursing explaining the aim of the study in order to obtain permission for collection of data.

IV) Statistical Items:

The collected data were organized, tabulated, and statistically analyzed using SPSS for Windows version 28.0 (SPSS, Chicago, IL). Data were first tested for normality. Categorical data are expressed as numbers and percentages. Continuous data were normally distributed and are expressed as the mean ± standard deviation (SD). Paired Samples t-test was used to compares means from the same group at different times. Fisher's exact test was used for the comparison of variables with categorical data. Pearson's correlation (r) coefficient was adopted to analyze the correlations among key study variables. The reliability (internal consistency) of the questionnaires used in the study was calculated using Cronbach's alpha coefficient. A significant level was considered when the p-value was ≤ 0.05 and a highly significant level when the p-value was ≤ 0.001.

Results

Table (1): Distribution of the studied nurses' regarding demographic characteristics (no = 156)

Items	No.	%
Age (As years)		
18 < 25	67	**43%**
25 < 30	66	42%
30 < 35	18	12%
≥ 35	5	3%
Mean ± SD	**24.65 ± 3.8**	
Gender		
Male	74	47%
Female	82	**53%**
Residence		
Rural	110	**71%**
Urban	46	29%
Marital status		
Single	76	49%
Married	57	37%
Divorced	14	9%
Others	9	6%
Qualification		
Diploma in nursing	47	30%
Technical institute	74	**47%**
Bachelor's	27	17%
Master's degree	8	5%

Table (1): shows that, less than half (43%) of the studied nurses were between 18 to less than 25 years old, with a mean age of 24.65 ± 3.8 years, and more than half (53%) were female. In addition, more than two-thirds (71%) of the studied nurses were from rural areas, and less than half (47%) had a technical institute education.

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Table (2): Distribution of the studied nurses' regarding work characteristics (no = 156)

Items	No.	%
Working experience in the hospital (As years)		
< 1	26	17%
1 < 5	71	**46%**
5 ≤ 10	59	38%
Working experience in the unit (As years)		
< 1	65	42%
1 < 5	69	**44%**
5 ≤ 10	22	14%
Job title		
Staff nurses	88	**56%**
In charge nurse	45	29%
Supervisor	12	8%
Head nurse	11	7%
Currently working unit in the hospital		
PICU (Medical)	46	29%
PICU (Surgical)	73	**47%**
PICU (Coronary)	37	24%
Previous VTE training		
Yes.	32	21%
No.	124	**79%**
If you answered the item (yes) educational resource (n = 32)		
In-service education	16	**50%**
Web resources	5	16%
Courses	8	25%
Congress/conferences	3	9%

Table (2): shows that, less than half (46%) of the studied nurses had 1 to 5 years of experience in the hospital, and less than half (44%) had 1 to 5 years of experience in the units. In addition, more than half (56%) of the studied nurses were staff nurses, and less than half (47%) were working in the Surgical PICU. Moreover, more than two-thirds (79%) of the studied nurses had not received any VTE training, while half (50%) had received in-service education.

Table (3): Distribution of hospitalized pediatric patients regarding clinical characteristics (no = 44)

Items	No.	%
Age (As years)		
3 < 6	6	14%
6 < 9	12	27%
9 < 12	17	**39%**
12 ≤ 18	9	20%
Gender		
Male	27	**61%**
Female	17	39%
Level of education		
Primary education	16	36%
Secondary education	28	**64%**
Length of stay		
One week	5	11%
Two weeks	13	30%

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Items	No.	%
Three weeks	14	**32%**
Four weeks and more	12	27%
Current medical disease		
Cancer	12	**27%**
Congenital heart disease	12	**27%**
Inherited thrombophilia	7	16%
Nephrotic syndrome	5	11%
Inflammatory bowel disease	4	9%
Sickle cell disease	4	9%
Medical family history		
No VTE history	40	**90%**
History of DVT	2	5%
History of PE	2	5%

Table (3): shows that, more than one-third (39%) of the pediatric patients were between 9 to less than 12 years old, and less than two-thirds (61%) were female. In addition, one-third (32%) stayed for three weeks. Moreover, more than one-quarter (27%) of the pediatric patients had cancer and congenital heart disease, and most (90%) had no history of VTE.

Table (4): Distribution of the subtotal nurses' knowledge regarding the prevention of VTE in pediatric patients (no = 156)

Items	Correct Answer		Incorrect Answer	
	No.	%	No.	%
Definition of VTE	92	59%	64	41%
Pathophysiology of VTE	80	51%	76	49%
Sites of VTE	77	49%	79	51%
Risk factors of VTE	79	51%	**77**	49%
Signs and symptoms	80	51%	76	49%
Diagnosis of VTE	83	53%	73	47%
Complication of VTE	77	49%	79	51%
Medical management of VTE	74	47%	82	53%
Types of prophylaxis of VTE	80	51%	76	49%
Nursing interventions and care plan of VTE	79	51%	77	49%
Total	**80**	**51%**	**76**	**49%**

Table (4): indicates that, slightly more than half (51%) of the studied nurses provided correct answers. However, slightly less than half (49%) answered incorrectly across all domains of knowledge regarding the prevention of VTE in pediatric patients.

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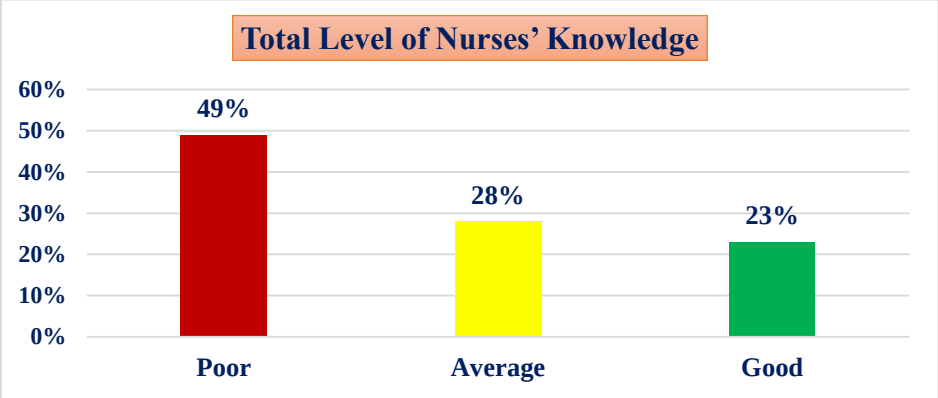

Figure (1): Percentage distribution of the studied nurses' total level of knowledge regarding the prevention of VTE in pediatric patients (no = 156)

Fig (1): illustrates that, less than half (49%) of the studied nurses had poor knowledge regarding the prevention of VTE in pediatric patients. In addition, more than one-quarter (28%) had average knowledge. However, less than one-quarter (23%) had good knowledge.

Table (5): Number and percentage distribution of the subtotal nurses' practices regarding the prevention of VTE in pediatric patients (no = 156)

Items	Never		Sometimes		Always	
	No.	%	No.	%	No.	%
General preventive measures	13	8%	45	29%	98	63%
Mechanical prophylaxis	14	9%	62	40%	80	51%
Pharmacologic prophylaxis	24	15%	31	20%	101	65%
Total	**17**	**11%**	**46**	**29%**	**93**	**60%**

Table (5): indicates that, only 11% of the studied nurses never performed preventive measures for VTE among hospitalized pediatric patients, while more than one-quarter (29%) did so sometimes. However, less than two-thirds (60%) always performed these measures.

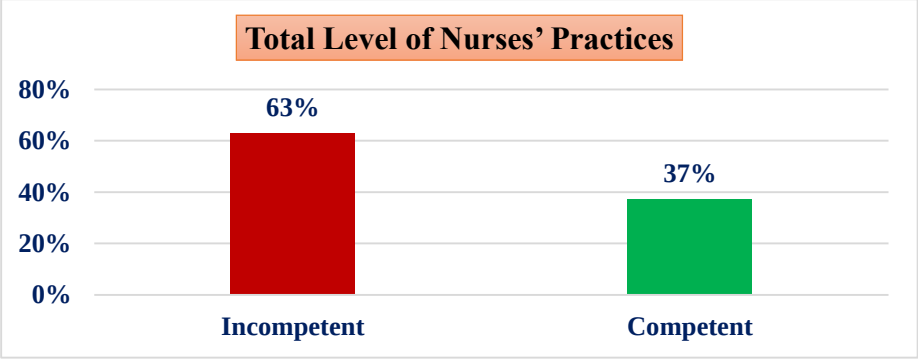

Figure (2): Percentage distribution of the studied nurses' total level of practices regarding the prevention of VTE in pediatric patients (no = 156)

Fig (2): illustrates that less than two-thirds (63%) of the studied nurses had incompetent practices. However, more than one-third (37%) had competent practices regarding preventive measures for VTE among hospitalized pediatric patients.

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Table (6): Relation between the studied nurses' total level of knowledge and demographic characteristics (no = 156)

Demographic Characteristics	Nurses' Knowledge						χ^2	P-value
	Poor		Average		Good			
	No.	%	No.	%	No.	%		
Age								
18 < 25	**40**	**60%**	14	21%	13	19%	7.491	**0.027***
25 < 30	30	45%	19	29%	17	26%		
30 < 35	5	28%	8	44%	5	28%		
≥ 35	2	40%	2	40%	1	20%		
Gender								
Male	37	50%	22	30%	15	20%	.732	0.069
Female	40	49%	21	26%	21	26%		
Level of education								
Diploma in nursing	**22**	**47%**	13	28%	12	26%	7.095	**0.031***
Technical institute	37	50%	22	30%	15	20%		
Bachelor's	11	41%	7	26%	9	33%		
Master's degree	7	88%	1	13%	0	0%		
Working experience in the unit								
< 1	29	45%	20	31%	16	25%	1.808	0.077
1 < 5	38	55%	16	23%	15	22%		
5 ≤ 10	10	45%	7	32%	5	23%		
Job title								
Staff nurses	**44**	**50%**	26	30%	18	20%	4.043	**0.040***
In charge nurse	22	49%	11	24%	12	27%		
Supervisor	4	33%	4	33%	4	33%		
Head nurse	7	64%	2	18%	2	18%		
Previous VTE training								
Yes.	18	56%	10	31%	4	13%	3.537	**0.050***
No.	59	**48%**	33	27%	32	26%		

[P-value > 0.05: Not statistically significant], [* P-value ≤ 0.05: Statistically significant], [P-value ≤ 0.001: Highly statistically significant]**

Table (6): reveals a statistically significant relationship between nurses' total level of knowledge and age, level of education, job title, and previous VTE training (p = 0.027, 0.031, 0.040, 0.050, respectively).

Table (7): Relation between the studied nurses' total level of practices and demographic characteristics (no = 156)

Demographic Characteristics	Nurses' Practices				χ^2	P-value
	Incompetent		Competent			
	No.	%	No.	%		
Age						
18 < 25	46	46%	21	37%	3.549	**0.041***
25 < 30	38	38%	**28**	**49%**		
30 < 35	13	13%	5	9%		
≥ 35	2	2%	3	5%		
Gender						
Male	47	47%	27	47%	.903	0.990
Female	52	53%	30	53%		
Level of education						
Diploma in nursing	26	26%	21	37%	3.520	**0.047***
Technical institute	**48**	**48%**	26	46%		
Bachelor's	18	18%	9	16%		

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Demographic Characteristics	Nurses' Practices				χ^2	P-value
	Incompetent		Competent			
	No.	%	No.	%		
Age						
Master's degree	7	7%	1	2%		
Working experience in the unit						
< 1	37	37%	**28**	**49%**	2.307	**0.051***
1 < 5	48	48%	21	37%		
5 ≤ 10	14	14%	8	14%		
Job title						
Staff nurses	53	54%	**35**	**61%**	1.285	**0.053***
In charge nurse	30	30%	15	26%		
Supervisor	9	9%	3	5%		
Head nurse	7	7%	4	7%		
Previous VTE training						
Yes.	18	18%	14	25%	.903	0.84
No.	81	82%	43	75%		

[P-value > 0.05: Not statistically significant], [* P-value ≤ 0.05: Statistically significant], [P-value ≤ 0.001: Highly statistically significant]**

Table (7): reveals a statistically significant relationship between nurses' total level of practices and age, level of education, work experience in the unit, and job title (p = 0.041, 0.047, 0.051, 0.053, respectively).

Table (8): Correlation between the studied nurses' total level of knowledge and total level of practices (no = 156)

Variable	Nurses' knowledge	
	Pearson Correlation (r)	Sig. (2-tailed) (P)
Nurses' practices	**0.216**	**0.002***

[P-value > 0.05: Not statistically significant], [* P-value ≤ 0.05: Statistically significant], [P-value ≤ 0.001: Highly statistically significant]**

Table (8): shows a moderate positive correlation between the studied nurses' total level of knowledge and practices (r = 0.216, p = 0.002*).

Discussion

Venous thromboembolism (VTE) in the pediatric population is a serious and potentially life-threatening condition that is largely preventable. The most common clinical presentations of VTE are deep venous thrombosis (DVT) and pulmonary embolism (PE). Prevention is more important and cost-effective than treatment because once VTE develops, curing it can be expensive. Given the challenges in diagnosis and the variability in treatment outcomes, the prevention of VTE is clearly essential. Effective prevention of DVT is crucial for reducing mortality from PE and morbidity associated with DVT **(Lutsey & Zakai, 2023).**

The Agency for Healthcare Research and Quality reports that VTE prophylaxis is among the top ten strongly recommended practices for improving patient safety. Pediatric nurses play a crucial role in early identification, risk assessment, and implementation of preventive measures **(Tian et al., 2023).** Enhancing nurses' knowledge and performance to evidence-based practices can significantly reduce the incidence of VTE in hospitalized pediatric patients, thereby ensuring safer patient care **(Adly, Ismail, & Saleh, 2020).** The aim of the study was to assess nurses'

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knowledge and practices regarding the prevention of VTE among hospitalized pediatric patients in pediatric intensive care units.

Regarding to the subtotal nurses' knowledge about the prevention of VTE in pediatric patients **Table (4).** The results showed that, slightly more than half of the studied nurses provided correct answers. However, slightly less than half answered incorrectly across all domains of knowledge regarding the prevention of VTE in pediatric patients. This is obviously detected as the majority of pediatric nurses had incorrect knowledge related to (definition, sites, signs and symptoms, complication, medical management, types of prophylaxis, nursing interventions and care plan).

This finding was consistent with a study conducted by **Ahmed, Ghanem, & Khalil (2020)** titled "Assessment of Nurses' Knowledge and Practice about Venous Thromboembolism for Cancer Surgery Patients," which reported that the majority of nurses had an unsatisfactory level of knowledge regarding nursing care for preventing VTE. This included the definition of VTE, types and sites, risk factors, causes, manifestations, complications, medical management, side effects of anticoagulation drugs, and nursing precautions during their administration. From the researcher perspective, this lack of knowledge might be attributed to several factors. Firstly, the majority of pediatric nurses have graduated from technical institutes or diploma nursing programs, where all nursing textbooks are written in English, while their education is conducted in Arabic. Additionally, more than two-thirds of pediatric nurses had not received any previous training on venous thromboembolism.

This finding contradicted with a study conducted by **Mohammed et al. (2019)** titled "Nurse's performance regarding prevention of deep venous thrombosis among intensive care patients," which revealed that less than two-thirds of the studied nurses had an unsatisfactory level of knowledge regarding the prevention of DVT among intensive care patients. This included general information about DVT, how to use elastic stockings, drug use for DVT, complications, prevention strategies, and the role of nurses in prevention. However, more than one-third of the studied nurses had a satisfactory level of knowledge. This discrepancy might be due to a lack of in-service training education on DVT. The study's findings highlighted the importance of continuing nursing education. According to the researcher, the reasons for nurses' lack of knowledge regarding DVT might be related to the absence of continuous evaluation of nurses' knowledge and insufficient cooperation between multidisciplinary healthcare team members (nurses and physicians).

This finding was inconsistent with a study conducted by **Khedr, Baker, & Gamal (2019)** titled "Nurses' performance regarding preventive measures of pulmonary embolism in Port Said hospitals," which indicated that more than two-thirds of studied nurses had unsatisfactory knowledge regarding preventive measures of PE. This includes definitions, causes, risk factors, signs & symptoms, diagnosis, preventive measures, treatment, and complications. The researcher suggested that for nurses to provide high-quality care and function effectively, they must possess adequate knowledge that can be applied in practice. They recommended the necessity of allocating special training courses for all nurses working in PICUs to improve their knowledge of preventive measures for PE **(Adly, Ismail, & Saleh, 2020).**

Concerning to the total level of nurses' knowledge regarding the prevention of VTE in pediatric patients **Figure (1),** the results illustrated that, less than half of the studied nurses had poor knowledge regarding the prevention of VTE in pediatric patients. In addition, more than one-quarter had average knowledge. However, less than one-quarter had good knowledge.

This finding was in accordance with a study conducted by **El-Gendy et al. (2022)** titled "Effect of An Educational Program on Nurses' Performance regarding Prevention of Venous Thromboembolism among Critically Ill Patients," which concluded that the majority of nurses had unsatisfactory knowledge regarding the prevention of venous thromboembolism before the intervention program. This may be a consequence of the lack of availability of medical books at the hospital and the absence of a PICU library, as well as nurses not having time to read due to their workload.

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The researcher inferred that this might be related to the lack of continuing educational programs or sessions about this disorder, or the absence of supervision and continuous evaluation of nurses' knowledge.

This finding aligned with a study conducted by **Malk et al. (2022)** titled "Efficacy of training program on nurses' performance regarding preventive measures of venous thromboembolism," which found that the majority of nurses had unsatisfactory knowledge regarding preventive measures of VTE before the program was implemented. This could be attributed to workload, lack of concentration, and insufficient knowledge, as nurses are overloaded with more duties and longer work hours. The researcher believed that this may be due to nurses' lack of desire to acquire new knowledge because of their overloaded work situations.

This finding was in line with a study conducted by **Elkattan & Elderiny (2019)** titled "Effect of nursing care guidelines on preventing deep venous thrombosis," which demonstrated that the majority of the nurses studied had a poor knowledge level about DVT. However, a few of them had a fair knowledge level, and some had a good knowledge level before the implementation of nursing care guidelines. This lack of knowledge among the majority of nurses regarding nursing care guidelines for preventing VTE may be attributed to the absence of in-service training programs, orientation programs for newly appointed nurses, and a supervision and evaluation system for nursing practices.

Regarding to the subtotal nurses' practices about the prevention of VTE in pediatric patients **Table (5).** The results showed that, few of the studied nurses never performed preventive measures for VTE among hospitalized pediatric patients, while more than one-quarter did so sometimes. However, less than two-thirds always performed these measures. This is obviously detected as the majority of pediatric nurses always practices related to (general preventive measures, mechanical prophylaxis, and pharmacologic prophylaxis).

This finding was inconsistent with a study conducted by **Mohammed et al. (2019),** who revealed that more than half of the studied nurses had inadequate levels of practice regarding the prevention of DVT among intensive care patients. This included initial assessments such as the modified Wells score, venous clinical severity score, and clinical risk factors, as well as nursing practices like applying elastic stockings and promoting range of motion. According to the researcher, there was a significant difference in practices between nurses who attended VTE training courses and those who did not.

This finding was not in line with a study conducted by **Khedr, Baker, & Gamal (2019),** who indicated that less than two-thirds of the studied nurses had unsatisfactory practices regarding preventive measures of pulmonary embolism. This included procedures such as assessing respiration, performing deep breathing exercises, assessing ambulation, performing leg exercises, turning patients in bed, and applying compression elastic stockings for preventive measures of PE. This can be explained by gaps in nursing practice stemming from poor understanding, ignorance, lack of time, or inadequate training, leading to insufficient performance to evidence-based guidelines. The researcher suggested a diverse approach is needed to improve VTE prevention and current practical guidelines.

Concerning to the total level of nurses' practices regarding the prevention of VTE in pediatric patients **Figure (2),** the results illustrated that, less than two-thirds of the studied nurses had incompetent practices. However, more than one-third had competent practices regarding preventive measures for VTE among hospitalized pediatric patients.

This finding was in agreement with a study conducted by **El-Gendy et al. (2022),** who concluded that the majority of nurses had unsatisfactory practice regarding the prevention of venous thromboembolism before the intervention program. Additionally, this finding agreed with a study conducted by **Malk et al. (2022),** which found that the majority of nurses had unsatisfactory practices regarding preventive measures of VTE before the program implementation. Moreover, this finding also aligned with a study conducted by **Elkattan & Elderiny (2019),** who demonstrated that all studied nurses had unsatisfactory overall practices regarding DVT before the implementation of nursing care guidelines. The researcher inferred that this could be attributed to less than half of the studied nurses having from one

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to less than five years of experience at the PICU, which may have hindered their acquisition of experience and skills in preventing VTE in pediatric patients.

With regard to the relation between total level of nurses' knowledge and demographic characteristics **Table (6),** the results identified that, there was a statistically significant relationship between total nurses' knowledge and age, level of education, job title, and previous VTE training.

This finding was consistent with a study conducted by **El-Gendy et al. (2022),** who observed that there was a statistically significant relation between the total knowledge score regarding prevention of VTE and the age and qualification of the studied nurses before the program intervention. Additionally, there was a highly statistically significant relation between the total knowledge score and the years of experience of the studied nurses in intensive care units before the program intervention.

This finding was contrary to a study conducted by **Ahmed, Ghanem, and Khalil (2020),** who indicated that there was no significant relation between the total nurses' knowledge and the socio-demographic characteristics of the studied nurses. From the researcher's perspective, the majority of nurses were diploma nurses with one to less than five years of experience, and they demonstrated poor knowledge. Additionally, the researcher found that most nurses between 18 to less than 25 years old who attended in-service training about VTE at the hospital were newly graduates.

With regard to the relation between total level of nurses' practices and demographic characteristics **Table (7),** the results identified that, there was a statistically significant relationship between total nurses' practices and age, level of education, work experience in the unit, and job title.

This finding was in accordance with a study conducted by **El-Gendy et al. (2022),** who observed that there was a statistically significant relation between the total practices score regarding prevention of VTE and the age and qualification of the studied nurses before the program intervention. Additionally, there was a highly statistically significant relation between the total practices score and the years of experience of the studied nurses in intensive care units before the program intervention. The researcher suggested that the findings of the present study can be explained by the fact that fresh nurses with fewer years of experience are more flexible and open to learning new skills if they are well-trained. Moreover, senior nurses with more years of experience and established attitudes may be more resistant to change.

In relation to correlation between total levels of nurses' knowledge and total nurses' practices **Table (8),** t the results identified that, there was a moderate positive correlation between the total level of nurses' knowledge and practices. This finding agreed with a study conducted by **Khedr, Baker, & Gamal (2019),** who indicated that there was a statistically significant positive correlation between nurses' knowledge and practices regarding preventive measures of pulmonary embolism. The moderate association between the total knowledge scores and practices score may be partially explained by factors such as lack of training courses, inadequate updating of existing knowledge, lack of time, workload, and insufficient equipment.

Despite the study's findings of poor knowledge and inadequate practices, this may be attributed to the absence of strict guidelines and protocols that clearly outline the implementation of nursing measures to prevent VTE. The hospital should focus on improving both personnel's knowledge and attitudes to positively influence their practices and behaviors. These findings underscore deficiencies in nurses' knowledge and practices regarding preventive measures of VTE, which can significantly impact patient safety. Training is considered crucial in preventing adverse nursing outcomes. Therefore, to provide high-quality care, nurses must possess adequate knowledge that they can effectively apply in practice.

Conclusion:

Based on the study findings, it can be concluded that less than half of the studied nurses had poor knowledge regarding the prevention of VTE in pediatric patients. In addition, less than two-thirds of the studied nurses had

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incompetent practices regarding the preventive measures for VTE among hospitalized pediatric patients. Moreover, there was a statistically significant relationship between the studied nurses' total level of knowledge and age, level of education, job title, and previous VTE training. There was a statistically significant relationship between the studied nurses' total level of practices and age, level of education, work experience in the unit, and job title. Additionally, there was a moderate positive correlation between the studied nurses' total level of knowledge and practices. Finally, the current study results answered the research questions and achieved the aim of the study.

Recommendations:

In the light of the study results, the following recommendations are suggested:

- Designing an educational program and in-service sessions for nurses on preventive measures for VTE, based on evidence-based guidelines, to improve their knowledge and practice in this specialized area.

Further research:

- Replication of this study on a larger probability sample from different geographical locations across the Arab Republic of Egypt.

References

Adly, R. M., Ismail, S. S., & Saleh, S. M. A. (2020). Assessment of nurses' knowledge and practices regarding the application of safety standard precautions in pediatric critical care. International Journal of Novel Research in Healthcare and Nursing, 7(3), 524-543. Available from https://www.noveltyjournals.com/upload/paper/Assessment%20of%20Nurses%E2%80%99%20Knowledge.pdf

Ahmed, M., Ghanem, H., Khalil, S. (2020). Assessment of Nurses' Knowledge and Practice about Venous Thrombo Embolism for Cancer Surgery Patients. Assiut Scientific Nursing Journal, 8(20), 13-20. https://dx.doi.org/10.21608/asnj.2020.78954

Arachchillage, D. J., Mackillop, L., Chandratheva, A., Motawani, J., MacCallum, P., & Laffan, M. (2022). Thrombophilia testing: A British Society for Haematology guideline. *British Journal of Haematology*, *198*(3), 443–458. https://doi.org/10.1111/bjh.18239

Audu, C. O., Wakefield, T. W., & Coleman, D. M. (2019). Pediatric deep venous thrombosis. *Journal of Vascular Surgery. Venous and Lymphatic Disorders*, *7*(3), 452–462. https://doi.org/10.1016/j.jvsv.2018.12.012

Bastas, D., Brandão, L. R., Allen, D. D., Vincelli, J., Amiri, N., Abdul-Samad, K., Liu, K., Stephens, S., & Avila, M. L. (2023). Functional impact of pediatric postthrombotic syndrome. *Journal of Thrombosis and Haemostasis: JTH*, *21*(4), 896–904. https://doi.org/10.1016/j.jtha.2023.01.004

Bosch, A., & Albisetti, M. (2020). Management of venous thromboembolism in children: Current recommendations and therapeutic options. *Therapeutics and Clinical Risk Management*, *16*, 673–679. https://doi.org/10.2147/tcrm.s218622

Centers for Disease Control and Prevention, (CDC). 2024. *About venous thromboembolism (blood clots)*. Venous Thromboembolism (Blood Clots). https://www.cdc.gov/blood-clots/about/index.html

Chen, A., Stecker, E., & A. Warden, B. (2020). Direct oral anticoagulant use: A practical guide to common clinical challenges. *Journal of the American Heart Association*, *9*(13). https://doi.org/10.1161/jaha.120.017559

Doshi, B. S., & Ellison, A. M. (2021). Diagnosis and management of pediatric venous thromboembolism: New therapies on the horizon. *Pediatric Emergency Care*, *37*(5), 273–279. https://doi.org/10.1097/pec.0000000000002431

El-gendy, G. H. A., Mahmoud, M. H., & Omran, E. S. (2022). Effect of An Educational Program on Nurses' Performance regarding Prevention of Venous Thromboembolism among Critically Ill Patients. *Journal of Nursing Science Benha University*, *3*(1), 225-272. https://doi.org/10.21608/jnsbu.2022.213765

Elias, A., Weber, T., Green, D. A., Harris, K. M., Laws, J. M., Greaves, D. K., Kim, D. S., Mazzolai-Duchosal, L., Roberts, L., Petersen, L. G., Limper, U., Bergauer, A., Elias, M., Winnard, A., & Goswami, N. (2024). Systematic review of the use of ultrasound for venous assessment and venous thrombosis screening in spaceflight. *NPJ Microgravity*, *10*(1). https://doi.org/10.1038/s41526-024-00356-w

Elkattan, B. A.-E. A. A., & Elderiny, S. N. M. (2019). Effect of nursing care guidelines on preventing deep venous thrombosis among patients undergoing arthroplastic surgery. *Egyptian Journal of Health Care*, *6*(2), 757-774. Available from: https://www.noveltyjournals.com/upload/paper/Effect%20of%20Nursing%20Care%20Guidelines-1849.pdf

Gerges, M., & Yacoub, M. (2020). Chronic thromboembolic pulmonary hypertension – still evolving. *Global Cardiology Science & Practice*, *2020*(1). https://doi.org/10.21542/gcsp.2020.11

Jinks, S., & Arana, A. (2019). Venous thromboembolism in paediatrics. *BJA Education*, *19*(9), 305–312. https://doi.org/10.1016/j.bjae.2019.05.003

Jung, S.-H. (2014). Stratified Fisher's exact test and its sample size calculation. *Biometrical Journal*, *56*(1), 129–140. https://doi.org/10.1002/bimj.201300048

Kearon, C., de Wit, K., Parpia, S., Schulman, S., Spencer, F. A., Sharma, S., Afilalo, M., Kahn, S. R., Le Gal, G., Shivakumar, S., Bates, S. M., Wu, C., Lazo-Langner, A., D'Aragon, F., Deshaies, J.-F., Spadafora, L., & Julian, J. A. (2022). Diagnosis of deep vein thrombosis with D-dimer adjusted to clinical probability: prospective diagnostic management study. *BMJ (Clinical Research Ed.)*, e067378. https://doi.org/10.1136/bmj-2021-067378

Khedr, F., Baker, A., & Gamal, E. (2019). Nurses' performance regarding preventive measures of pulmonary embolism in Port Said hospitals. *Port Said Scientific Journal of Nursing*, *6*(2), 61-77. https://doi.org/10.21608/pssjn.2019.20600.1009

Lassandro, G., Palmieri, V. V., Palladino, V., Amoruso, A., Faienza, M. F., & Giordano, P. (2020). Venous thromboembolism in children: From diagnosis to management. *International Journal of Environmental Research and Public Health*, *17*(14), 4993. https://doi.org/10.3390/ijerph17144993

Li, H. Y., Wang, J., Wang, T., & Wang, H. S. (2023). Management of venous thromboembolism in pediatric patients: Quality assessment of clinical practice guidelines and variations in recommendations. *Thrombosis research*, *226*, 107–116. https://doi.org/10.1016/j.thromres.2023.04.022

Lonnberg, F., Roos, A., Farm, M., Heurlin, A., Okas, M., Gigante, B., & Siddiqui, A. J. (2024). Causes of death after first time venous thromboembolism. *Thrombosis Journal*, *22*(1). https://doi.org/10.1186/s12959-024-00586-8

Low, C. L., Kow, R. Y., Abd Aziz, A., Mohd Yusof, M., Lim, B. C., Kamarudin, N. A., & Md Ralib Md Raghib, A. R. (2023). Diagnostic yield of CT pulmonary angiogram in the diagnosis of pulmonary embolism and its predictive factors. *Cureus*. https://doi.org/10.7759/cureus.40484

Lutsey, P. L., & Zakai, N. A. (2023). Epidemiology and prevention of venous thromboembolism. *Nature Reviews. Cardiology*, *20*(4), 248–262. https://doi.org/10.1038/s41569-022-00787-6

Malk, R. N., Fahem, E. M., Hassan, H. E., & Soultan, A. A. A. (2022). Efficacy of training program on nurses' performance regarding preventive measures of venous thromboembolism among critical pregnant women. *Egyptian Journal of Health Care*, *13*(2), 402-414. https://doi.org/10.21608/ejhc.2022.230390

Mohammed, W. I., Salah, M., & Mohamed, R. (2019). Nurse's performance regarding prevention of deep venous thrombosis among intensive care patients. *Egyptian Journal of Health Care*, *10*(4), 657-666. https://doi.org/10.21608/ejhc.2019.2531413

Mokadem, N. E., & EL-Sayed, S. (2019). 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*, *7*(6), 974-982. Available from: https://pubs.sciepub.com/ajnr/7/6/10

Mulpuri, N., Sanborn, R. M., Pradhan, P., Miller, P. E., Canizares, M. F., & Shore, B. J. (2024). Pediatric orthopaedic venous thromboembolism: A systematic review investigating incidence, risk factors, and outcome. *JB & JS Open Access*, *9*(1). https://doi.org/10.2106/jbjs.oa.23.00107

Nabil M, R., Mawed F, E., Elzeblawy H, H., & Abouda A, S, A. (2022). Efficacy of Training Program on Nurses Performance regarding Preventive Measures of Venous Thromboembolism among Critical Pregnant Women. *Egyptian Journal of Health Care*, *13*(2), 402-414. https://doi.org/10.21608/ejhc.2022.230390

Nicholson, M., Chan, N., Bhagirath, V., & Ginsberg, J. (2020). Prevention of venous thromboembolism in 2020 and beyond. *Journal of Clinical Medicine*, *9*(8), 2467. https://doi.org/10.3390/jcm9082467

Odent, T., de Courtivron, B., & Gruel, Y. (2020). Thrombotic risk in children undergoing orthopedic surgery. *Orthopaedics & Traumatology, Surgery & Research: OTSR*, *106*(1), S109–S114. https://doi.org/10.1016/j.otsr.2019.05.026

Pągowska-Klimek, I. (2020). Perioperative thromboembolism prophylaxis in children – is it necessary? *Anaesthesiology Intensive Therapy*, *52*(4), 316–322. https://doi.org/10.5114/ait.2020.97599

Park, E. S., Choi, H. S., Lee, K. S., Kim, S. W., & Lee, J. M. (2019). Venous thromboembolism in children and young adults in Korea: Analysis of the Korean health insurance review and assessment service database. *Journal of Korean Medical Science*, *34*(49). https://doi.org/10.3346/jkms.2019.34.e316

Rodriguez, V. (2022). Thrombosis complications in pediatric acute lymphoblastic leukemia: Risk factors, management, and prevention: Is there any role for pharmacologic prophylaxis? *Frontiers in Pediatrics*, *10*. https://doi.org/10.3389/fped.2022.828702

Shoag, J., Davis, J. A., & Corrales-Medina, F. F. (2021). Venous thromboembolism in pediatrics. *Pediatrics in Review*, *42*(2), 78–89. https://doi.org/10.1542/pir.2019-0026

Tian, L., Feng, X., Yang, H., Tan, X., Gao, Y., Luo, H., Li, W., Yan, P., & Li, Y. (2023). Knowledge, attitude, and practice of pediatric nurses in prevention of central venous access device-related thrombosis in hospitalized children: a nationwide cross-sectional survey. *European Journal of Pediatrics*, *182*(8), 3481–3490. https://doi.org/10.1007/s00431-023-04997-z

Van Ommen, C. H., & Luijnenburg, S. E. (2024). Anticoagulation of pediatric patients with venous thromboembolism in 2023. *Thrombosis Research*, 235, 186–193. https://doi.org/10.1016/j.thromres.2023.12.019

Waheed, S. M., Kudaravalli, P., & Hotwagner, D. T. (2023). *Deep vein thrombosis*. StatPearls Publishing. Available from: https://www.ncbi.nlm.nih.gov/books/NBK507708/

Witmer, C., & Raffini, L. (2020). Treatment of venous thromboembolism in pediatric patients. *Blood*, *135*(5), 335–343. https://doi.org/10.1182/blood.2019001847

Zhou, J., Zhu, Y., Liu, Y., Zhan, H., Niu, P., Chen, H., & Zhang, J. (2024). Risk factors for venous thromboembolism in a single pediatric intensive care unit in China. *Thrombosis Journal*, *22*(1), 26. https://doi.org/10.1186/s12959-024-00596-6