RESEARCH PAPER

Nurses Knowledge and Practice Regarding Late Pregnancy Venous Thromboembolism Prophylaxis: Intervention Study

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Abstract

Background: Venous thromboembolism (VTE) consists of deep venous thrombosis (DVT) and pulmonary embolism (PE), obstetric VTE is a major factor of maternal mortality and morbidity during pregnancy and the peripartum period worldwide, with the incidence ranges from 0.76 to 1.72 per 1,000 pregnancies, 4 times higher than in non-pregnant women of the same age. **The aim of this study** was to evaluate the effect of intervention study on nurses' knowledge and practice regarding late pregnancy venous thromboembolism prophylaxis. **methods:** Research design: A Quasi-experimental design (pre- and post-test) was utilized. **Setting:** This study was carried out at the labor and preterm infants' hospital and antenatal outpatient clinic, Zagazig University. **Study subjects:** A convenience sample of 100 maternity nurses from the above-mentioned setting. **Tools of data collection:** Structured interview questioner which consists of two parts: questionnaire of Nurses' Knowledge regarding Venous thromboembolism and observational checklist of nurses' practice regarding venous thromboembolism prophylaxis. **Results:** In the light of the present study results, there was a significant improvement in nurses' overall knowledge regarding venous thromboembolism prophylaxis following implementation of the intervention (82.0%), compared to (36.0%) the pre-intervention assessment, additionally practice increased from (24.0%) pre intervention to 75.0% post intervention **Conclusion:** There was a highly statistically significant correlation between total nurses' knowledge score and total practice score at both pre and post implementation of the interventional study at $p < 0.001$. **Recommendation**: Further studies with different educational approaches such as e-learning and blended learning should be developed for improving venous thromboembolism preventive practices.

Keywords: Deep venous thrombosis, Practice, Pregnancy, Pulmonary embolism

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Introduction

Venous thromboembolism (VTE) is a disease affecting the venous system causing complete or incomplete obstruction of the vessels and characterized by two distinct clinical manifestation: deep vein thrombosis (DVT) and pulmonary embolism (PE) **(Ali *et al*., 2026)**. Rates of VTE during pregnancy and the postpartum period have not decreased over the previous two decades and pregnancy associated VTE still poses a substantial health concern **(Al-Mugheed *et al*., 2023).**

Despite the development of diagnostic and therapeutic modalities, the prevalence of high-risk pregnancies is rising due to the rises in advanced maternal age and obesity, and the morbidity and mortality of pregnancy-related thromboembolism are anticipated to increase correspondingly **(Park et al., 2021; Varrias *et al.,* 2023).** The incidence rate of obstetric VTE is reported to be 1–2 per 1000 pregnancies /year in developed countries **(Cardaniuc & Sagaidak 2026)**.

Pregnant women are more susceptible to VTE for owing to many factors. There are hormonally mediated and pregnancy-specific alterations of coagulation that favor thrombosis, including increased production of clotting factors. A slower rate of venous blood flow from the lower extremities as pregnancy advances is one of the physiological and anatomical factors that also play a role. These alterations may raise the risk of thromboembolism, especially in the later stages of pregnancy and during puerperium. **(Othman *et al*., 2023**).

Hospitalization is a substantial risk factor for VTE, contributing to nearly half of all case **(Hu *et al., 2025).*** Relative immobilization during the third trimester worsens venous stasis and increases the risk of thrombosis, especially in women whose mobility is limited due to pregnancy-related complication. **(Didembourg *et al*., 2025)**.

Venous thromboembolism (VTE) presented with symptoms differing depending on the clot's site and size. Although it often goes unnoticed in its early stages, deep vein thrombosis usually manifests as localized swelling, pain, heat, or skin discoloration in the leg **(CDC., 2025).** Conversely, a PE may occur without any prior DVT

symptoms. Since many of these symptoms are presented on by physiological conditions that are common during pregnancy, such as pregnancy-related physiological dyspnea and palpitations **(Varrias *et al.*, 2023).**

Inadequate knowledge and practice associated with increased VTE prevalence worldwide **(Silva *et al.*, 2020).** Increasing the knowledge and adopting better preventive practices against venous thromboembolism are vital for avoiding severe complications. Ultimately, improving awareness plays a key role in preventing this critical public health issue **(Al-Mugheed *et al*., 2023).**

VTE prophylaxis is regarded as one of the ten most crucial patient safety practices since it is a preventable disease. Organizations have developed a number of VTE guidelines to improve prevention and reduce VTE mortality. These guidelines recommend both pharmaceutical and non-pharmacological preventive measures, including as anticoagulant medication, graduated compression stockings, and intermittent pneumatic compression. **(AL-Mugheed *et al*.,2022).**

Despite the variations in recommendations and strategies proposed by various organizations, the fundamental concepts of VTE prevention in pregnant and postpartum women are similar. Every clinical choice should be founded on a thorough, documented risk assessment of each pregnant woman **(Kalaitzopoulos *et al*., 2022).** According to **Hashem, Abdel Menem, and EL-Said (2023),** maternity nurses play a complex and vital role in preventing VTE during pregnancy**.** They represent as a front line in providing mothers with essential knowledge and practices related to therapeutic regimens of both prevention and treatment.

Significance of the study

More than 80% of thrombo-embolic illnesses in pregnant women are venous thromboembolism (VTE). The disease is highly dangerous, develops rapidly and threatens the health and life of the pregnant women. VTE is one of the most common critical illnesses in obstetric **(Zhang and Sun, 2020)**. Incidence of VTE during pregnancy increases slightly above that of the general population in the first trimester rises to a greater degree during the third trimester **(Maughan *et al.,* 2022)**.

Based on Egypt's Vision 2030 for improving the quality and safety of health services provided in the new republic, the General Authority for Healthcare Accreditation & Regulation created a clinical standard for the prevention of VTE by assessing the patients' risk of developing venous thromboembolism (DVT& PE), reevaluating them on a regular basis, and managing them in a safe and efficient manner **(Hashem, Abdel Menem & EL-Said., 2023).**

Maternity and Obstetric staff members are required to remain up-to-date with the guidance about venous thromboembolism risk factors, preventive measures and necessary instructions to handle this situation for early detection and providing necessary care and treatment **(Elkashif *et al*., 2024).** So, the intervention study is developed to enable nurses in obstetrics departments with decisions on appropriate measures regarding venous thromboembolism prophylaxis.

Aim of the Study

The aim of this study was to evaluate the effect of intervention study on nurses' knowledge and practice regarding late pregnancy venous thromboembolism prophylaxis

Research objectives

1-Assess nurses' knowledge regarding venous thromboembolism pre and post implementation of intervention study.
2-Evaluate nurses' practice regarding venous thromboembolism prophylaxis pre and post implementation of intervention study.
3-Design, implement and evaluate a program regarding venous thromboembolism prophylaxis.

Research Hypothesis

H1. Nurses' Knowledge regarding venous thromboembolism prophylaxis will be increased post-implementation of intervention study.

H2. Nurses' practice regarding venous thromboembolism prophylaxis will be improved post-implementation of intervention study.

Subjects and Methods

Research-design

Quasi-experimental design (pre-and post- test) used to evaluate the effect of intervention study on nurses' knowledge and practice regarding venous thromboembolism prophylaxis

Setting

This study was carried out at the labor and preterm infants' hospital and antenatal outpatient clinic, Zagazig University hospitals.

Study Subjects

The Sample size is 100 maternity nurses in labor and preterm infants' hospital and antenatal outpatient clinic.

Tools of data collection:

Tool I: structured interview questionnaire which consists of two parts

It was developed by the researcher to collect the necessary data for achieving the study objectives**,** it composed of two parts:

Part 1: Questionnaire of Nurses' Knowledge regarding Venous thromboembolism (pre/post): This part includes questions to assess knowledge of maternity nurses regarding to venous thromboembolism which composed 48 questions with about main nine parts. physiological and vascular changes, venous thromboembolism, pre-existing risk factors, obstetrics risk factors, transient risk factors, signs and symptoms of venous thromboembolism complications of venous thromboembolism (VTE), investigations and prophylaxis which involved general prophylaxis, mechanical prophylaxis and pharmacological.

Scoring system:

The questionnaire contained of 48 questions, each question evaluated as "the correct answer was scored as one degree and the incorrect answer was scored as a zero". The total scores of the questionnaire were 48 grades. These scores summed and converted into a percent score. It classified into 2 categories:

Good knowledge if score ≥60% (29-48 grades).

Poor knowledge if score <60% (0-28 grades)

Part 2: Observational checklist of nurses' practice regarding Venous thromboembolism prophylaxis (pre/post):

Observational checklist was used to assess nurse's practice regarding care to the pregnant women it includes 4 main items (Assess regularly the venous thromboembolism risks, venous thromboembolism risk assessment scales, life style modification, mechanical prophylaxis.

Scoring system:

The scale contained of 31 items, each item evaluated as "Done" was scored as one degree and "Not done" was scored as a zero. The total scores of the scale were 31 grades. These scores summed and converted into a percent score. It classified into 2 categories:

- **Adequate** if score ≥ 60%. (19-31 grades)

- **Inadequate** if score from < 60%. (0-18 grades)

Tools validity and reliability

The validity of the tools was tested for content validity by Jury of three experts, one professor of obstetrics and gynecological nursing department and two assistant professors of Obstetrics and Gynecological Nursing Department. These experts assessed the tool for clarity, relevance, comprehensiveness, applicability, and Subjects and methods understanding. All recommended modifications in the tools were made. Additionally, the researcher prepared a guide educational booklet for the studied subjects, which covered all items related to Venous Thromboembolism prophylaxis in late pregnancy based on their identified needs and in view of the pertinent literature. The same experts who validated the tool also revised and validated the educational booklet.

Fieldwork

Following ethical approval, data were collected over a six-month period from November 2025 to April 2026. The intervention and data collection followed four main phases:

1. Assessment Phase

The researcher established a structured timetable and interviewed participant nurses to collect baseline data, identifying their baseline knowledge and practice needs regarding VTE prophylaxis using pre-test tools. Participants were given adequate time to complete the questionnaire. Findings guided the magnitude of the issue and informed the development of the study tools and educational program**.**

2. Planning Phase

Based on the assessment results and literature review, an educational program and supportive materials (an English-to-Arabic translated educational booklet validated by a scientific committee) were developed. Participant Grouping: To facilitate attendance without disrupting hospital duties, nurses were divided into eight groups of 12 nurses each.

3. Implementation Phase

The study took place in the labor and preterm infants' hospital and antenatal outpatient clinic. The researcher introduced herself, explained the study's aim, and obtained verbal informed consent prior to data collection.

- Theoretical Sessions: Conducted across four interactive sessions (two per week per group, 45–60 minutes each). Content was delivered via videos, and group discussions using simple language:

Session 1: Physiological/vascular changes in pregnancy and VTE definitions/types.

Session 2: Pre-existing, obstetric, and transient VTE risk factors, alongside signs and symptoms.

Session 3: VTE complications and diagnostic investigations during pregnancy.

Session 4: General, pharmacological, and mechanical prophylaxis, and the nursing role.

- Practical Sessions: Conducted across two interactive sessions (one per week per group, 60 minutes each):

Session 5: Overview of VTE, clinical risk assessment, and step-by-step use of risk assessment scales.

Session 6: Lifestyle modifications (mobility, fluids, weight management, leg exercises) and mechanical prophylaxis (compression stockings, pneumatic

compression devices, and application techniques).

4. Evaluation Phase

Post-tests were administered immediately following the completion of the sessions using the same pre-test tool format to measure improvements in nurses' total knowledge and practice scores**.**

Pilot study:

After development of the tools, a pilot study was carried out before conducting the main study. The pilot sample involved about 10% (10 nurses) to test the study tools in terms of clarity, feasibility and time required to fill out and complete the collection of all questionnaires and the necessary modification will be done. Therefore, adjustments were made according to the results of the experimental sample. The subjects of pilot sample were excluded from the main study sample.

Administrative and ethical considerations:

The ethical approval was given by the scientific and ethics committee of the faculty of Nursing at Zagazig University **(M.D.ZU.NUR/ 265 /13/5/2025)**. The researcher introduce herself to the participated nurse, explain the nature of research study and aim of the study was explained to each nurse who participated in the research study.

Content validity

An oral consent was obtained from each nurse participants. The researcher-maintained anonymity and confidentiality of the nurses to encourage their participation in the information collected, and anonymity is ensured, the studied nurses were informed that their participation is voluntary, and they have the right to withdraw from the study at any time.

Statistical analysis

The collected data organized, tabulated and statistically analyzed using Statistical Package for Social Science (SPSS) version 25 for windows, running on IBM compatible computer. Chi-square tests examined associations between categorical variables, and Wilcoxon signed-rank tests were used for pairwise comparisons. Correlation coefficient was used to test the correlation between studied variables. A significant level value was considered when $p < 0.05$ and a highly significant level value was considered when $p < 0.001$. No statistical significance difference was considered when $p \geq 0.05$

Results:

Table 1, shows that the proportion of nurses who had correct knowledge about the physiological changes responsible for hypercoagulability increased from 49.0% at pre-program to 90.0% at post-program. Additionally, correct knowledge regarding the effect of hormone-mediated Veno-dilation increased from 50.0% at pre-program to 86.0% at post-program. Moreover, correct knowledge about causes of endothelial damage increased from 60.0% at pre-program to 84.0% at post-program.

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Table 2, displays that, there was a significant improvement in nurses' knowledge regarding venous thromboembolism after implementation of the study, with a highly statistically significant difference $p < 0.001$. As evidence, correct knowledge regarding types of thromboembolism increased from 69.0% pre-program to 91.0% post-program. Moreover, correct knowledge regarding the definition of venous thromboembolism improved from 43.0% pre-program to 87.0% post-program.

Table 3, shows that, there was a significant improvement in nurses' knowledge regarding pre-existing risk factors of venous thromboembolism after implementation of the program $p < 0.001$, correct knowledge regarding personal or family history increased from 31.0% pre-program to 76.0% post- intervention. Regarding thrombophilia, smoking, SLE and nephrotic syndrome increased markedly from 37.0%, 28.0%, 24.0% and 29.0% pre- intervention to75.0%, 82.0%, 82.0% and 84.0% post-program. Multiple gestation and preeclampsia increased from 41.0% and 36.0% pre-program 85.0% and 85.0% post- program. moreover, knowledge about cesarean section risk, assisted reproductive techniques improved from 35.0% and 46.0% pre- program to 79.0% and 75.0% post- program.

Table 4, shows that there was a significant improvement in nurses' knowledge regarding signs and symptoms of venous thromboembolism after implementation of the program $p < 0.001$. As evidence, correct knowledge regarding classic of deep venous thrombosis and about Homan's sign increased from 39.0% and 38.0% pre-program to 83.0% and 76.0% post-program

Table 5, shows that there was a significant improvement in nurses' knowledge regarding complications and investigations of venous thromboembolism after implementation of the program $p < 0.001$. As evidence, correct knowledge regarding characters of post-thrombotic syndrome increased from 37.0% to 83.0% post- program. Moreover, correct knowledge about diagnostic investigations improved markedly, including D-dimer and ventilation/perfusion scan from 26.0% and 28.0% pre-program to 78.0% and 80.0% post-program

Table 6, shows that there was a significant improvement in nurses' knowledge regarding prophylaxis of venous thromboembolism after implementation of the program $p < 0.001$. As evidence, correct knowledge regarding the use of venous thromboembolism risk assessment scale increased from 41.0% pre-program to 78.0% post-program**.**

Table 7, shows that there was a significant improvement in nurses' practice regarding venous thromboembolism risk assessment after implementation of the program, with a highly statistically significant difference $p < 0.001$. As evidence, use of venous thromboembolism risk assessment

scales to assess the risks increased from 22.0% pre-program to 61.0% post-program.

Table 8, shows that there was a significant improvement in nurses' practice regarding lifestyle modification after implementation of the program ($p < 0.001$. As evidence, encouraging healthy diet increased from 49.0% pre-program to 70.0% post-program, while deep breathing exercises increased from 43.0% pre-program to 74.0% post-program

Table 9, shows that there was a significant improvement in nurses' practice regarding lifestyle modification after implementation of the program $p < 0.001$. As evidence, teaching exercises such as ankle rotation, leg lifting, and foot movements showed marked improvement from ranges between 19.0%–37.0% pre-program to 64.0%–78.0% post-program.

Table 10, shows that there was a significant improvement in nurses' practice regarding mechanical prophylaxis after implementation of the program $p < 0.001$. As evidence, teaching proper use of antiembolism stockings increased from 31.0% pre-program to 73.0% post-program. Moreover, teaching use of pneumatic compression devices improved markedly from ranges between 23.0%–31.0% pre-program to 72.0%–89.0% post-program

Discussion

Concerning to level of nurse's knowledge regarding physiological and vascular changes, the present study showed that there was a significant improvement in nurses' knowledge regarding physiological and vascular changes after implementation of the training program, with a highly statistically significant difference $p < 0.001$. As evidence, the proportion of nurses who had correct knowledge about the physiological changes responsible for hypercoagulability state increased from half at pre-program to almost at post-program, highlighting the effectiveness of structured educational interventions in improving nurses' understanding of venous thromboembolism (VTE) prophylaxis.

This finding was consistent with the systematic review conducted by **Al-Mugheed and Bayraktar (2023)** concluded that nurses' knowledge and practice regarding VTE remain inconsistent worldwide and emphasized that continuous educational programs and standardized in-service training are among the most effective strategies for improving nurses' knowledge, risk assessment skills, and adherence to evidence-based thromboprophylaxis guidelines.

Similarly, A cross-sectional study by **Tolera and Gebremedhin (2024)** in Addis Ababa, Ethiopia, reported that nurses' knowledge and practice regarding VTE prevention were suboptimal in tertiary hospitals and recommended continuous professional education and competency-based training to improve clinical performance and patient safety. Their findings reinforce the importance of regular educational interventions in enhancing nurses' ability to recognize VTE risk factors and implement appropriate preventive measures.

Additionally, correct knowledge regarding the effect of hormone-mediated Veno-dilation increased from half of them at pre-program to majority at post-program. Moreover, correct knowledge about causes of endothelial damage increased from three fifth at pre-program to the majority at post-program. The present findings were supported the recent research on nursing competency assessment. **Yuksel and Arli (2025**) in Turkey highlighted the necessity of standardized tools to evaluate nurses' knowledge and practice regarding VTE prevention, emphasizing that identifying educational needs should precede targeted training interventions to improve competency and patient outcomes.

In contrast a descriptive study conducted by **Yee *et al.*, (2022)** in Kuala Lumpur, Malaysia revealed that nearly all participant nurses had a correct knowledge. This is discrepancy could be due to different educational system between countries, variations in healthcare infrastructure, institutional policies, and availability of evidence-based protocols,

Moreover, the current study showed that correct knowledge about causes of endothelial damage increased from more than half at pre-program to majority of them at post-program. Furthermore, the proportion of nurses with correct knowledge about coagulation factors that increased in concentration during pregnancy showed a marked improvement from more than one quarter pre-program to majority of them post-program. These findings indicate that the training program effectively enhanced nurses' understanding of the pathophysiological changes that contribute to the hypercoagulable state during pregnancy.

The current findings are supported by **Dyke *et al.* (2023)**, who, in a realist review of "e-learning interventions for venous thromboembolism prevention" concluded that structured educational programs significantly improve nurses' understanding of VTE pathophysiology and facilitate the translation of theoretical knowledge into clinical practice. The authors emphasized that educational interventions incorporating evidence-based content, interactive learning strategies, and clinical scenarios are more effective than traditional didactic teaching in improving nurses' competency.

Similarly, **Yuksel and Arli (2025)** emphasized that assessing nurses' knowledge regarding VTE prevention is essential for identifying educational needs and guiding targeted educational interventions. Their study highlighted persistent deficiencies in nurses' understanding of VTE risk factors and preventive measures before training, supporting the need for continuous competency-based education.

The improvement observed in the current study may be explained by the comprehensive content of the training program, which focused on pregnancy-induced physiological alterations, including endothelial dysfunction, increased coagulation factors, venous stasis, and hypercoagulability. In addition, **Elkashif *et al.* (2024)** in Port Said, Egypt, reported that an in-service training program significantly improved maternity nurses' knowledge and performance regarding venous thromboembolism prophylaxis during pregnancy and the postpartum period

Concerning level of nurse's knowledge regarding venous thromboembolism the present study showed that half of nurses had a good knowledge regarding types of VTE, regarding the definition of VTE knowledge. Moreover, deep venous thrombosis is the most common type during pregnancy before applying the training program while increased to the majority of them after applying the training program. In partial agreement a descriptive study conducted by **Ali-Al-Halabiah., (2024)** in Palestine, reported that the largest percentage of participants had a good awareness level related to the definition of VTE

Similarly, **Hu *et al*., (2025)** concluded that in the knowledge dimension, certain areas showed particularly poor results. For instance, a substantial proportion of nurses could not correctly identify the stages of DVT or the appropriate use of risk assessment tools

In the contrary a study conducted by **Rabaei., (2024)**. To assessed nurses' knowledge, perception, and practices regarding VTE prevention" showed that reported that the majority of nurses had a poor level of knowledge about VTE. This discrepancy may be due to differences in the questionnaire items and language

Concerning level of nurse's knowledge regarding pregnancy risk factors of venous thromboembolism risk factors of venous thromboembolism the present study revealed that shows that, there was a significant improvement in nurses' knowledge regarding pre-existing risk factors of venous thromboembolism after implementation of the training program $p < 0.001$. The marked improvement observed in the present study may be attributed to the comprehensive content of the training program, which emphasized internationally recognized antenatal risk factors for VTE, including previous thromboembolic events, inherited or acquired thrombophilia, cigarette smoking, autoimmune diseases, nephrotic syndrome, obesity, and other chronic maternal conditions

In the same line a study conducted by **Elkashif *et al.,* (2024)** proved that nearly one third had adequate knowledge regarding Venous thromboembolism risk factors, pre-in-service training program intervention which increases to three quarter immediately after post-in-service training program. This similarity could be justified by both studies carried out in the same community.

The present study demonstrated that, there was a significant improvement in nurses' knowledge regarding obstetric risk factors of venous thromboembolism after implementation of the training program $p < 0.001$. As evidence, correct knowledge regarding major obstetric risk factors increased from more than one third at pre-program to more than three quarter post-program. These findings indicate that the training program effectively enhanced nurses' awareness of pregnancy-specific conditions associated with thromboembolic risk.

The findings of the current study were consistent with those reported by **Varrias *et al.*, (2023)**, who found that structured educational interventions significantly improved maternity healthcare providers' ability to identify obstetric risk factors associated with pregnancy-related VTE. The authors emphasized that knowledge deficits concerning obstetric risk assessment remain common among healthcare professionals and can be effectively addressed through evidence-based continuing education program

The present findings are also supported by **De Backer *et al.*, (2025)** "ESC Guidelines for the management of cardiovascular disease and pregnancy" which identified cesarean delivery, preeclampsia, multiple pregnancy, assisted reproductive technologies, and multiparity among the major obstetric risk factors requiring antenatal and postpartum VTE risk assessment.

The present study showed that there was a significant improvement in nurses' knowledge regarding transient risk factors of venous thromboembolism (hyperemesis gravidarum, infection and surgical procedures) after implementation of the training program $p < 0.001$. The present findings were supported by the recent meta-analysis conducted by **He *et al.* (2024),** which identified pregnancy-related clinical conditions as major contributors to venous thromboembolism and emphasized the importance of early recognition of these risk factors during antenatal care.

Concerning level of nurse's knowledge regarding signs and symptoms of venous thromboembolism the present study found that nearly one third of nurses had a good knowledge regarding a classic sign of deep venous thrombosis. Also, correct knowledge about Homan's sign before applying the training program and the majority of nurses had good knowledge after applying of training program. In the same line a study conducted by **Bai *et al.,* (2025)** in China revealed that the questions with the lowest accuracy before the training pertained to the clinical symptoms of deep venous thrombus answered correctly with a less than one tenth of participant nurses, additionally symptoms or signs of lower extremity DVT was answered correctly with more than two fifth. While after that training the correct answers with improved to more than half respectively. This similarity reflects the effectiveness of

training programs to improve nurse's knowledge background.

Concerning level of nurse's knowledge regarding complications of venous thromboembolism the present study found that half of nurses had correct answer regarding pulmonary embolism before applying the study while after applying the study the majority of them had correct knowledge additionally above one third of studied nurses had correct knowledge regarding characters of post-thrombotic syndrome before applying the study while after applying the study the majority of them had correct knowledge.

In the same line a study by **Bai *et al.,* (2025)** revealed that samal number of participants had a good knowled rearding (DVT) complicated by pulmonary embolism before the study, as well as the long-term complications of lower extremity DVT, while increased to more than half and more than quarter after the study. Additionally, long-term complications of lower extremity DVT increased from almost one tenth before training to less than one quarter after the study. This improvement in knowledge is crucial as it may directly influence the quality of care provided to patients at risk of VTE

Regarding level nurses' knowledge regarding prophylaxis of venous thromboembolism the present study revealed that showed that there was a significant improvement in nurses' knowledge regarding prophylaxis of venous thromboembolism after implementation of the study $p < 0.001$.in the same line a study conducted by **Malk *et al.,* (2022)** illustrated that the majority of the studied nurses had unsatisfactory knowledge regarding preventive measures of VTE at pre- program implementation which improved to the majority of immediately post program and follow up program**.** This is agreement could be due to similar training program applied in the both studies.

Regarding assessing the venous thromboembolism risks the present study revealed that less than one quarter of studied nurses regularly assess the venous thromboembolism risks before applying the study, which increased to nearly two thirds after applying it. In contrast a descriptive study conducted by **Yesuf *et al*., (2021)** in northwest Ethiopia found that nearly all studied Participants assessing the DVT risks of patients regularly. The difference could be due to different cultural context.

Pertaining to level of nurses practice regarding venous thromboembolism risks assessment, the present study revealed that there was a significant improvement in nurses' practice regarding venous thromboembolism risk assessment after implementation of the study, with a highly statistically significant difference $p < 0.001$. As evidence, use of venous thromboembolism risk assessment scales to assess the risks increased from less than one quarter pre-program to nearly two third post-program This finding suggests that the educational intervention successfully enhanced nurses' adherence to evidence-based risk assessment practices and promoted the integration of standardized assessment tools into routine maternity care.

The current finding agreed with **Yuksel and Arli (2025),** who reported that educational interventions combined with standardized assessment instruments significantly improved nurses' competency in VTE prevention. Their study emphasized that the routine use of validated VTE risk assessment tools enhances nurses' clinical decision-making, facilitates early identification of high-risk patients, and supports timely implementation of thromboprophylaxis.

Concerning Life style modification, showed that there was a significant improvement in nurses' practice regarding lifestyle modification after implementation of the study $p < 0.001$. As evidence, teaching exercises such as ankle rotation, leg lifting, and foot movements showed marked improvement. These findings in the same line with **AL Mugheed *et al.,* (2023)** showed that the most nurses frequently implemented practices like encouraging early mobilization, leg exercise, maintain hydration and take sufficient fluids during pregnancy and postpartum. A possible explanation may be that this type of practice doesn't require additional resources or effort, or they learned from their experience.

Regarding mechanical prophylaxis the present showed there was improvement in nurses' practice regarding teaching proper use of antiembolism stockings increased from less than one quarter before applying the study to nearly three quarter after applying the study Additionally, teaching use of pneumatic compression devices improved markedly less than one quarter to the majority after applying program. In consistent with a descriptive study conducted by **AL-Mugheed *et al.,* (2022** demonstrated that almost a quarter only of nurses were done rightly and completely toward mechanical prophylaxis measures.

Conclusion

There was a highly statistically significant correlation between total nurses' knowledge score and total practice score at both pre and post implementation of the interventional study $p < 0.001$. Intervention study has a positive effect in the allover nurses' knowledge and practice score regarding venous thromboembolism prophylaxis.

Recommendations

- Further studies with different educational approaches (E-learning, blended learning) should be developed for improving venous thromboembolism preventive practices.
- Further studies recommended to investigate long-term retention of nurses' knowledge and practice following educational intervention.

Authors' contributions

E.A.M; developed the research, provided an explanation, collected information, produced the first

manuscript. H.M.S; made significant contributions to the goal and research hypothesis, introduction, review of the study's significance, debate. F.E.E; review study finding, discussion, conclusion, and recommendations and offered critical feedback on the text. H.A.E.; participated in every phase of the research process, and publication. All authors revised and approved the final manuscript.

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Table (1): comparison between nurses' knowledge regarding physiological and vascular changes pre and post implementation of training program **(n=100)**.

Items	Pre program				Post program				X^2	P-value
	Correct answer		ncorrect answer		Correct answer		Incorrect answer			
	No.	%	No.	%	No.	%	No.	%		
The physiological changes responsible for hypercoagulability state	**49**	**49.0**	51	51.0	**90**	**90.0**	10	10.0	**39.65**	**0.000** **
the effect hormone-mediated Veno-dilation	**50**	**50.0**	50	50.0	**86**	**86.0**	14	14.0	**29.77**	**0.000** **
Causes of endothelial damage in the pelvic and leg veins	**60**	**60.0**	40	40.0	**84**	**84.0**	16	16.0	**14.28**	**0.000** **
Pregnancy-related hypercoagulability is physiological adaptation to decrease the risk of postpartum hemorrhage.	70	70.0	30	30.0	87	87.0	13	13.0	**8.562**	**0.003** **
The coagulation factors show increase in concentration during pregnancy	**28**	**28.0**	72	72.0	**84**	**84.0**	16	16.0	**63.63**	**0.000** **
Physiologic lower limb edema in late pregnancy can mask the signs of a deep venous thrombosis	69	69.0	31	31.0	92	92.0	8	8.0	**16.85**	**0.000** **

Notes: X^2: Chi Square Test. (**) highly statistically significant at $p<0.001$

Table (2): Comparison between nurses' knowledge regarding venous thromboembolism pre and post implementation of training program **(n=100)**.

Items	Pre-program				Post program				X^2	P-value
	Correct answer		ncorrect answer		Correct answer		Incorrect answer			
	No.	%	No.	%	No.	%	No.	%		
Types of thromboembolism	**69**	**69.0**	31	31.0	**91**	**91.0**	9	9.0	**15.12**	**0.000****
Deep venous thrombosis is the most common type of venous thromboembolism occurs during pregnancy	**51**	**51.0**	49	49.0	**89**	**89.0**	11	11.0	**34.38**	**0.000****
Definition of venous thromboembolism	**43**	**43.0**	57	57.0	**87**	**87.0**	13	13.0	**42.54**	**0.000****
The risk of venous thromboembolism increases during postpartum period	**32**	**32.0**	68	68.0	**85**	**85.0**	15	15.0	**57.85**	**0.000****
The third trimester of pregnancy has the highest risk for developing venous thromboembolism compared to first and second trimesters	29	29.0	71	71.0	81	81.0	19	19.0	**54.62**	**0.000****

Notes: X^2: Chi Square Test. (**) highly statistically significant at p<0.001.

Table (3): Comparison between nurses' knowledge regarding risk factors of venous thromboembolism pre and post implementation of training program **(n=100)**.

Risk factors of venous thromboembolism	Pre-program				Post program				X^2	P-value
	Correct answer		ncorrect answer		Correct answer		Incorrect answer			
	No.	%	No.	%	No.	%	No.	%		
Pre-existing risk factors of venous thromboembolism										
Personal or family history	**31**	**31.0**	69	69.0	**76**	**76.0**	24	24.0	**40.69**	**0.000****
Obesity	73	73.0	27	27.0	90	90.0	10	10.0	**9.584**	**0.002****
Maternal age of 35 or more	74	74.0	26	26.0	81	81.0	19	19.0	**1.405**	**0.236**
More than half of pregnancy-related venous thromboembolism are associated with an underlying thrombophilia due to deficiencies of endogenous anticoagulants	**37**	**37.0**	63	63.0	**75**	**75.0**	25	25.0	**29.30**	**0.000****
Smoking during pregnancy	**28**	**28.0**	72	72.0	**82**	**82.0**	18	18.0	**58.90**	**0.000****
History of Systemic Lupus Erythematosus	**24**	**24.0**	76	76.0	**82**	**82.0**	18	18.0	**67.52**	**0.000****
Nephrotic Syndrome with pregnancy	**29**	**29.0**	71	71.0	**84**	**84.0**	16	16.0	**61.54**	**0.000****
varicose veins in the lower limbs	60	60.0	40	40.0	78	78.0	22	22.0	**7.574**	**0.006****
Obstetric risk Factors of venous thromboembolism										
Still birth in present pregnancy	**39**	**39.0**	61	61.0	**79**	**79.0**	21	21.0	**33.07**	**0.000****
Preterm labor& prolonged labor	50	50.0	50	50.0	83	83.0	17	17.0	**24.44**	**0.000****
Multiple gestation (e.g.,	**41**	**41.0**	59	59.0	**85**	**85.0**	15	15.0	**41.52**	**0.000****

twins)										
History of preeclampsia	**36**	**36.0**	64	64.0	**85**	**85.0**	15	15.0	**50.23**	**0.000****
emergency cesarean section is	**35**	**35.0**	65	65.0	**79**	**79.0**	21	21.0	**39.49**	**0.000****
Assisted Reproductive Technique	**46**	**46.0**	54	54.0	**75**	**75.0**	25	25.0	**17.59**	**0.000****
Multiple parity	60	60.0	40	40.0	84	84.0	16	16.0	**14.28**	**0.000****
Transient Risk Factors of venous thromboembolism										
Prolonged immobilization (more than 3 days)	65	65.0	35	35.0	79	79.0	21	21.0	**4.861**	**0.027***
Hyperemesis gravidarum	**45**	**45.0**	55	55.0	**79**	**79.0**	21	21.0	**24.53**	**0.000****
A systemic infection during pregnancy, such as pyelonephritis	**27**	**27.0**	73	73.0	**80**	**80.0**	20	20.0	**56.45**	**0.000****
Pregnant patients who undergo surgical procedures during pregnancy	**49**	**49.0**	51	51.0	**73**	**73.0**	27	27.0	**12.10**	**0.001****
leg edema	78	78.0	22	22.0	92	92.0	8	8.0	**7.686**	**0.006****

Notes: $X^{2:}$ Chi Square Test. No significant at p > 0.05. *Significant at p ‹ 0.05. (**) highly statistically significant at p<0.001.

Table (4): Comparison between nurses' knowledge regarding signs and symptoms of venous thromboembolism pre and post implementation of training program **(n=100)**.

Signs and symptoms of VTE	**Pre program**				**Post program**				**X^2**	**P-value**
	Correct answer		**ncorrect answer**		**Correct answer**		**Incorrect answer**			
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**		
Signs of VTE										
A classic sign of deep venous thrombosis is warmth and erythema	**39**	**39.0**	61	61.0	**83**	**83.0**	17	17.0	**40.68**	**0.000****
over the affected area										
Positive Homan's sign which is a calf pain on dorsiflexion	**38**	**38.0**	62	62.0	**76**	**76.0**	24	24.0	**29.45**	**0.000****
Symptoms of VTE										
Itching symptom is not commonly associated with	**55**	**55.0**	45	45.0	**78**	**78.0**	22	22.0	**11.87**	**0.001****
Pain or tenderness in one calf and thigh that is not caused by injury	**43**	**43.0**	57	57.0	**70**	**70.0**	30	30.0	**14.83**	**0.000****

Notes: $X^{2:}$ Chi Square Test. (**) highly statistically significant at p<0.0

Table (5): Comparison between nurses' knowledge regarding complications and investigations of venous thromboembolism at pre and post implementation of training program **(n=100)**.

Complications and investigations of VTE	**Pre program**				**Post program**				**X^2**	**P-value**
	Correct answer		**ncorrect answer**		**Correct answer**		**Incorrect answer**			
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**		
Complications of VTE										
pulmonary embolism characterized by sudden onset of shortness of breath and chest pain	58	58.0	42	42.0	86	86.0	14	14.0	**19.44**	**0.000****
Characters of Post-Thrombotic Syndrome	**37**	**37.0**	63	63.0	**83**	**83.0**	14	14.0	**44.08**	**0.000****
Placental infarction	**47**	**47.0**	53	53.0	**81**	**81.0**	19	19.0	**25.08**	**0.000****

results in fetal demise and preterm labor										
Investigations of VTE										
Coagulation screen and thrombophilia screening	46	46.0	54	54.0	80	80.0	20	20.0	**24.79**	**0.000****
D-dimer is much less specific for VTE in late pregnancy	**26**	**26.0**	74	74.0	**78**	**78.0**	22	22.0	**54.16**	**0.000****
Doppler ultrasound is done for measuring deep venous velocity and flow in (femoral and popliteal veins) for deep venous thrombosis	77	77.0	23	23.0	92	92.0	8	8.0	**8.589**	**0.003****
Planar lung ventilation/perfusion for woman suspected with Pulmonary embolism	**28**	**28.0**	72	72.0	**80**	**80.0**	20	20.0	**54.42**	**0.000****
CT pulmonary angiography for evaluation of pulmonary embolism	70	70.0	30	30.0	88	88.0	12	12.0	**9.765**	**0.002****

Notes: X^2: Chi Square Test. (**) highly statistically significant at p<0.001.

Table (6): Comparison between nurses' knowledge regarding prophylaxis of venous thromboembolism at pre and post implementation of training program **(n=100)**.

Prophylaxis of Venous Thromboembolism	**Pre program**				**Post program**				**X^2**	**P-value**
	Correct answer		**Incorrect answer**		**Correct answer**		**Incorrect answer**			
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**		
General prophylaxis										
A key step in general prophylaxis against venous thromboembolism	72	72.0	28	28.0	94	94.0	6	6.0	**17.15**	**0.000****
The use of venous thromboembolism risk assessment scale	**41**	**41.0**	59	59.0	**78**	**78.0**	22	22.0	**28.40**	**0.000****
Timing of venous thromboembolism risk assessment	**39**	**39.0**	61	61.0	**83**	**83.0**	17	17.0	**40.68**	**0.000****
Mechanical prophylaxis										
Indications for Mechanical Prophylaxis Used	**39**	**39.0**	61	61.0	**84**	**84.0**	16	16.0	**42.76**	**0.000****
Pharmacological management										
Indications for Thromboprophylaxis with (LMHW)	**39**	**39.0**	61	61.0	**77**	**77.0**	23	23.0	**29.63**	**0.000****

Notes: X^2: Chi Square Test. (**) highly statistically significant at p<0.001.

Table (7): Comparison between nurses' practice regarding venous thromboembolism risks assessment at pre and post implementation of training program **(n=100)**.

Items	**Pre program**				**Post program**				**X^2**	**P-value**
	Done		**Not done**		**Done**		**Not done**			
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**		
Assess regularly the venous thromboembolism risks	**22**	**22.0**	78	78.0	**61**	**61.0**	39	39.0	**31.32**	**0.000****
Venous thromboembolism risk assessment scales										
Ask woman if there is previous history of VTE related to pregnancy.	**26**	**26.0**	74	74.0	**79**	**79.0**	21	21.0	**56.32**	**0.000****
Ask woman if there is history of recent VTE<2 years.	18	18.0	82	82.0	72	72.0	28	28.0	**58.90**	**0.000****
Ask woman if there is history	23	23.0	77	77.0	64	64.0	36	36.0	**34.19**	**0.000****

of spontaneous or estrogen induced pulmonary embolism or deep venous thrombosis										
Check for a history of thrombophilia	**20**	**20.0**	80	80.0	**80**	**80.0**	20	20.0	**72.00**	**0.000****
Evaluate woman level of mobility.	57	57.0	43	43.0	76	76.0	24	24.0	**8.102**	**0.004****
Measuring body mass index.	43	43.0	57	57.0	72	72.0	28	28.0	**17.20**	**0.000****
Ask for woman's age group	**34**	**34.0**	66	66.0	**84**	**84.0**	16	16.0	**51.67**	**0.000****

Notes: $X^{2:}$ Chi Square Test. (**) highly statistically significant at p<0.001.

Table (8): Comparison between nurses' practice regarding life style modification at pre and post implementation of training program **(n=100)**.

Items	**Pre program**				**Post program**				**X^2**	**P-value**
	Done		**Not done**		**Done**		**Not done**			
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**		
Increase the mobilization and exercise during pregnancy unless avoided.	63	63.0	37	37.0	84	84.0	16	16.0	**11.32**	**0.001****
Assist in early ambulation during postpartum.	85	85.0	15	15.0	95	95.0	5	5.0	**5.556**	**0.0018***
Elevate legs to decrease leg edema and varicose vein.	63	63.0	37	37.0	85	85.0	15	15.0	**12.57**	**0.000****
Maintain hydration and take sufficient fluids during pregnancy and post-partum	71	71.0	29	29.0	89	89.0	11	11.0	**10.12**	**0.001****
Encourage women to eat healthy diet.	**49**	**49.0**	51	51.0	**70**	**70.0**	30	30.0	**9.150**	**0.002****
Instruct the woman to perform deep-breathing for 10 seconds at least /2 hours / day	**43**	**43.0**	57	57.0	**74**	**74.0**	26	26.0	**19.79**	**0.000****
Teach the woman about water immersion in case of leg edema.	34	34.0	66	66.0	69	69.0	31	31.0	**24.52**	**0.000****
Encourage woman to wear loose clothing especially lower of the body	23	23.0	77	77.0	76	76.0	24	24.0	**56.18**	**0.000****

Notes: $X^{2:}$ Chi Square Test. (**) highly statistically significant at p<0.001.

Table (9): Comparison between nurses' practice regarding life style modification at pre and post implementation of training program **(n=100)**.

Items	**Pre program**				**Post program**				**X^2**	**P-value**
	Done		**Not done**		**Done**		**Not done**			
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**		
Encouraging the women to do leg and foot exercises										
Pointing toes toward body, feeling a stretch in calf.	**37**	**37.0**	63	63.0	**64**	**64.0**	36	36.0	**14.58**	**0.000****

Hold for 3-5 seconds										
Point toes away from body, contracting calf muscles. Hold for 3-5 seconds; Repeat pumping action 10- 15 times	**33**	**33.0**	67	67.0	**66**	**66.0**	34	34.0	**21.78**	**0.000****
Rotate ankles in a circular motion, first clockwise, then counter clockwise; Perform 5-10 circles in each direction for both ankles	**22**	**22.0**	78	78.0	**69**	**69.0**	31	31.0	**44.54**	**0.000****
Bend knees and lift one leg at a time toward chest While sitting or lying down	**32**	**32.0**	68	68.0	**77**	**77.0**	23	23.0	**40.83**	**0.000****
Hold for a few seconds, then gently lower leg back down	**19**	**19.0**	81	81.0	**78**	**78.0**	22	22.0	**69.68**	**0.000****
Alternate legs and repeat 10 times for each leg	**24**	**24.0**	76	76.0	**72**	**72.0**	28	28.0	**46.15**	**0.000****
Teaching the woman about the appropriate use of antiembolism stockings	**31**	**31.0**	69	69.0	**73**	**73.0**	27	27.0	**35.33**	**0.000****
Apply graduate elastic stocking throughout the day specially while sitting or standing position	**32**	**32.0**	68	68.0	**80**	**80.0**	20	20.0	**46.75**	**0.000****
Inform woman that She should remove them at night before going to bed	**42**	**42.0**	58	58.0	**85**	**85.0**	15	15.0	**39.88**	**0.000****
Instruct woman to remove stockings immediately and seek medical advice if experiences (numbness, discoloration, pain in her legs)	**33**	**33.0**	67	67.0	**71**	**71.0**	29	29.0	**28.92**	**0.000****
Teaching the woman how to use intermittent pneumatic compression device										
Wear the device 24 hours a day while she is immobilized.	**29**	**29.0**	71	71.0	**89**	**89.0**	11	11.0	**74.41**	**0.000****
Show the woman how to turn the pump on and off	**28**	**28.0**	72	72.0	**84**	**84.0**	16	16.0	**63.63**	**0.000****
Wrap sleeves or cuffs around the patient's legs	**23**	**23.0**	77	77.0	**78**	**78.0**	22	22.0	**60.50**	**0.000****
Report any	**26**	**26.0**	74	74.0	**84**	**84.**	16	16.	**67.9**	**0.000**

Notes: $X^{2:}$ Chi Square Test. (**) highly statistically significant at $p<0.001$.

Table (10): Comparison between nurses' practice regarding mechanical prophylaxis at pre and post implementation of training program **(n=100)**.

Items	**Pre-program**				**Post program**				**X^2**	**P-value**
	Done		**Not done**		**Done**		**Not done**			
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**		
Select the proper size of Antiembolism stockings										

discomfort, numbness, or skin irritation					**0**		0	**6**	**
Instruct woman to remove cuffs for short periods to check her skin	**31**	**31.0**	69	69.0	**72**	**72.0**	28	28.0	**33.65**	**0.000** **

Notes: $X^{2:}$ Chi Square Test. (**) highly statistically significant at $p<0.001$.

References

Ali, J. M. E. H., Saleem, B. A. M., Al-Ani, A., Alkhatam, H. E., Alabood, S. E., Rayan, S. E., Mohamed, A. E., Alasheeri, F. J., Hasan, F. Y., Elbana, O. M., & Zaid, E. M. (2026). Incidence, risk factors, and outcomes of VTE in surgical and obstetric patients: A systematic review. Journal of Medical and Health Studies, 7(5), 94–99. https://doi.org/10.32996/jmhs.2026.7.5.12

Ali-Al-Halabiah, R. A. *Awareness and Attitudes toward Venous Thromboembo-lism among Nurses and Midwives in Obstetric Wards in Bethlehem and East Jerusalem* (Doctoral dissertation, Al-Quds University).

Al-Mugheed, K., & Bayraktar, N. (2023). Knowledge, risk assessment, practices, self-efficacy, attitudes, and behaviour's towards venous thromboembolism among nurses: A systematic review. *Nursing Open*, *10*(9), 6033-6044. https://doi.org/10.1002/nop2.1914

Al-Mugheed, K., & Bayraktar, N. (2023). Knowledge, risk assessment, practices, self-efficacy, attitudes, and behaviour's towards venous thromboembolism among nurses: A systematic review. *Nursing Open*, *10*(9), 6033-6044. https://doi.org/10.1002/nop2.1914

Al-Mugheed, K., Bayraktar, N., Nashwan, J. A., Al-Bsheish, M., AlSyouf, A., & Jarrar, M. (2022). Compliance of non-pharmacological preventive practice of venous thromboembolism among Jordanian nurses. *Medicine*, *101*(44), Article e31189. https://doi.org/10.1097/MD.0000000000031189

Al-Mugheed, K., Bayraktar, N., Nashwan, J., Al-Bsheish, M., AlSyouf, A., & Jarrar, M. (2022). Compliance of non-pharmacological preventive practice of venous thromboembolism among Jordanian nurses. Medicine, 101(44), e31189. https://doi.org/10.1097/MD.0000000000031189

Al-Mugheed, K., Totur Dikmen, B., Bayraktar, N., Farghaly Abdelaliem, S.M. and Ahmed Alsenany, S. (2023) 'Nursing care and barriers for prevention of venous thromboembolism in total knee and hip arthroplasty patients: a qualitative study. Journal of Multidisciplinary Healthcare, pp.547-556. https://doi.org/10.2147/JMDH.S403383

Bai, Y., Qin, H., Wang, K., Jia, Z., & Li, X. (2025). A Blended Interprofessional Education Program Enhances Healthcare Workers' Knowledge, Attitudes, and Practices Regarding Venous Thromboembolism. *Clinical and Applied Thrombosis/Hemostasis*, *31*, 10760296251372943. https://doi.org/10.1177/10760296251372943

Cardaniuc, C., & Sagaidak, I. V. (2026). Thromboprophylaxis in pregnancy, delivery and puerperium: a review of literature and current guidelines. *Revista de Ştiinţe ale Sănătăţii din Moldova*, (1), 85-95. https://doi.org/10.52645/MJHS.2026.1.13

Centers for Disease Control and Prevention. (2025). Venous Thromboembolism (Blood Clots). https://www.cdc.gov/blood-clots/about/index.html

De Backer, J., Haugaa, K. H., Hasselberg, N. E., De Hosson, M., Brida, M., Castelletti, S., ... & Valente, A. M. (2025). 2025 ESC Guidelines for the management of cardiovascular disease and pregnancy: Developed by the task force on the management of cardiovascular disease and pregnancy of the European Society of Cardiology (ESC) Endorsed by the European Society of Gynecology (ESG). *European heart journal*, *46*(43), 4462-4568.https://doi.org/10.1093/eurheartj/ehaf193

Didembourg, M., Morimont, L., De Gottal, E. and Douxfils, J.(2025). The maternal hemostatic shift: Understanding VTE risk in pregnancy and postpartum. Thrombosis Research, p.109561. https://doi.org/10.1016/j.thromres.2024.109561

Dyke, E. V., Jauncey-Cooke, J., & Johnston, A. N. (2023). e-Learning interventions for nurses to prevent venous thromboembolism in patients: A realist review. *Journal of clinical nursing*, *32*(15-16), 4441-4453. . https://doi.org/10.1111/jocn.16571

Hashem, S.M., Abdel Menem, E.E. and EL-Said, F.M. (2023) ' Effect of Nursing Intervention on Nurses' Performance regarding the Prevention of Deep Vein Thrombosis among Postpartum Women. Tanta

Scientific Nursing Journal, 31(4), pp.318-341 https://doi.org/10.21608/tsnj.2023.328840

He, L., Liu, J., Sun, R., Qiu, L., Tang, L., & Gao, Y. (2024). Risk factors related to venous thromboembolism in pregnant women: A meta-analysis. International Angiology, 43(3), 323–330. https://doi.org/10.23736/S0392-9590.24.05141-1

Hu, S., Huang, J., Wang, H. and Wang, Y. (2025). Nurses' knowledge, attitudes, and practices regarding deep vein thrombosis and the nursing management. *Scientific Reports*, *15*(1), p.17174**.** https://doi.org/10.1038/s41598-025-96551-0

Hu, S., Huang, J., Wang, H. and Wang, Y. (2025). Nurses' knowledge, attitudes, and practices regarding deep vein thrombosis and the nursing management. *Scientific Reports*, *15*(1), p.17174**.** https://doi.org/10.1038/s41598-025-96551-0

Kalaitzopoulos, D. R., Panagopoulos, A., Samant, S., Ghalib, N., Kadillari, J., Daniilidis, A., Samartzis, N., Makadia, J., Palaiodimos, L., Kokkinidis, D. G., & Spyrou, N. (2022). Management of venous thromboembolism in pregnancy. Thrombosis Research, 211, 106–113. https://doi.org/10.1016/j.thromres.2022.01.018

Maughan, B.C., Marin, M., Han, J., Gibbins, K.J., Brixey, A.G., Caughey, A.B., Kline, J.A. and Jarman, A.F. (2022) 'Venous thromboembolism during pregnancy and the postpartum period: risk factors, diagnostic testing, and treatment. Obstetrical & gynecological survey, 77(7), pp.433-444 https://doi.org/10.1097/ogx.0000000000001043

Mohamed Labib Elkashif, M., Ramadan Ail Mohamed, M., Ahmed Gassmelseed Abdalla, D., & Hamdy Nasr Abdelhalim, E. (2024). Effect of in-service training program on improving nurses' performance regarding venous thromboembolism prophylaxis during pregnancy and postpartum. Egyptian Journal of Health Care, 15(3), 200–222. https://doi.org/10.21608/ejhc.2024.364402

Nabil Malk, R., Mawed Fahem, E., Elzeblawy Hassan, H., & Abouda Abdelhamed Soultan, 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.doi: 10.21608/ejhc.2022.230390

Othman, M., & Pradhan, A. (2023). Laboratory testing of hemostasis in pregnancy: A brief overview. Hemostasis and Thrombosis: Methods and Protocols, 111–125. https://doi.org/10.1007/978-1-0716-3175-1_7

Park, J. E., Park, Y., & Yuk, J. S. (2021). Incidence of and risk factors for thromboembolism during pregnancy and postpartum: A 10-year nationwide population-based study. *Taiwanese Journal of Obstetrics and Gynecology*, 60(1), 103–110. https://doi.org/10.1016/j.tjog.2020.11.016

Rabaei, A. A. A. (2024). Nurses' Knowledge, Perception of Practice, and Their Related Factors Regarding Venous Thromboembolism Prevention in Southern West Bank Hospitals رسالة ماجستير(Doctoral dissertation, AAUP). : http://repository.aaup.edu/jspui/handle/123456789/2903

Silva, J. S. D., Lee, J. A., Grisante, D. L., Lopes, J. D. L., & Lopes, C. T. (2020). Nurses' knowledge, risk assessment, and self-efficacy regarding venous thromboembolism. Acta Paulista de Enfermagem, 33, Article eAPE20190125. https://doi.org/10.1016/j.eswa.2025.131348

Tolera, B. D., & Gebremedhin, K. B. (2024). Nurses' knowledge and practice regarding venous-thromboembolism prevention in tertiary hospitals of Addis Ababa, Ethiopia: a cross-sectional study. *Journal of Vascular Nursing*, *42*(2), 123-130

Varrias, D., Spanos, M., Kokkinidis, D. G., Zoumpourlis, P., & Kalaitzopoulos, D. R. (2023). Venous thromboembolism in pregnancy: challenges and solutions. *Vascular health and risk management*, 469-484. https://doi.org/10.2147/VHRM.S404537

Wang, Y., Wu, X. J., Ma, Y. F., Xu, Y., Wang, X. J., Zhu, C., ... & Zhu, L. Y. (2021). Chinese orthopaedic nurses' knowledge, attitude and venous thromboembolic prophylactic practices: A multicentric cross-sectional survey. Journal of clinical nursing, 30(5-6), 773-782. https://doi.org/10.1111/jocn.15615

Yee, B. L., Sano, J. A., & Bakar, R. A. (2022). Knowledge and awareness among registered nurses in the prevention of venous thromboembolism (VTE) for high-risk antenatal and postnatal mothers. *The Malaysian Journal of Nursing*, 13(4), 62–69. https://doi.org/10.31674/mjn.2022.v13i04.010

Yesuf, N. N., Abebe, T., Adane, R., Lelisa, R., Asefa, M., Tessema, M., & Birhanu, Y. (2021). Nurses knowledge and practice towards prevention on deep vein thrombosis in University of Gondar Comprehensive Specialized Hospital, northwest Ethiopia. *International Journal of Africa Nursing*

Sciences, *15*, 100357. https://doi.org/10.1016/j.ijans.2021.100357

Yuksel, B., & Arli, S. K. (2025). Nurses' knowledge and practice in venous thromboembolism prevention: Development and validation of a scale**.** *Nurse Education in Practice, 90*, 104660. https://doi.org/10.1016/j.nepr.2025.104660

Zhang, J., & Sun, J.-L. (2020). Severe venous thromboembolism in the puerperal period caused by thrombosis: A case report. *World Journal of Clinical Cases*, 8(7), 1311–1318. https://doi.org/10.12998/wjcc.v8.i7.1311