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ICU NURSES' SELF-RATED KNOWLEDGE AND PRACTICE REGARDING VENOUS THROMBOEMBOLISM RISK ASSESSMENT AND PREVENTION IN JORDAN: A CROSS-SECTIONAL STUDY

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Abstract

Venous thromboembolism (VTE), which includes deep vein thrombosis (DVT) and pulmonary embolism (PE), affects millions of people worldwide each year and has become the third most common vascular disease in most countries. VTE is regarded as a common cause of increased length of stay in hospitals and is a significant cause of morbidity and mortality in hospitalized patients, leading to high costs. Clinical nurses are key in preventing VTEs by identifying risks and applying preventive measures to enhance patient safety and reduce the occurrence and impact of VTEs. To assess Jordanian nurses' level of perceived knowledge and practice of venous thromboembolism (VTE) risk assessment and prevention. A descriptive cross-sectional study was conducted with ICU nurses using a predesigned questionnaire. Convenient sampling was used, and data were analyzed with SPSS 26, employing descriptive statistics, t-tests, and ANOVA with significance set at 0.05. The sample comprised 282 participants with a mean age of 30.6 years. Of the total sample, 55.3% were male, the majority (79.4%) had three or more years of experience working in the ICU, half reported attending a course about VTE, and 46.8 % of them self-rated their knowledge about VTE as good, while 25.1 % perceived their knowledge as very good or excellent. 49.5% was the average score for all VTE knowledge questions, out of 100. The average self-efficacy scores between 2.53 and 2.7 on a Likert scale of 1 to 5 for VTE prevention and prophylaxis. The most commonly cited barriers are "Lack of time" (17.0%) and "Lack of a standardized protocol" (16.3%). The self-reported VTE assessment performance of patients was inconsistent between nurses. Age and attending a course about VTE were the only statistically significant factors associated with knowledge level. The nurses in Jordan have limited knowledge and practice regarding VTE, particularly regarding risk factors and PE diagnosis. Time constraints and a lack of standardized protocols hinder their role in conducting thorough risk assessments and applying evidence-based prophylactic measures. Despite confidence, self-efficacy in VTE risk assessment and prophylaxis remains low. Educational and training programs targeting nurses working in the ICUs are needed, and including further VTE-related content in nursing programs is a must.

Keywords: Venous Thromboembolism (VTE), Nursing Knowledge, Risk Assessment, Intensive Care Unit (ICU), VTE Prevention.

1. INTRODUCTION

Venous thromboembolism (VTE) is a serious medical condition that involves the formation of a blood clot within the veins. This can happen in any vein in the body (which are typically located in the lower limbs, abdomen, or pelvis), but most often occurs in the deep veins of the legs, a condition known as deep vein thrombosis (DVT) (Verso et al., 2012). If the clot breaks free and travels through the right heart chambers and inferior vena cava before entering the pulmonary arterial system, it may lead to a blockage in the pulmonary blood vessels, known as a pulmonary embolism (PE) (Verso et al., 2012). VTE

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has become the third most common thromboembolic disease, affecting over 10 million people worldwide each year (Heit, Spencer, & White, 2016). It was estimated that 1 in 12 individuals in Western regions would be diagnosed with venous thromboembolism in their lifetime, and the incidence rate in Europe and the USA is estimated to be 1-2 per 1000 person-years (Lutsey & Zakai, 2023). Even though the incidence of VTE is lower in Asian nations than in Western nations, this issue is now the primary concern in daily clinical practice in the Asian region (Yamashita et al., 2020). The incidence rate of VTE in Asian populations is estimated to be high. In nine Asian hospitals, estimates of VTE cases per 10,000 admissions range from 11 to 88, also Post-surgical DVT was calculated from 0.15 to 1.35% (Giustozzi et al., 2019).

Many risk factors are considered as triggers that lead to the development of VTE; some are acute triggers, such as sudden emergencies or injuries, and others are subacute triggers due to progressive changes within the body or the surrounding environment. Other risk factors of VTE include demographic factors such as age and gender. The health status of the individual also plays an important role in developing VTE, such as having chronic diseases, exposure to long periods of immobility, and undergoing surgical procedures (Lutsey & Zakai, 2023). According to research estimates, 50% of VTEs are related to recent or ongoing hospitalization for surgery or a serious medical condition (Schünemann et al., 2018). Patients who are admitted to the intensive care unit (ICU) due to severe illness are more likely to experience high-risk VTE because they may require mechanical ventilation, a central venous catheter, or immobilization (Li et al., 2024). Factors such as endothelial damage, blood hypercoagulability, and venous stasis are thought to be linked with an increased risk of VTE (Nicholson et al., 2020). The VTE, sometimes referred to as the "silent killer" of hospitalized patients, has been known to impact both ambulatory and inpatient patients (CDC., 2020).

The burden of VTE extends beyond the initial occurrence of the illness; it also includes its complications, such as chronic thromboembolism, pulmonary hypertension, recurrence, and post-phlebitis syndrome. These complications result in a markedly higher rate of death, morbidity, extended hospital stays, and expenses. (Kafeza et al., 2017). According to the US Centers for Disease Control and Prevention, the most frequent cause of avoidable death for hospitalized patients is VTE, particularly PE. (Healthcare Engineering, 2023). Since VTE is a preventable condition, one of the top ten patient safety measures is VTE prophylaxis. Organizations have developed many VTE guidelines to improve prevention and reduce VTE mortality. (Middeldorp et al., 2023). According to a study, when VTE prophylaxis is a standard protocol component of admission and order sets, most patients will have prophylaxis ordered for them, even though nurses may choose not to administer it because they feel the therapy is unnecessary. (Kittitirapong et al., 2022).

Pharmacotherapy and non-pharmacotherapy measures like leg elevation, walking, vena cava filters, compression stockings, and intermittent pneumatic compression are available for VTE prophylaxis. Anticoagulants such as fondaparinux, rivaroxaban, betrixaban, and low molecular weight heparin (LMWH) are among the pharmacotherapy

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options. (Ayalew et al., 2018). The American Heart Association called for action to prevent VTE since the high incidence of VTE is often caused by poor compliance with VTE prophylaxis. Their policy calls for improved prophylactic implementation, reporting, nationwide tracking, assessment of VTE risk, and prevention of VTE events (Healthcare Engineering, 2023).

In Jordan, out of 456 hospitalized patients, only 35.1% had their VTE prophylaxis appropriately administered. (Gharaibeh et al., 2017). In the US, non-pharmacological prophylaxis will cost between $465 to $875 per patient, while the monthly cost of treating DVT is estimated to be between $700 and $1400 (Dawoud et al., 2018). Prevention and risk assessment of VTE require collaboration between healthcare professionals from various specialties to ensure effective delivery and follow-up care outcomes. Registered nurses (RN) play an important role in assessing and preventing VTE in clinical settings, but they should be well-prepared to do so (Lee et al., 2014).

1.1 Problem of Statement & Significance of Study

Venous thromboembolism is regarded as a common leading cause of increased length of stay and cost in hospitalized patients and is a significant cause of morbidity and mortality in hospitalized medical and surgical patients worldwide. (Yohannes et al., 2022). An estimated 900,000 people have PE or DVT, and the Centers for Disease Control and Prevention (CDC) estimated that the complications of VTE cause 60,000–100,000 deaths annually. (CDC, 2020). One of the symptoms of PE is sudden death, which affects 25% of cases, while 10% to 30% of cases are predicted to pass away within a month of diagnosis. One-third to half of DVT patients will experience post-thrombotic syndrome, which is a chronic condition that includes symptoms like limb swelling, pain, discoloration, and scaling. (CDC, 2020).

In hospitalized patients, inadequate prophylactic therapy for VTE results in 10–80% of cases of VTE, with mortality rates of 30–40% and 0.2–0.9% due to DVT and PE, respectively. (Kamdem et al., 2018). Globally, VTE is highly prevalent and incidence-prone, with an approximate yearly incidence rate of 1.2 per 1000 persons and an estimated death toll of 60,000–100,000 in the US. (Scheres et al., 2018). In a study involving autopsies, 108 out of 982 cases (11%) had PE as the cause of death. The hospital had an average autopsy rate of 30% ± 0:07% (Westra et al., 2023).

Clinical nurses are an essential group of healthcare professionals to recognize and address the risks of VTE. Although nurses do not prescribe pharmacologic prophylaxis for VTE, they do assess risks, educate patients and their families about these risks, and manage anticoagulant therapy when patients leave the hospital and enter other healthcare settings. Hence, disparities in nurses' self-perceived and objective knowledge, self-efficacy, and perceived barriers to risk assessment and VTE prevention may have a positive or negative influence on their ability to carry out these responsibilities (Huxley, 2023). Scholars have studied this difficult subject in great detail.

According to several studies, clinical nurses are essential in thromboprophylaxis because they assess patients, identify patients at risk, collect data, make recommendations, and

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see those recommendations through treatment courses (Ahmed et al.,2020). When nurses receive adequate education, they can effectively implement VTE prophylaxis guidelines into clinical practice, improving patient safety and reducing the incidence of VTEs (Al-Mugheed & Bayraktar, 2021). One of the most important areas of a nurse's license is VTE management, which gives them the chance to provide critical care. There is broad agreement that nurses are accountable for primary prevention, even though physicians decide on the final course of treatment for VTE (Yohannes et al., 2022). Despite the availability of VTE prophylaxis guidelines, it is still difficult to incorporate them into standard clinical nursing practice. Numerous studies have found that a large number of hospitalized patients do not receive appropriate VTE preventive prophylaxis, which harms patient safety and quality of life (Sousa Da Silva et al., 2020).

The overwhelming body of research from all over the world suggests that most nurses are essential to VTE prevention and control, where they must recognize the value of VTE education and look into the various factors that affect clinical nursing in this regard. While many studies have looked at nurses' knowledge of venous thromboembolism prevention worldwide, few studies have been published locally. To improve VTE in clinical nursing, the researcher surveyed nurses nationwide in Jordan to address knowledge gaps in current guidelines and knowledge regarding VTE risk assessment and prevention.

1.2 Research Questions

1. What is the knowledge level of targeted nurses regarding venous thromboembolism Prophylaxis?
2. What is the level of nurses’ practice regarding venous thromboembolism Prophylaxis?
3. What is the nurses’ perception regarding venous thromboembolism prophylaxis?

1.3 Research Objectives

1. Assess nurses' level of knowledge regarding venous thromboembolism prophylaxis.
2. Assess the level of venous thromboembolism prophylaxis practice among nurses.
3. Assess nurses' perspectives on venous thromboembolism prevention.

1.4 Conceptual Definitions

VTE: Venous thromboembolism (VTE) refers to conditions where a blood clot forms in the venous circulation, such as Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE). (CDC., 2020).

Deep Vein Thrombosis (DVT): A medical condition known as deep vein thrombosis is brought on by forming a blood clot in a deep vein. These clots typically appear in the lower legs, thighs, or pelvis, but rarely in the arms. (CDC., 2020)

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A pulmonary embolism is a blood clot that obstructs and terminates blood flow to a lung artery. Most often, a blood clot begins in a peripheral limb, particularly the legs' deep veins, and moves to the lungs (Ortel et al., 2020).

Knowledge: Understanding knowledge as the process by which people and communities give meaning to their experiences is essential to any conversation about learning. For this reason, it can be broadly understood to include the knowledge, comprehension, skills, principles, and attitudes that are gained via education. (Elfert, 2019).

Perceived self-efficacy refers to people's perceptions of their ability to achieve specific performance levels and exert control over life events. People are more likely to successfully reduce unhealthy habits and adopt and incorporate healthy habits into their daily routines when they have a higher sense of self-efficacy. (Bandura, A., & Wessels, S., 1997)

Self-perceived knowledge: A person's subjective evaluation of their knowledge and comprehension of a given subject is known as self-perceived knowledge. (Park, Gardner, & Thukral, 1988)

Intensive care unit (ICU): A systematized setting in which to treat unstable patients, intensive care units were developed in the late 1950s as separate architectural spaces. ICU nurses who work in the ICU understood that nursing care for patients in this unit would be of higher intensity, with advanced monitoring, and a variety of physiological system support to maintain life during critical illness (Jastremski, 2000).

1.5 Operational Definitions

Knowledge is measured by 55 items answered as true or false, choosing from multiple options included in the questionnaire. The total ICU nurse VTE knowledge equals the total correct answers to these 55 items, ranging from 0 to 55.

Perceived self-efficacy: will be operationally measured by a 5-point Likert scale, ranging from none of the time, A Little of the time, some of the time, most of the time, and always, on a total of 6 items.

Self-perceived knowledge: will be operationally measured by a 5-point Likert scale, ranging from Poor, Fair, Good, very good, and Excellent, on a total of 1 item.

2. LITERATURE REVIEW

Venous thromboembolism (VTE) consists of two conditions, Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE). DVT typically originates in the deep veins in the lower extremities, but can occur in the arms or pelvis, with clots typically starting in the calf and extending proximally (Kakkos et al, 2021). PE occurs when a clot is dislodged and travels to the pulmonary area, possibly obstructing blood flow (dislodged clots originating in the thigh are more likely to cause PE; Tice, Connor, et al. 2020). The American Heart Association (AHA) and the European Society of Cardiology (ESC) classify PE as acute or chronic. Acute PE occurs suddenly and induces cardiopulmonary strain that the AHA categorizes as massive, submassive, or low risk, and the ESC

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categorizes are low, intermediate, or high risk (Konstantinides et al., 2020). Immediate treatment using an anticoagulant is required (Schünemann et al., 2018). Chronic PE occurs from existing clots that have yet to resolve and can present as heart failure. Around 50 percent of the PE cases can contribute to long-term functional limits, while others can progress to Chronic Thromboembolic Pulmonary Hypertension (CTEPH), which can be fatal (Yamashita et al., 2020).

2.1 Epidemiology of VTE

In Europe and the USA, the incidence rate of venous thromboembolism (VTE) is approximately 1–2 cases per 1,000 person-years; however, this incidence could vary based on race, sex, age, and health status (Wendelboe et al., 2016). Regions report different rates: Buenos Aires is 0.7 per 1,000 person-years (Vázquez et al., 2013), Perth, Australia is 0.8 (Danwang et al., 2017), and South Korea is only 0.2 (Hong et al., 2018). A systematic review of Asia found annual incidence per 100,000 was 19.9 for Hong Kong, 15.9 for Taiwan, and 13.8 for South Korea. Over time, the incidence has increased (Lee et al., 2017). Race and ethnicity significantly affect the incidence of VTE. African Americans have the highest incidence, especially in terms of PE, while Asians and Pacific Islanders had a prevalence that was 70% lower than the other demographic groups. For instance, U.S. Hispanics were more prevalent than Asians but less than Caucasians, while the risk of recurrence was also impacted by demographic factors (White & Keenan, 2009). Khan (2019) performed a systematic review and found that overall, in the absence of provoking factors to decline the anticoagulant therapy, 10% of patients with unprovoked VTE had recurrence within 1 year but this rises to 36% over 10 years, and men had a recurrence rate that was 1.4 times higher than women.

Overall, while exact data for the incidence of VTE in Jordan is missing, in a regional study of 10 different Middle Eastern countries (Jordan included), it was determined that the VTE prophylaxis guidelines were applied poorly, and 14.1% of the Jordanian patients were at low risk, 23.2% were moderate risk, 30% were high risk, and 32.7% were considered very high risk with VTE (Mokhtari et al., 2011). Despite all patients in low-income countries being at lower rates for VTE, they continued to be adjusted for a few demographic and medical aspects (Siegal et al., 2020). VTE is a great health burden, as 10–30% of patients will have a recurrence within five years of stopping treatment in the U.S. (Kyrle et al., 2010). The annual direct cost to manage acute VTE is more than $12,000 US per patient, that is an excess cost of approximately $10,000 US, even when only 18% of patients will be readmitted to the hospital within the first thirty days (Secemsky et al., 2018).

2.2 Risk Factors for Venous Thromboembolism

VTE risk factors consist of a range of provocative events and modifiable risk factors (Lutsey & Zakai, 2023). A meta-analysis of 2,554 patients reported higher recurrent rates in males versus females at one year (9.5% vs. 5.3%) and at 3 years (11.3% vs. 7.3%), even when controlling for hormone-related VTE (Douketis et al., 2017). A systematic review reported that men were 2.8 times more likely than females to have recurrent VTE,

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and in males with reproductive risk factors (monogenic or hormonal) the risk of recurrence was 5.2 times higher should it happen (Roach et al., 2015).

Surgical procedures, injuries, and fractures all contribute to acute provoking events (Lutsey & Zakai, 2023). The incidence rates for DVT were anywhere from 0.21% - 41%, and PE was anywhere from 0.64% - 21.7% in patients who had pelvic and acetabular fractures (Mahmoud et al., 2022). Obesity and inactivity have also added significantly to high rates of VTE incidents (Mokhtari et al., 2011). Cancer has about a 4 - 6.5-fold increase in VTE incidence (Agnelli et al., 2018); cancer that is metastatic increases the incidence to a shocking 68 per 1,000 person years, with pancreatic cancer being the highest risk to patients (Roopkumar et al., 2021).

According to a Norwegian study of 36,341 individuals, excess weight factors account for 25% of the morbidity and mortality in VTE cases, with the risk of VTE being 1.4 times greater for overweight patients and 1.84 times higher for obese patients (Frischmuth et al., 2024). Male sex and patients with diabetes, congestive heart failure, previous DVT, CRRT, and the need for mechanical ventilation were risk factors for VTE in the elderly intensive care unit population (Chen et al., 2021). VTE is also known to be associated with inflammatory and autoimmune conditions such as SLE, IBD, and DIC (Wendelbo & Raskob, 2016).

2.3 Risk assessment model (RAM) of venous thromboembolism (VTE)

Various paper- and computer-based approaches, including physician reminders and decision support tools, have proven effective in VTE risk assessment and prevention (Eliason, 2023). Numerous Risk Assessment Models (RAMs)—such as Caprini, Padua, and IMPROVE—are used clinically to stratify VTE risk, especially in high-risk groups like surgical and cancer patients (Hazeltine et al., 2021; Stuck et al., 2017). Over 200,000 patients have taken part in more than 100 different clinical trials to validate Caprini, a dynamic RAM that needs to be constantly assessed (Cronin et al., 2019). While bedside nurses typically do not have the training needed to effectively use RAMs, particularly nurses in the ICU (Intensive Care Unit), they can help promote shared making and aid in customizing prophylactic strategies (Darzi et al., 2020; Lee et al., 2014). Despite 98.8% of physicians agreeing that VTE prevention is important, only 35.4% of them used RAMs, and 44.9% of them were not aware of RAMs according to a 2023 U.S. survey (Lam et al., 2023).

2.4 Nurses' knowledge and practice in VTE

Venous thromboembolism (VTE), which refers to pulmonary embolism (PE) and deep vein thrombosis (DVT), is a significant cause of preventable morbidity, mortality, and hospital length of stay and cost to the healthcare system (Heit, Spencer & White, 2016). Though it can both be reduced and prevented, it hinges on appropriate clinical practice, especially as it relates to the nursing profession, and educating nursing staff is a vital contributor (Al-Mugheed & Bayraktar, 2023). However, studies from around the world have shown that there continues to be a gap in nursing knowledge. In Brazil, only 33.1% of nurses answered VTE questions correctly and reported that the lack of protocols or

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guidelines to follow was a barrier to reducing VTE (Silva et al., 2020). South Korean nurses averaged 50.9 out of 100 for knowledge in VTE, and only 2.4% rated their knowledge as excellent (Oh et al., 2017). In China, only 55.43% of nurses answered all questions on knowledge correctly, but nurses showed a positive attitude towards prevention (Yan et al., 2021). In Ethiopia, as well as Nigeria, researchers found that knowledge of VTE was low, and prophylaxis practices were poor (Kiflie et al., 2022; Makusidi et al., 2016; Onianwa et al., 2023). In Northern Cyprus, while nurses reported an awareness of DVT, their knowledge and practice were still inadequate, and there was some indication related to education and experience of nursing staff and performance (Al-Mugheed & Bayraktar, 2018). Educational interventions have shown promising evidence: In Egypt, ICU nurses showed improved compliance with VTE guidelines after education (Mokadem & EL-Sayed, 2019), and a 14-day program increased nurses' knowledge and practice (Malk et al., 2022).

2.5 Prevention of VTE

It's known that VTE prophylaxis is both effective and cost-effective with established protocols that guarantee continuity of practices in hospitals (Okuhara et al., 2014). Huilcarema et al. (2024) reviewed both pharmacological (heparin, warfarin), which are effective, however, they are associated with bleeding risks, and non-pharmacological approaches, as graduated compression stockings (GCS) and intermittent pneumatic compression (IPC). IPC is aimed at improving venous flow, using little to no side effects. Fitriani & Kariasa (2023) found that IPC was the most effective method in congestion reduction of VTE occurrence and has the least adverse effects. Hospitals are turning towards the adoption of IPC as a cost-effective and patient-friendly method to improve venous return, while decreasing VTE (Streiff et al., 2012). In addition to bettering venous return, IPC contains other additive benefits, such as improving fibrinolysis and NO release profile.

2.6 VTE research in Jordan

Limited national data is available on the incidence and prevalence of venous thromboembolism (VTE) in Jordan, and no prior studies exist that specifically evaluated Jordanian nurses' knowledge of VTE risk assessment, prevention, and control (Amawi et al., 2023). To date, there has been limited research on the relatedness of patient knowledge of VTE to nurse education and practice in Jordan: Jarab et al. (2020) found that only 22.2% of patients were aware of PE, 38.2% were aware of DVT; Alzoubi et al. (2013) found similar low awareness of VTE among women after a cesarean delivery (DVT 46%, PE 18.7%). In a regional study, Mokhtari et al. (2011) identified that Jordanian patients (only 32.7%) experience a high VTE risk rate. For example, Amawi et al. (2023) found that among hospitalized patients diagnosed with VTE were DVT 84.2% had DVT, and 45% stayed 7 or more days, and that hypertension also increased the length of stay. Moreover, Al-Mugheed et al. (2022) assessed non-pharmacological preventive practices of Jordanian nurses and reported that mean total compliance was low (10.6/20). Compliance was the lowest for nurses with less than one year of experience or who were not taught about VTE prevention. These studies do demonstrate the timely need to

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assess ICU nurses' knowledge and practice related to VTE prophylaxis, and this study will do that.

3. METHODOLOGY

An outline of the research methods utilized to measure the knowledge level of Jordanian nurses in the ICU of selected hospitals about VTE, their practice, and perceived self-efficacy in dealing with the condition. The chapter covers the research design, setting, ethical considerations, sampling process (study population, sample size, and sampling method), study tools, data gathering methods, and data analysis techniques.

3.1 Design

The research design adopted for this study is a descriptive cross-sectional study conducted to assess ICU nurses' VTE knowledge and self-practice. Cross-sectional studies are observational studies that examine data from a population at a single point in time. Cross-sectional studies are usually utilized to estimate the amount of a phenomenon in a population, such as the prevalence of one or more health outcomes in a particular population. Cross-sectional studies are also designed to estimate knowledge, attitude, and practice (KAP) levels (Wang & Cheng 2020).

3.2 Settings

The present study was conducted at five governmental hospitals: Al-Bashir Hospital, AL Hussain Hospital in Al-Salt, Princess Basma Hospital, Alkarak Governmental Hospital, and Altafila Governmental Hospital. These hospitals are administered and owned by the Ministry of Health in Jordan. Together, these hospitals contain five CCUs and four ICUs with a total number of 211 beds (Ministry of Health, 2023).

Hospital details according Ministry of Health

Hospital	Location	ICU beds	ICU nurses
Al-Bashir Hospital	In the Capital, Amman	118 beds	200 nurses
AL-Hussain Hospital	In the Balqa Governorate	35 beds	64 nurses
Princess Basma Hospital	In the Governorate of Irbid	19 beds	53 nurses
Al-Karak Governmental Hospital	in the city of Al-Karak	22 beds	48 nurses
Tafilah Governmental Hospital	Tafilah Governorate in the Al-Ays area	17 beds	35nurses

3.3 Population and Sample

The population was nursing staff in all government hospitals in Jordan of all classifications, including the following degrees: diploma, bachelor, and master, who were working in ICUs and CCUs at the targeted hospitals. the sample was selected as a convenience sample based on inclusion and exclusion criteria.

3.4 Inclusion Criteria

The inclusion criteria were as follows: being a Jordanian registered nurse (RN) (bachelor’s degree or above) or associate degree nurse (diploma degree); providing

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direct care to critically ill patients; had experience in the ICU for at least six month and finally, able to read, write, and understand English languages.

3.5 Exclusion Criteria

The exclusion criteria were as follows: Head nurses and students. A group of nurses who met the preceding criteria was recruited conveniently from the accessible population.

3.6 Sampling Technique

Convenience sampling was used in the selection of the nurses who took part in this study. The most popular sampling method in nursing research is convenience sampling (Polit & Beck, 2012), and it would be more practical to choose ICU nurses from the chosen hospitals using this method in this study. Convenience sampling guarantees that participants are chosen based on their accessibility. Convenience sampling may not, however, be representative of the population among the available individuals. A significant problem with convenience is the possibility of bias. When a segment of the population is over- or under-represented about its characteristics, this is known as sample bias (Polit & Beck, 2012).

3.7 Sample Calculation

The determent sample size by the Richard Geiger formula was applied (Wirths et al., 2015).

$$n = \frac{\left(\frac{z}{d.}\right)^2 x(P)^2}{1 + \frac{1}{N}\left(\left(\frac{z}{d.}\right)^2 \times (P)^2 - 1\right)}$$

$$n = \frac{\left(\frac{1.96}{0.05}\right)^2 x(0.5)^2}{1 + \frac{1}{1000}\left(\left(\frac{1.96}{0.05}\right)^2 \times (0.5)^2 - 1\right)}$$

n=260

Based on the above-mentioned inclusion and exclusion criteria, and by applying the aforementioned formula, the number of participant nurses was 282.

3.8 Study time and duration

The start time for the present study was from May 2024 to October 2024.

3.9 Instrument

In this study, we used the questionnaire that was developed by Jung-Ah Lee in 2010, and based on Lee and colleagues (2014) were contacted to permit using it in this study (appendix E), The tool also was used by many authors including (Silva et al., 2020) and (Sousa et al., 2020) to assess Nurses' knowledge, risk assessment, and self-efficacy regarding venous thromboembolism, and evaluate clinical nurses' knowledge of VTE in the Brazil and United States (U.S.). The questionnaire included four parts; the first part

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Vol: 58 Issue: 07:2025
DOI: 10.5281/zenodo.16014426

includes a basic information form that contains questions about the demographic data such as age, experience, hospital work, and level of education, second part contains questions related to self-perceived VTE knowledge with a 5-point Likert scale from 1 (poor) to 5 (excellent) and self-reported VTE assessment performance with a 5-point Likert scale from 1 (with none of my patients) to 5 (with all of my patients). The third part contains questions related to VTE knowledge, composed of 55 items regarding knowledge of signs and symptoms (25 items), knowledge of diagnosis (2 items), risk factors, and prevention of VTE (17 items), and 11 questions about the prophylaxis of VTE by answering true or false questions. One point was awarded for a correct response on the 55 knowledge questions, while zero points were deducted for an incorrect response. When the total score was equal to or higher than 60%, the nurse's level of knowledge was deemed satisfactory; when it was less than 60%, it was deemed unsatisfactory. The fourth part includes one question about self-efficacy in practicing VTE prevention/prophylaxis with a 5-point Likert scale from 1 (none of the time) to 5 (always).

3.10 Reliability and Validity

The Cronbach's alpha of the questionnaire was 0.84, indicating very good reliability.

3.11 Pilot study

We conducted a pilot study on 10 nurses to test the comprehensiveness, clarity, and time of the questionnaire. Based on the results, we made simple modifications, such as rearranging some questions and rephrasing them. These 10 copies of questionnaires were excluded from the final sample.

3.12 Data Collection Procedure

The official permission to collect data in hospitals affiliated with the Jordanian Ministry of Health was obtained from the hospitals' administrative staff by submitting an official letter from the Dean of the College of Nursing. questionnaires were distributed to the intensive care units in each hospital. In the beginning, the researcher conducted a pilot study. This paper questionnaire was distributed by the researcher to 10 nurses to test the comprehensiveness, clarity, and time of the questionnaire before the final submission of the questionnaire to the targeted participants. Of the 300 questionnaires distributed, 282, including 124 from Albashir Hospital, 31 from AL Hussain as Salt Hospital, 50 from Princess Basma Hospital, 44 from Alkarak governmental hospital, and 33 from Altafila governmental hospital,) were completed and returned with a response rate of 94. %. The self-administered questionnaire included a cover letter explaining the purpose of the research as well as the informed consent form. The questionnaire took approximately 20_25 minutes to complete. The paper questionnaire was distributed to the nurses in their respective units from July 2024 to October 2024, in three different shifts (mornings, afternoons, and nights) by the researcher, who explained the objectives of the study and invited the nurses to participate. Those who accepted to join the study answered the data collection documents were to be handed in in up to seven days. The best date and time for the collection of the completed instrument in print within this period was agreed upon individually between the nurse and the researcher. Nurses who did not complete the

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online):0493-2137
E-Publication: Online Open Access
Vol: 58 Issue: 07:2025
DOI: 10.5281/zenodo.16014426

instrument in print or who did not answer the instrument within the established period were excluded.

3.13 Data Analysis

We used the most recent IBM SPSS version 26 for Windows to analyze the data. Every study variable, such as age, gender, education, experience, VTE knowledge, and practice, was examined for anomalies and missing data. The knowledge scores were transformed into percentages where true responses for each participant were divided by 55 (for the total score) and divided by the sum of each category, such as 25, to estimate the knowledge level of risk factors. For categorical variables, participant characteristics are displayed as frequencies and percentages, while for continuous variables, means (± standard deviations) and/or medians are used. Visual representation of self-assessed VTE knowledge is provided by a bar graph. The means (± standard deviations) and rates of correct answers for each subcategory, along with general knowledge, serve as a summary of the actual level of VTE knowledge. self-assessment. To test whether there is a statistical relationship between the main dependent variables (knowledge and knowledge sub-categories), the independent t-test was used with independent variables of binary type, where analysis of variance (ANOVA) was used with independent variables that are multicategory. The presentation of self-efficacy in VTE prophylaxis/prevention practice includes means (± standard deviation), frequencies, and percentages.

4. RESULTS

The main purpose of the current study was to assess Jordanian nurses' level of perceived knowledge and practice of VTE risk assessment, as well as prevention and actual knowledge of VTE. Moreover, the study tried to identify the perceived knowledge and practice of VTE risk assessment, as well as to determine the relationship between nurses' demographic variables and their level of knowledge regarding VTE. This chapter consists of three sections: The first part describes the critical care nurses' demographic characteristics; the second part summarizes perceived knowledge and practice of VTE risk assessment; the third part focuses on the relationship between nurses' demographic variables and their level of knowledge regarding VTE.

Table 4.1: Demographic characteristics of participants n= 282

Characteristics	Frequency	Percent	Mean±SD
Gender			
Male	156	55.3	
Female	126	44.7	
Age			**30.55±6.4**
21-29	159	56.4	
30-39	85	30.1	
40-50	38	13.5	
Education			
Bachelor's degree	238	84.4	
Master's degree	20	7.1	
Associate's degree	24	8.5	

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online):0493-2137
E-Publication: Online Open Access
Vol: 58 Issue: 07:2025
DOI: 10.5281/zenodo.16014426

The above table shows a relatively balanced gender distribution, with males making up 55.3% and females 44.7%. This reflects a slight male predominance in the sample. The nurses' mean age was (30.55±6.40 years). The vast majority of participants hold a Bachelor's degree (84.4%), with smaller percentages holding a Master's degree (7.1%) or an Associate's degree (8.5%).

Table 4.2: clinical characteristics of participants n= 282

Characteristics	Frequency	Percent
Attending courses or programs on venous thromboembolism (VTE) risk assessment and prevention		
YES	140	49.6
NO	142	50.4
Experience in nursing care		
Less than 1 year	16	5.7
1-3 years	67	23.8
4-6 years	87	30.9
7-9 years	38	13.5
10-15 years	36	12.8
16-20 years	38	13.5
Experience in critical care nursing		
Less than 1 year	58	20.6
1-3years	95	33.7
4-6 years	72	25.5
7-9 years	22	7.8
10-15 years	29	10.3
16-20 years	6	2.1
Hospital		
Alkarak governmental hospital	44	15.6
Altafila governmental hospital	33	11.7
Princess Basma hospital	50	17.7
AL Hussain as salt hospital	31	11.0
Abasher hospital	124	44.0
What type of unit do you work in intensive care		
General ICU	184	65.2
CCU	21	7.4
Burns ICU	6	2.1
medical ICU	55	19.5
Surgical ICU	14	5.0
Neuro ICU	2	.7

The data shows that the sample is almost evenly split between those who have attended courses or programs on VTE risk assessment (49.6%) and those who have not (50.4%). This balance suggests that only half of the participants have had formal training in this area. The largest group has 4-6 years of nursing experience (30.9%), followed by those with 1-3 years of experience (23.8%).

Fewer participants have more than 10 years of experience, indicating that the majority of the sample has mid-level experience in nursing care. In addition, there is a notable

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online):0493-2137
E-Publication: Online Open Access
Vol: 58 Issue: 07:2025
DOI: 10.5281/zenodo.16014426

proportion of participants who have 1-3 years of experience in critical care nursing (33.7%), followed by those with less than one year (20.6%) and 4-6 years (25.5%). The number of participants with more than 10 years of experience in critical care nursing is relatively low (12.4%). The majority of participants work at Abasher Hospital (44.0%), followed by Princess Basma Hospital (17.7%). The remaining hospitals each account for a smaller percentage of the sample, ranging from 11.0% to 15.6%.

The majority of participants work in General ICU units (65.2%), while smaller numbers work in specialized units such as CCU (7.4%), medical ICU (19.5%), and surgical ICU (5.0%). Very few participants are in Neuro ICU or Burns ICU, reflecting their more niche roles.

Table 4.3: Knowledge of VTE

	Number of items	Mean	SD	Correct answers %
Risk factors for venous thromboembolism	25	10.1	7.39	40.4%
Signs and symptoms of deep vein thrombosis (DVT)	8	4.35	2.35	54.4%
Signs and symptoms of pulmonary embolism (PE)	9	4.79	2.54	53.2%
Diagnosis DVT	1	.59	0.83	59.9%
Diagnosis PE	1	.21	1.02	21.6%
Prophylaxis	11	7.12	0.42	64.7%
Total	55	27.23	--	49.5%.

The table highlights participants' knowledge of venous thromboembolism (VTE) across various domains, including risk factors, signs and symptoms, diagnostic methods, and prophylaxis.

It shows that out of 55 total items, participants had an average of 27,23 correct answers, with an overall accuracy rate of 49.5%.

Knowledge of risk factors for VTE appears to be relatively limited, with a mean of 10.1 correct answers out of 25 items and an accuracy rate of 40,4%.

Similarly, awareness of the signs and symptoms of deep vein thrombosis (DVT) and pulmonary embolism (PE) is also low, with average scores of 4.35 and 4.79 out of 8 and 9 items, respectively, and accuracy rates of 54.4% and 53.2%.

Participants performed better in identifying diagnostic methods for DVT and PE, with mean scores of 0.59 and 0.21 out of a single item for each, reflecting accuracy rates of 59.9% and 21.6%, respectively.

The highest level of knowledge was observed in the prophylaxis domain, where participants had a mean score of 7.12 out of 11 items, achieving an accuracy rate of 64,7%.

This disparity in knowledge highlights areas that require targeted educational interventions, particularly in recognizing risk factors and clinical signs of VTE.

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online):0493-2137
E-Publication: Online Open Access
Vol: 58 Issue: 07:2025
DOI: 10.5281/zenodo.16014426

Table 4.4: Participants' detailed answers about Risk factors for VTE.

Option	Frequencies	Percentage of correct answers %
Risk factors for venous thromboembolism		
Age >40 years	199	70.57
Cancer	91	32.27
Inflammatory bowel disease	53	18.79
Thrombophilia	117	41.49
Smoking history	182	64.54
Obesity	198	70.21
History of venous thromboembolism	205	72.70
Family history of venous thromboembolism	162	57.16
Pregnancy/puerperium	164	58.16
Diabetes mellitus	122	43.26
Heart and respiratory failure	138	48.94
Nephrotic syndrome	77	27.30
Trauma (upper or lower extremities)	148	52.48
Bedridden patient	161	57.09
Central venous catheterization/pacemaker	118	41.84
Postoperative period	161	57.09
Hormone replacement therapy	83	29.43
Chemotherapy/radiation therapy	80	28.37
Oral contraception containing estrogen	92	32.62
Restricted ambulation	132	46.81
Paroxysmal nocturnal hemoglobinuria	51	18.09
Hospitalization	122	43.26
Acute medical diseases (such as pneumonia, sepsis, etc.)	00	0.00
Varicose veins of the lower extremities	162	57.45
Neurological condition presenting with paresis of the extremities	114	40.43

The table effectively demonstrates the knowledge levels of participants regarding various aspects

of venous thromboembolism (VTE). For the section on risk factors, common contributors such as "Age >40 years" and "History of venous thromboembolism" were well-recognized, showing high awareness among participants.

However, rare risk factors like "Paroxysmal nocturnal hemoglobinuria" and "Inflammatory bowel disease" were less frequently identified. Notably, "Acute medical diseases (such

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ISSN (Online):0493-2137
E-Publication: Online Open Access
Vol: 58 Issue: 07:2025
DOI: 10.5281/zenodo.16014426

as pneumonia, sepsis, etc.)" had no correct responses, highlighting a critical gap in understanding.

Table 4.5: Participants' detailed answers about Signs and symptoms of DVT and PE

Option	Frequencies	Percentage of correct answers %
Signs and symptoms of deep vein thrombosis (DVT)		
Calf pain, tenderness	225	79.79
Swelling	236	83.69
localized heat	193	68.44
Groin swelling	100	35.46
Erythema and discoloration	147	52.13
Pitting edema	109	38.65
Dilated superficial veins	106	37.59
Cyanosis	113	40.07
What are the signs and symptoms of pulmonary embolism (PE)?		
Tachypnea (>20 breaths/miin)	203	71.99
Tachycardia (>100 bpm)	210	74.47
Dyspnea	160	56.74
Pleuritic or chest pain	178	63.12
Cyanosis	141	50.00
Hemoptysis	50	17.73
Sudden collapse	117	41.49
Cough	132	46.81
Sweating	160	56.74

The table effectively demonstrates the knowledge levels of participants regarding various aspects of venous thromboembolism (VTE).

For the section on signs and symptoms of deep vein thrombosis (DVT), most participants recognized key symptoms such as "Swelling" and "Calf pain, tenderness," reflecting familiarity with classic presentations.

On the other hand, less apparent symptoms like "Dilated superficial veins" and "Cyanosis" were underrecognized, which may affect timely identification in clinical settings.

The responses for signs and symptoms of pulmonary embolism (PE) show good awareness of prominent signs like "Tachypnea" and "Tachycardia."

However, more specific symptoms, including "Hemoptysis" and "Sudden collapse," were less frequently recognized, indicating a need for an improved understanding of the diverse manifestations of PE.

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online):0493-2137
E-Publication: Online Open Access
Vol: 58 Issue: 07:2025
DOI: 10.5281/zenodo.16014426

Table 4.6: Participants' detailed answers about prophylaxis for VTE

Option	Frequencies	Percentage of correct answers %
Which of the following is the initial diagnostic test of choice for DVT		
Correct option	169	59.9
Which of the following is the initial diagnostic test of choice for PE		
Correct option	61	21.6
Prophylaxis		
Q1) Almost all patients admitted to the hospital are at risk for VTE	189	67
Q2) Mechanical prophylaxis is as effective as pharmacological prophylaxis in preventing VTE	58	20
Q3) A 35-year-old hospitalized patient with no significant medical history admitted to the hospital following a hernia repair is at risk for VTE.	192	68
Q4) A history of heparin-induced thrombocytopenia is a contraindication for pharmacologic VTE prophylaxis with heparin or low molecular weight heparin (e.g., enoxaparin)	209	74
Q5) CNS surgery within 24 hours is an absolute contraindication for prophylaxis with heparin	200	70
Q6) Enoxaparin compared to heparin offers significant advantages for VTE prophylaxis because enoxaparin has a lower incidence of heparin-induced thrombocytopenia	227	80
Q7) Aspirin is an acceptable alternative to heparin for pharmacologic VTE prophylaxis	170	60
Q8) Beverages that are low in vitamin K do not influence warfarin. These include herbal and black tea (green tea is an exception), coffee, and cola	171	60
Q9) Platelet count < 100,000 is an absolute contraindication for prophylaxis with heparin	213	75
Q10) Warfarin (oral anticoagulant) interacts with many other medications such as aspirin	204	72
Q11) Recent surgery is a contraindication for pharmacologic VTE prophylaxis with heparin or low molecular weight heparin	177	62

Regarding diagnostic tests, the responses show moderate awareness of DVT diagnostic protocols but significantly lower recognition rates for the initial diagnostic test for PE. This indicates an area requiring more focused education.

The section on prophylaxis shows varied knowledge levels, with some items achieving high correct response rates, while others, like Q2, were poorly recognized. This suggests variability in participants' understanding of prophylaxis measures.

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online):0493-2137
E-Publication: Online Open Access
Vol: 58 Issue: 07:2025
DOI: 10.5281/zenodo.16014426

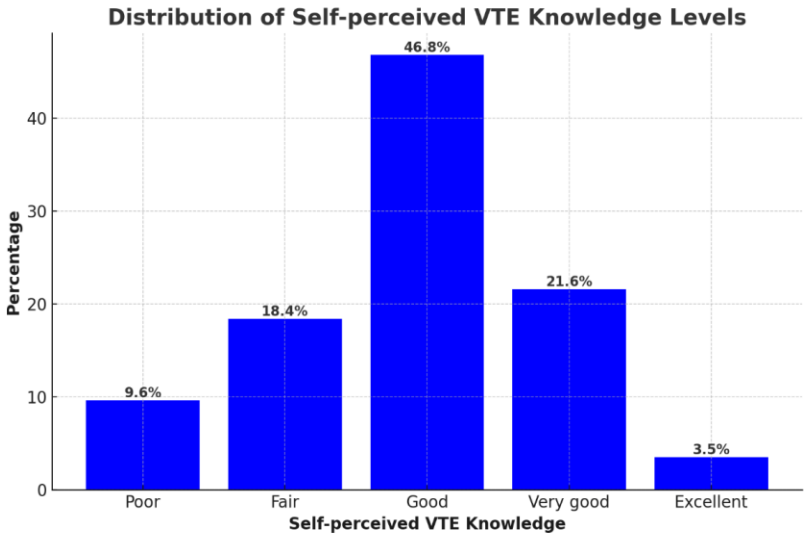

Figure 2: Self-perceived VTE Knowledge (n = 282)

The majority of participants (46.8%) rate their knowledge of VTE risk assessment as "Good," and 21.6% rate it as "Very Good." However, nearly a third (28.0%) rate their knowledge as only "Fair" or "Poor," indicating room for improvement in overall knowledge levels.

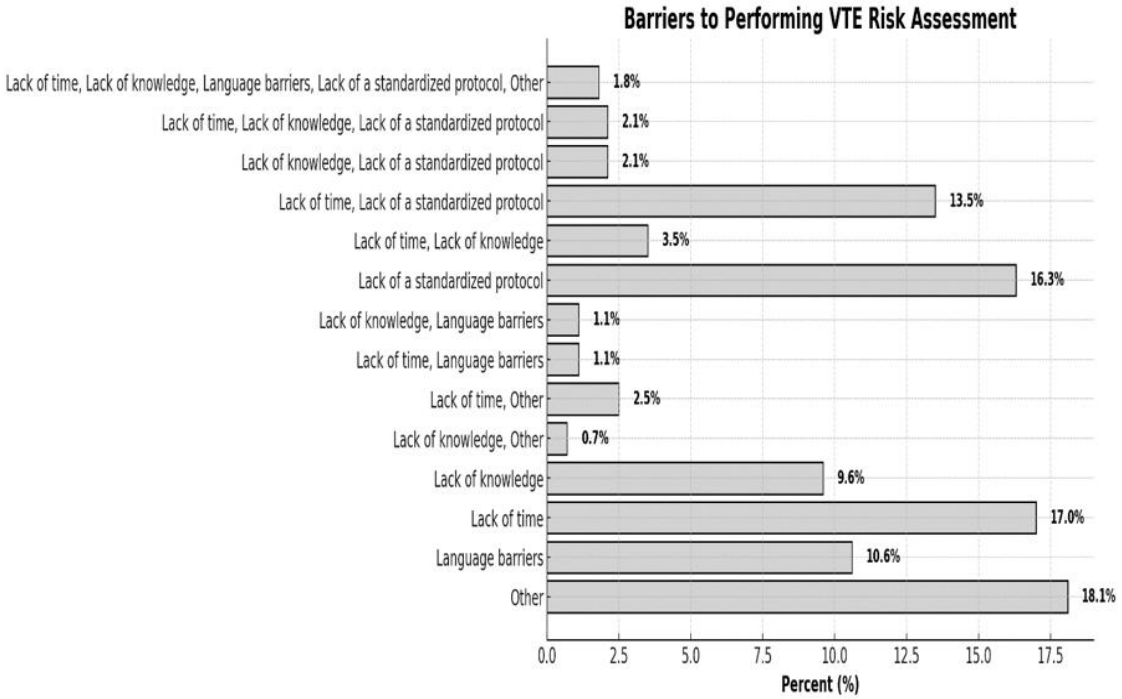

Figure 3: Barriers to thorough VTE risk assessment (n = 282)

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online):0493-2137
E-Publication: Online Open Access
Vol: 58 Issue: 07:2025
DOI: 10.5281/zenodo.16014426

The most commonly cited barriers are "Lack of time" (17.0%) and "Lack of a standardized protocol" (16.3%), while a notable portion identified "Other" unspecified barriers (18.1%). "Lack of knowledge" was also a significant barrier for 9.6% of respondents. A smaller percentage mentioned barriers like "Language barriers" (10.6%) and combinations of the above factors.

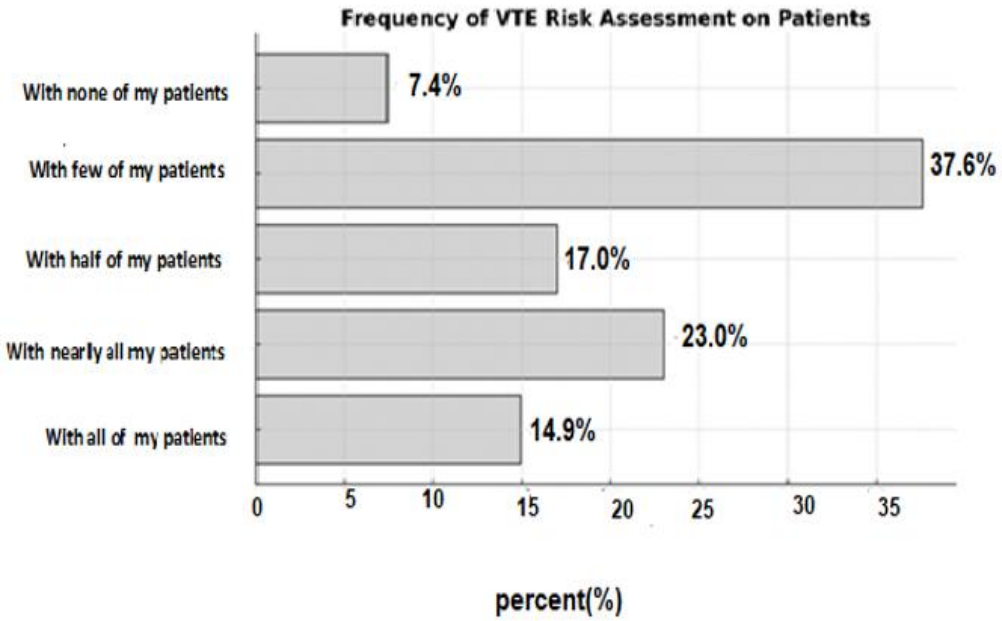

Figure 4. Self-rated VTE Assessment Performance

The data shows that many participants (37.6%) complete a VTE risk assessment for only a few of their patients. A smaller group (23.0%) performs assessments on nearly all patients, while 14.9% do so with all patients. This suggests variability in how consistently VTE risk assessments are completed, with over half performing them sporadically or infrequently.

Table 4.7: Self-efficacy in practicing VTE prevention among ICU nurses

Question	M ± SD	None of the time	Little of the time	Some of the time	Most of the time	Always
a. Conduct a thorough VTE risk assessment	2.53 (1.02)	44 (15.6%)	99 (35.1%)	77 (27.3%)	00	00
b. Educate the patient on oral anticoagulants	2.67 (1.13)	27 (9.6%)	87 (30.9%)	101(35.8%)	37 (13.1%)	30 (10.6%)
c. Effectively use mechanical devices for VTE prevention	2.58 (1.10)	30 (10.6%)	86 (30.5%)	104(36.9%)	42 (14.9%)	20 (7.1%)

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online):0493-2137
E-Publication: Online Open Access
Vol: 58 Issue: 07:2025
DOI: 10.5281/zenodo.16014426

d. Educate patients and families about DVT and PE	2.65(1.09)	20 (7.1%)	94 (33.3%)	89 (31.6%)	50 (17.7%)	29 (10.3%)
e. Advise at-risk patients about lifestyle changes	2.62 (1.08)	21 (7.4%)	96 (34.0%)	90 (31.9%)	40 (14.2%)	35 (12.4%)
f. Encourage early mobilization and leg exercises	2.70(1.09)	17 (6.0%)	80 (28.4%)	105 (37.2%)	40 (14.2%)	40 (14.2%)
Total (percentage)		9.4	32	33.5	14	11

The table shows moderate confidence among participants in performing VTE-related practices, with mean scores between 2.53 and 2.70. Most participants report being able to perform these tasks "some of the time" or "little of the time," reflecting varying confidence levels. Educating patients on anticoagulants and encouraging mobilization and leg exercises has slightly higher means, indicating relatively more confidence in these areas. A smaller portion of respondents feel fully confident ("always") across all items, suggesting an overall need for enhanced training or experience in VTE prevention practices. The general practice of VTE shows that 33.5% of nurses were able to practice VTE some of the time, while 32% could only do so a little. 14% were able to practice VTE most of the time, and only 11% always. Only 9.4 % of nurses said that they could not practice VTE at all.

Table 4.8: Analysis of association between VTE Knowledge with Attending the course of VTE (independent t-test)

Knowledge groups	Total	Attending the course on VTE				t-value	P-value
	Mean ±SD	Not attending		Attending course			
		Mean	SD	Mean	SD		
Risk factors for VTE	10,1 (7.28)	9.3	7.254	11.43	7.133	-2.9	.004 *
Signs and symptoms of (DVT)	4.35 (2.14)	4.73	2.206	5.1	1.928	-4.59	.000 **
signs and symptoms of (PE)	4.79 (2.54)	4.16	2.462	5.4	2.472	-4.23	-4.23
Initial diagnostic test of choice for DVT	0.59 (.490)	0.16	0.4976	0.45	0.4834	1.19	0.235
Initial diagnostic test of choice for PE	0.21 (.412)	0.22	0.4067	0.2	0.4192	0.37	0.712
Prophylaxis	7.12 (1.84)	6.98	2.045	7.33	1.604	-4.59	0.052

*SD= Standard Deviation, ** p<0.01, * p<0.05*

The independent t-test results indicate various statistical significance levels for the dependent variables across the groups based on attending courses. For "Risk factors for venous thromboembolism," the t-test result ($t = -2.90$, $p > 0.05$) shows a statistically significant. Similarly, "Signs and symptoms of DVT" ($t = -4.59$, $p > 0.05$) and "signs and symptoms of PE" ($t = -4.23$, $p > 0.05$) do show significant differences between the groups.

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
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Vol: 58 Issue: 07:2025
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The t-test (t = 1.19, p > 0.05) suggests no significant difference in means for the "Initial diagnostic test of choice for DVT." The same holds for "Initial diagnostic test of choice for PE" (t = 0.370, p > 0.05). Lastly, "Prophylaxis" shows no significant mean difference (t = -4.59, p > 0.05). Overall, the analysis reveals that attending courses significantly affects VTE knowledge.

Table 4.9: Analysis of the association between VTE Knowledge with the gender of VTE (independent t-test)

Knowledge groups	Total	Gender				t-value	P-value
	Mean ±SD	Male		Female			
		Mean	SD	Mean	SD		
Risk factors for VTE	10.1(7.28)	10.07	6.99	10.07	7.66	0.074	0.941
Signs and symptoms of (DVT)	4.35(2.14)	4.53	2.06	4.07	2.24	-0.185	0.853
signs and symptoms of (PE)	4.79(2.54)	5	2.37	4.52	2.71	1.59	0.113
Initial diagnostic test of choice for DVT	0.59(.490)	0.61	0.496	0.55	0.48	1.09	0.274
Initial diagnostic test of choice for PE	0.21(.412)	0.25	0.385	0.16	0.44	1.67	0.095
Prophylaxis	7.12(.490)	7.13	1.82	7.09	1.88	0.254	0.801

SD= Standard Deviation

The independent t-test results compare the dependent variables across genders to assess whether there are significant differences. For the variable "Risk factors for venous thromboembolism," The t-test for equality of means, however, does not show a statistically significant difference in mean scores between genders, with a t-value of 0.074 (p > .05). For "Signs and symptoms of deep vein thrombosis (DVT)," The t-test reveals a negative t-value (-0.185), suggesting a slight mean difference favoring one gender, but it is not statistically significant (p > .05). Similarly, for "Signs and symptoms of pulmonary embolism (PE)," the t-test show no significant differences in variances or means between genders. Regarding the "Initial diagnostic test of choice for DVT" and "Initial diagnostic test of choice for PE," the results indicate no significant differences in mean scores between genders, with a non-significant p-value. For "Prophylaxis," the t-test shows no statistically significant difference in mean scores between genders, with a t-value of 0.254 (p > .05).

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
ISSN (Online):0493-2137
E-Publication: Online Open Access
Vol: 58 Issue: 07:2025
DOI: 10.5281/zenodo.16014426

Table 4.10: Knowledge levels of VTE in relation to age and education One-way ANOVA (Independent – dependent variables)

	Knowledge Group											
	Risk factors		**Signs & symptoms of DVT**		**Signs & symptoms of PE**		**diagnosis of DVT**		**diagnosis of PE**		**prophylaxis**	
	M SD	**F**	M	**F**	M	**F**	M	**F**	M	**F**	M	**F**
		P-value	SD	*P-value*	SD	*P-value*	SD	*P-value*	SD	*P-value*	SD	*P-value*
Age	10.134	F=3.247	4.352	F=2.980	4.79	F=3.109	0.59	F=0.865	0.214	F=0.010	7.12	F=9.518
	-7.288	P=**0.001**	-2.144	P=**0.005**	(2.54	P=**0.002**	-0.49	P=0.353	-0.412	P=0.919	-0.922	P=0.002
21-29	9.864		4.406		4.419		0.615		0.204		7.493	
	-6.561		-2.103		-2.529		-0.494		-0.419		-0.982	
30-39	9.678		4.173		3.716		0.592		0.266		7.417	
	-7.054		-2.072		-2.337		-0.492		-0.373		-0.885	
40-50	13.544		4.386		6.171		0.563		0.116		7.257	
	-9.94		-2.588		-2.673		-0.49		-0.471		-0.741	
Education	10.134	F=3.582	4.352	F=3.210	4.79	F=2.895	0.592	F=1.109	0.214	F=0.998	7.129	F=0.554
	-7.288	P=0.079	-2.144	P=0.071	-2.54	P=0.097	-0.49	P=0.330	-0.41	P=0.372	-0.922	P=0.612
Bachelor	9.734		4.253		4.575		0.574		0.213		7.407	
	-7.022		-2.123		-2.48		-0.486		-0.411		-0.923	
Master	13,39		5.337		6		0.742		0.234		7.55	
	-6.303		-1.337		-2		-0.51		-0.41		-1.099	
Associate's degree	12.214 -9.878		4.578 -9.878		5.916 -9.878		0.649 -9.878		0.241 -9.878		7.602 -9.878	

SD= Standard Deviation, F-statistic

The One-Way ANOVA results demonstrate varying levels of association between independent and dependent variables. Age shows significant differences for risk factors of venous thromboembolism (Mean= 10.134; p=0.001) and signs and symptoms of DVT (Mean= 4.352; p=0.005) and signs and symptoms of PE (Mean= 4.790; p=0.002), and "Prophylaxis," the results indicate a significant relationship with age, with (Mean= 7.12; p = .002). indicating that age plays a more prominent role in influencing these aspects. For education, the results indicate no statistically significant differences across groups for most variables, suggesting that these factors do not strongly affect the understanding or management of these clinical areas. The results highlight that age significantly influences

Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
Journal of Tianjin University Science and Technology
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E-Publication: Online Open Access
Vol: 58 Issue: 07:2025
DOI: 10.5281/zenodo.16014426

knowledge and awareness of certain dependent variables, such as risk factors, signs and symptoms of DVT and PE, and prophylaxis. However, age does not appear to significantly affect knowledge related to the initial diagnostic tests for DVT and PE.

Table 4.11: Knowledge levels of VTE in relation to hospitals and experience One-way ANOVA (Independent – dependent variables)

	Knowledge Group											
	Risk factors		**Signs & symptoms of DVT**		**Signs & symptoms of PE**		**diagnosis of DVT**		**diagnosis of PE**		**Prophylaxis**	
	M	**F**	M	**F**	M	**F**	M	**F**	M	**F**	M	**F**
	SD	*P-value*	SD	*P-value*	SD	*P-value*	SD	*P-value*	SD	*P-value*	SD	*P-value*
ICU	10.13	F=2.753	4.352	F=2.582	4.79	F=1.857	0.592	F=0.781	0.214	F=0.554	7.129	F=4.672
experience	7.28	P=0.076	2.541	P=0.51	2.541	P=0.10	0.49	P=0.462	0.41	P=0.612	0.92	P=0.055
< 1 year	11.189(7.99)		4.832(2.143)		5.084(2.743)		0.734(1.383)		0.287(0.362)		7.483(0.84)	
1-3years	9.078(6.29)		4.422(1.29)		4.904(2.441)		.575(0.488)		0.239(0.395)		7.51(0.84)	
4-6 years	9.078(6.36)		3.978(2.084)		4.366(2.237)		0.572(0.488)		0.233(0.400)		7.394(1.07)	
7-9 years	10.132(7.13)		3.921(2.612)		4.272(2.675)		0.510(0.476)		0.112(0.476)		7.000(0.70)	
10-15 years	12.785(9.09)		4.932(2.389)		5.344(2.943)		0.718(0.470)		0.086(0.483)		7.569(0.88)	
16-20 years	15.624(10.46)		3.331(2.00)		4.428(2.760)		1.285(0.87)		0.022(0.534)		7.282(1.18)	
Hospital	10.13	F=2.451	4.352	F=1.789	4.79	F=2.621	0.592	F=1.234	0.214	F=0.475	7.129	F=3.672
	7.28	P=0.054	2.14	P=0.087	2.541	P=0.069	0.49	P=0.278	0.41	P=0.621	0.922	P=0.065
Abasher	11.871		4.977		5.581		0.435		0.147		7.682	
hospital	7.127		2.07		2.404		0.431		0.453		0.796	
Princess	8.509		4.3		3.961		0.615		0.244		7.144	
Basma hospital	5.754		1.88		2.195		0.498		0.364		1.035	
AL Hussain	10.714		5.814		5.774		0.512		0.237		7.403	
as salt hospital	6.712		2.142		2.565		0.475		0.401		0.7	
Altafila	8.367		4.149		3.727		0.676		0.189		7.621	
hospital	6.975		2.337		2.322		0.507		0.435		1.218	

SD= Standard Deviation, F-statistic

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Vol: 58 Issue: 07:2025
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The One-Way ANOVA results demonstrate varying levels of association between independent and dependent variables. For hospitals and ICU experience, the results indicate no statistically significant differences across groups for most variables, suggesting that these factors do not strongly affect the understanding or management of these clinical areas.

DISCUSSION

The literature regarding diabetic patient knowledge and awareness of hypoglycemia indicates a worldwide concern regarding education, risk awareness, and prevention. Al-Mugheed and Bayraktar (2018) noted that lack of knowledge and lack of knowledge of hypoglycemia symptoms and management is a significant barrier in patient self-care. This corresponds to Lee et al.'s (2014) findings that many patients, and type-2 diabetic patients especially, were not able to accurately identify and respond to hypoglycemic symptoms, showing great risk potential with potential serious complications. Oh, Boo, and Lee (2017) also noted a need for focused individualized education and described how individualized patient education interventions can significantly decrease the occurrence of hypoglycemic hypoglycemia. Research from various regions supports this knowledge gap further. For example, Majluf-Cruz et al. (2012) found that patients in Mexico had insufficient information regarding blood sugar monitoring and treatment adjustment. Muhammad, Isah, and Abdullahi (2016) also reported that diabetic patients in Nigeria were generally unaware of hypoglycemia that was related to poor glycemic control.

Shah et al. (2020) also stressed the need for education and suggested how education should be designed in a culturally relevant and contextualized way to mitigate the recurrence of hypoglycemia risks. Regarding the Arab context, Mohammed, Taha, and Abdel-Aziz (2018) found that diabetic patients in Sudan had a moderate level of knowledge, and many were not aware of the emerging symptoms of severe hypoglycemia. Similarly, Kiflie et al. (2022) (e.g., Kaflie in some instances) noted the significance of educational background and previous education on health and health education as factors affecting patients' capacity to monitor and handle hypoglycemia in Ethiopia. From the perspective of health care providers, Gaston and White (2013) and Watson et al. (2015) emphasized the responsibility of nurses and educators to engage in ongoing diabetes education, to be learning and to facilitate learning in patients. Feng et al. (2021) show that nurse-led interventions improved recognition and management of hypoglycemia, again particularly for patients with minimal ability because of limited health literacy. Liew et al. (2012) also acknowledged that routine care could include structured education programs on diabetes to prevent emergency admissions related to hypoglycemia. Research such as Yan et al. (2021) and Gray (2016) also suggests that the way to patients' empowerment through knowledge can promote adherence and lessen anxiety that is associated with hypoglycemic episodes. Both authors reveal that hypoglycemia awareness can be presented and recommended in national diabetes management guidelines. While K. Gibbs et al. (2011) outline psychosocial factors that patients who fully understand the condition and have an interdisciplinary care team can take preventive actions to get back on track. Similarly, Hebeshy (2018) synthesizes the

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Journal of Tianjin University Science and Technology
ISSN (Online):0493-2137
E-Publication: Online Open Access
Vol: 58 Issue: 07:2025
DOI: 10.5281/zenodo.16014426

situation locally, where in parts of the Middle East, knowledge can be of limited use due to belief systems and access to health services. The literature above provides a consistent observation when considering the awareness of patients with diabetes about hypoglycemia is low amongst different nationalities and cultures. Bridging this gap takes commitment from health care providers, culture-sensitive engagement strategies, and ongoing education to mitigate hypoglycemic incidents and improve patient experiences.

Limitations of the Study

This study has a number of limitations. First, the sample of the study was from five Ministry of Health hospitals. This may affect the generalization of our findings to other types of health care settings. Second, the type of sampling used in this study was convenience sampling, and this type had a limitation, especially regarding bias. Finally, although the recommended sample size of participants was achieved, increasing the sample size may allow for more robust conclusions to be drawn. Furthermore, the study setting was not representative of the country's hospitals, where the included hospitals were chosen conveniently to ease access to collect data in the limited time for conducting the study. The tool used in English may represent an obstacle to being understood by participants. However, the included items are technical terms that are commonly used in health settings, and translation will not guarantee their understanding by health professionals.

CONCLUSION

According to our research, RNs in Jordan have a low level of VTE practice and knowledge. The risk factors for VTE and the symptoms of PE were the specific areas where a lack of knowledge was found, whereas the prophylactic measures for VTE and the symptoms of DVT were moderately understood. Due primarily to a lack of a standardized protocol and time constraints, most nurses only conducted risk assessments on a few patients; despite believing they knew a good deal about VTE risk assessment. In terms of self-efficacy in risk assessment, mechanical prophylaxis, and comprehensive VTE risk assessment were low. By using this study and survey, hospital nurse educators can create, execute, and assess a comprehensive teaching program on VTE assessment and care, which will increase patient safety and positive outcomes through appropriate nursing care.

The program should consist of three main components: (1) daily VTE risk assessment; (2) anticoagulation management; and (3) education for patients upon discharge regarding home anticoagulation management and VTE avoidance. Enhancing nurse competencies in patient VTE prevention and management is the goal of this rigorous training program for nursing personnel. Hospital care systems with regard to VTE prevention should also be evaluated in order to find ways to remove obstacles to VTE risk assessment across a number of departments, such as pharmacy and medicine. As part of a process to enhance quality, individual hospitals may decide to start evaluating VTE care. At the same time, they may look for benchmarks for high-quality instruction and suitable metrics of patient outcomes related to nursing practice on VTE treatment. Lastly, think about conducting additional research on VTE in a larger sample under various conditions.

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Tianjin Daxue Xuebao (Ziran Kexue yu Gongcheng Jishu Ban)/
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