Research Article

Nurses’ Knowledge, Perceived Practice, and their Associated Factors regarding Deep Venous Thrombosis (DVT) Prevention in Amhara Region Comprehensive Specialized Hospitals, Northwest Ethiopia, 2021: A Cross-Sectional Study

Senay Yohannes, Tarkie Abebe, Kidist Endalkachew, and Destaw Endeshaw

1Department of Surgical Nursing, School of Nursing, College of Medicine and Health Science, University of Gondar, Gondar, Ethiopia
2Department of Comprehensive Nursing, School of Nursing, College of Medicine and Health Science, University of Gondar, Gondar, Ethiopia
3Department of Surgical Nursing, School of Nursing and Midwifery, College of Medicine and Health Science, Bahir Dar University, Bahirdar, Ethiopia

Correspondence should be addressed to Senay Yohannes; senayson12@gmail.com

Received 9 November 2021; Accepted 27 January 2022; Published 16 March 2022

Academic Editor: Samuel A. Tisherman

Copyright © 2022 Senay Yohannes et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Introduction. Deep venous thrombosis is a preventable and treatable cause of death among hospitalized patients. Nurses’ knowledge and proper assessment can play a major role in improving deep venous thrombosis prevention care. Objective. To assess the knowledge, practice, and associated factors towards deep venous thrombosis prevention among nurses working at Amhara region hospitals. Methods. Institutional-based cross-sectional study was conducted among nurses working at Amhara region comprehensive specialized hospitals, Northwest, Ethiopia, from April 1 to 30, 2021. A simple random sampling technique was used to select 423 samples. A structured pretested self-administered questionnaire was used to collect data. Data were entered in epi-info version 7, analyzed using SPSS version 25, and presented by frequencies, percentages, and tables. Bivariable and multivariable logistic regression was computed, and P value < 0.05 was considered to identify statistically significant factors. Result. Good knowledge and practice of nurses towards DVT prevention were 55.6% and 48.8%, respectively. Working at the medical ward [AOR 3.175, 95% CI (1.42, 7.11)], having a BSc degree [AOR = 3.248(1.245, 8.469)], Master’s degree [AOR = 3.48, 95% CI (1.22, 9.89)], obtaining a formal training about deep venous thrombosis [AOR = 1.59; 95% CI (1.03, 2.47)], and working experience of ≥11 years [AOR = 2.11; 95% CI (1.07, 4.16)] were associated with good knowledge of nurses on the prevention of deep venous thrombosis. While having good knowledge about deep venous prevention AOR = 1.75; 95% CI [1.15, 2.65] and working experience ≥11 years [AOR = 3.44; 95% CI (1.45, 8.13)] were significantly associated with nurses’ practice about deep venous thrombosis prevention. Conclusion. Knowledge and practice of the nurses regarding the prevention of deep venous thrombosis were found to be inadequate. Therefore, providing training, creating a conducive environment for sharing of experience, and upgrading the academic status of nurses are measures to scale up the knowledge and practice of nurses regarding deep venous thrombosis prevention.

1. Background

Deep venous thrombosis (DVT) is a common and serious pathology among hospitalized patients, which is a potentially preventable and treatable health problem that contributes to patients’ morbidity and mortality [1]. Both deep vein thrombosis (DVT) and pulmonary embolism (PE) are the elements of venous
thromboembolism (VTE), become a major public health concern of population of the USA affecting more than 900,000 people, and nearly 60,000–100,000 of them are died because of venous thromboembolism (VTE) each year [2].

The European Union also experiences a substantial venous thromboembolism burden of nearly 684,019 deep venous thrombosis, 434,723 pulmonary embolisms, and 610,138 post-thrombotic syndrome events that occur annually and cost billions of dollars each year [3].

According to the center for disease control and prevention (CDC), venous thromboembolism is the 5th most common cardiovascular condition following myocardial infarction and stroke, and it is a growing public health problem with 26.4% of recurrent after the patients have been diagnosed, and this results in further cost of treatment for all hospital deaths, and over half of VTE incidents are hospital-acquired. Appropriate preventive practice (e.g., pharmacological and mechanical prophylaxis) can significantly reduce the incidence of VTE by 70% for both medical and surgical patients [7].

Deep venous thrombosis is the third most common cardiovascular condition following myocardial infarction and stroke, and it is a growing public health problem with 26.4% of recurrent after the patients have been diagnosed, and this results in further cost of treatment for patients and intensifies hospital’s burden [8].

Deep venous thrombosis is considered the third most common cardiovascular condition following myocardial infarction and stroke, and it is a growing public health problem with 26.4% of recurrent after the patients have been diagnosed, and this results in further cost of treatment for patients and intensifies hospital’s burden [8].

Deep venous thrombosis (DVT) prevention includes the three arms, pharmacological, mechanical, and general care (early mobilization, exercising, and hydration) of hospitalized patients can reduce the incidence of DVT in both medical and surgical patients significantly [9].

Nurses are key components to assess and recognize risk factors of deep venous thrombosis of patients in the hospital care setting. When sufficient knowledge along with proper patient care including graduated compression stockings, administration of the correct dose of an anticoagulation agent with careful assessment, and monitoring of risk factors by nurses help to minimize the burden of DVT and its complication [10, 11].

Studies have shown that having a poor level of knowledge and expressed practice of nurses on prevention of deep venous thromboembolism could increase hospitalization and ultimately leads to poor health care outcome [9, 12].

Despite the advance in medical care, the presence of effective strategies, and standard guidelines, deep vein thrombosis (DVT) prevention is not possible as it is needed and expected. So, this study was aimed to assess the actual gap in knowledge, practice, and its associated factors of DVT prevention among nurses working at Amhara region comprehensive specialized hospitals, Northwest, Ethiopia.

2. Method and Materials

2.1. Study Design, Area, and Period. An institution-based cross-sectional study was conducted from April 30, 2021, at five comprehensive specialized hospitals of the Amhara region, Northwest, Ethiopia.

The study was conducted in Amhara Regional State Referral Hospitals, Northwest, Ethiopia. There are five government comprehensive specialized hospitals found in Amhara regional state, Northwest, Ethiopia such as University of Gondar Comprehensive Specialized Hospital (UoGCSH), Felegehiwot Comprehensive Specialized Hospital (FHCSH), Tibe region Specialized Teaching Hospital (TGSTH), Debre Markos Comprehensive Specialized Hospital (DMCSH), and Debre Tabor Comprehensive Specialized Hospital (DTCSH). All hospitals provide outpatient and inpatient services for more than 22,000,000 people living in their catchment area. Currently, these hospitals have 1682 nurses, and the total number of nurses who are working in surgical, medical, ICU, emergency, and Gyn-obs wards were around 728.

2.2. Source Population and Study Population. Source populations were all nurses who were working in medical, surgical, emergency, ICU, and Gyn-obs wards of Amhara Region comprehensive specialized hospitals, Northwest, Ethiopia. Whereas all nurses who were working in selected units or wards (medical, surgical, emergency, ICU, and Gyn-obs) at UoGCSRH, FHCSH, TGSTH, DTCSH, DMCSH, and available during the data collection period are included in the study.

2.3. Inclusion and Exclusion Criteria. All nurses working in surgical, medical, ICU, emergency, and Gyn-obs units of Amhara region Comprehensive Specialized Hospitals, Northwest, Ethiopia, during the study period were included in the study, while those who are working as matron and an administrator were excluded in the study.

2.4. Sample Size Determination and Sampling Technique

2.4.1. Sample Size Determination. The sample size was calculated using the single population proportion formula. Since there was no similar published study found in our country addressing knowledge and practice on prevention of DVT, so considered the proportion of knowledge and practice (p) as 50% using the following formula
A stratified simple random sampling technique was employed to recruit the required participants for the study. First, we stratified participants from each hospital and working ward/unit, and then we allocated the required sample for each stratum proportionally. Finally, we selected study participants from each stratum by simple random sampling.

2.5. Operational Definitions. Good knowledge: respondents were labeled to have “good knowledge of DVT prevention” if they score the mean score or above, on the closed-ended knowledge questions of DVT prevention.

Good practice: respondents were labeled to have “good practice of DVT prevention” if they score the mean score or above, on the closed-ended knowledge questions of DVT prevention.

2.6. Data Collection Tool and Procedure. Data were collected using a self-administered structured questionnaire to obtain information from participants. The questionnaire has three parts, the first section is regarding the sociodemographic characteristics of nurses and included 10 questions. The second section consists of 34 questions regarding knowledge of nurses on DVT prevention with 3 choices (true, false, and I do not know). The last section consisted of 13 questions concerning the practices of nurses on DVT prevention with 3 points Likert scale (always = 2, sometimes = 1, and never = 0). Which were adopted from a study conducted in the Near East University hospital, North Cyprus, Turkey [9].

Eligible study participants were approached in each ward unit. Participants were provided with appropriate information about the study, then informed consent was be obtained to assure their willingness to participate in the study. Five trained BSc nurses collected the data, and five trained MSc nurses closely followed the data collection process.

The instruments were distributed among the study population, after guarantying their willingness to take part in the study, and then it was collected by the data collectors after completion. During data collection, data collectors and supervisors followed the recommended precautions to prevent COVID-19.

2.7. Data Quality Assurance. A self-administered structured questionnaire was prepared, and training was given for both collectors and supervisors about the concept of the questionnaire and the rights of the participants two days before the actual day of data collection. Moreover, the tool was pretested in 10% of the total sample size at Dessie comprehensive specialized hospital a week before the actual data collection period was conducted. Based on the finding, necessary modifications were done to the wording and phrases. The reliability of the tool used for measuring the dependent variable was 0.786 and 0.760 for knowledge and practice, respectively. There was regular supervision, spot-checking, and reviewing the completed questionnaire to maintain data quality. Data were checked again for completeness before data entry and during the data cleaning process.

2.8. Data Processing and Analysis. Data were cleaned, coded, and entered into Epi-info version 7 and then exported to SPSS version 25.0 for analysis. Descriptive statistics including frequencies, proportions, mean, and SD was computed and displayed by using tables, charts, and texts. Multicollinearity was checked. Model adequacy was checked by using Hosmer and Lemeshow with 0.21 and 0.456 for knowledge and practice, respectively. Bivariable and multivariable logistic regression analyses were computed to examine the association between the dependent variable and independent variables. Variables with p < 0.05 at multivariable logistic regression analysis were considered statistically significant.

3. Results

3.1. Sociodemographic Characteristics of Respondents. A total of 412 participants were included in the analysis with a response rate of 97.4%. Among respondents, 202 (49.0%) were female and 210 (51.0%) were male. The mean age of the participants was 31.6 years ±5.1 standard deviations. Most of the participants 311 (75.5%) of the nurses had a bachelor’s degree, nearly 223 (54.1%) were married (Table 1).

3.2. Work-Related Characteristics. Most of the participants 180 (43.7%) had 6–10 years of working experience, out of 412 nurses who participated in the study, 120 (29.1%) nurses were working in surgical units and only 153 (37.1%) of nurses responded that they have received formal training on the prevention of DVT. Among all participants, only 141 (34.2%) participants responded to the presence of DVT prevention guidelines in their hospital, and only 221 (53.6%) of them were read professional literature about DVT prevention (Table 2).

3.3. Nurses’ Knowledge regarding Deep Venous Thrombosis Prevention. From all 412 study participants, more than half 55.6% 95% CI (51.0, 60.4) of the respondents were found to have good knowledge, while 44.4% of the respondents were found to have poor knowledge regarding DVT prevention.

Participants were asked 34 questions to assess their knowledge on the prevention of DVT, and they were categorized into two groups based on their score with their mean. The mean score was 22.8 (SD = ±4.43). Among all the actual sample size was 423.
questions “DVT occurs as a result of stasis of blood (venous stasis), vessel wall injury, and altered blood coagulation” was the most frequently answered question (97.3%) whereas “Alcohol may predispose to DVT” was the least frequently answered (Table 3).

3.4. Nurses’ Practice regarding Prevention of DVT. By using 13 practice-based questions, the mean practice score of the respondents was found to be 20.19 (SD = ± 4.84). From all questions, “Encouraging early ambulation surgical patients (70.4%)” was the most frequently answered question on the contrary “Using of the graduated compression stockings” was the least frequently answered question (Table 4).

3.5. Factors Associated with Nurses’ Knowledge towards DVT Prevention. Nurses working in the medical ward [AOR = 3.18, 95% CI (1.42, 7.11)] are more likely to have good knowledge on the prevention of DVT as compared to nurses who worked in the Gyn-obs ward.

3.6. Factors Associated with Nurses’ Practice towards DVT Prevention. Having a good knowledge about DVT [AOR = 1.74, 95% CI (1.15, 2.65)] and working experience ≥11 years [AOR = 2.11; 95%CI (1.07,4.16)], and nurses who ever took training [AOR = 1.59; 95%CI (1.03, 2.47)] were shown to have a strong statistical association during multivariable analysis (Table 5).

4. Discussion

The study has attempted to assess knowledge, practice, and associated factors of nurses on DVT prevention, and it revealed that only 55.6% with 95% CI (50.6, 60.4) of the

**Table 1:** Sociodemographic characteristics of nurses working at Amhara region comprehensive specialized hospitals, Northwest, Ethiopia, 2021 (n = 412).

| Variables               | Category     | Frequency (n) | Percent |
|-------------------------|--------------|---------------|---------|
| Sex                     | Male         | 210           | 51.0    |
|                         | Female       | 202           | 49.0    |
| Age                     | 25 years     | 27            | 6.6     |
|                         | 26–30 years  | 181           | 43.9    |
|                         | 31–35 years  | 129           | 31.3    |
|                         | 36 years     | 75            | 18.2    |
| Marital status          | Married      | 223           | 54.1    |
|                         | Others*      | 17            | 4.1     |
|                         | Masters      | 78            | 18.9    |
| Educational status      | BSc degree   | 311           | 75.5    |
|                         | Diploma      | 23            | 5.6     |

* Separated, divorced, and widowed.

**Table 2:** Work-related factors about a study participant in Amhara region comprehensive specialized hospitals, Northwest, Ethiopia 2021 (n = 412).

| Variables               | Category         | Frequency (n) | Percent |
|-------------------------|------------------|---------------|---------|
| Working hospital        | UoGCSH           | 98            | 23.8    |
|                         | TGCTH            | 77            | 18.7    |
|                         | FHCSH            | 120           | 29.1    |
|                         | DTCSSH           | 59            | 14.3    |
|                         | DMCSH            | 58            | 14.1    |
|                         | Medical          | 87            | 21.1    |
|                         | Surgical         | 120           | 29.1    |
| Working ward            | Intensive care unit (ICU) | 89 | 21.6 |
|                         | Emergency        | 75            | 18.2    |
|                         | Gyn-obs          | 41            | 10.0    |
| Work experience         | ≤5 years         | 177           | 43.0    |
|                         | 6–10 years       | 180           | 43.7    |
|                         | ≥11 years        | 55            | 13.3    |
| Training                | Yes              | 153           | 37.1    |
|                         | No               | 259           | 62.9    |
| Literature reading      | Yes              | 221           | 53.6    |
|                         | No               | 191           | 46.4    |
| Guideline/protocol      | Yes              | 141           | 34.2    |
|                         | No               | 271           | 65.8    |
study participants had good knowledge about DVT prevention. This finding is consistent with a study conducted in Kochi, India, and São Paulo, which is 58% and 53.3% of the respondents had good knowledge, respectively [12,13]. Even though there is a difference in socioeconomic status and level of health sector development, the possible reason for this similarity might be using a similar study population (staff nurse), study unit, and study design.

| Table 3: Nurses’ knowledge on DVT prevention working at Amhara region comprehensive specialized hospitals, Northwest, Ethiopia 2021 (n = 412). |
|---------------------------------------------------------------|
| Statements on general knowledge, risk factors, and prevention of DVT | True/false | Correctly answered | Incorrectly answered |
|--------------------------------------------------------------------------|-------------|--------------------|----------------------|
| 1. DVT occurs as a result of stasis of blood (venous stasis), vessel wall injury, and altered blood coagulation. | (T) * | 401 97.3 11 2.7 |
| 2. Venous thromboembolism (VTE) is a fatal complication of DVT. | (T) * | 385 93.4 27 6.6 |
| 3. DVT occurs most frequently in the veins of the lower extremities. | (T) * | 306 74.3 106 25.7 |
| 4. There is no relationship between cancer or cancer treatment and DVTE/VTE. | (F) * | 195 47.3 217 52.7 |
| 5. There is no relationship between respiratory disease and DVT. | (F) * | 232 56.3 180 43.7 |
| 6. DVT also occurs frequently in the upper limbs. | (F) * | 215 52.2 197 47.8 |
| 7. There is no relationship between family history of DVT/VTE and DVT. | (F) * | 211 51.2 201 48.8 |
| 8. Prolonged immobilization predisposes to DVT in hospitalized patients. | (T) * | 347 84.2 65 15.8 |
| 9. VTE is a major cause of sudden death in hospitalized patients. | (T) * | 308 74.8 104 25.2 |
| 10. Surgical patients are more prone than medical patients to DVT/VTE. | (T) * | 302 73.3 109 26.7 |
| 11. Indwelling intravenous devices such as central venous catheters may predispose to DVT. | (T) * | 279 67.7 113 32.3 |
| 12. Paralysis, paresis, or recent plaster cast on lower extremities may predispose to DVT. | (T) * | 309 75.0 103 25.0 |
| 13. Obesity may predispose to DVT. | (T) * | 325 78.9 87 21.1 |
| 14. Low body mass index may predispose to DVT. | (F) * | 204 49.5 208 50.5 |
| 15. Advancing age may predispose to DVT. | (T) * | 293 71.1 119 28.9 |
| 16. Previous DVT/VTE history may predispose to DVT. | (T) * | 301 73.1 112 26.9 |
| 17. Major surgery may predispose to DVT. | (T) * | 289 70.1 120 29.9 |
| 18. Varicose veins may predispose to DVT. | (T) * | 297 72.1 115 27.9 |
| 19. Exercises may predispose to DVT. | (F) * | 219 53.2 193 46.8 |
| 20. Trauma may predispose to DVT. | (T) * | 306 74.3 103 25.7 |
| 21. Smoking may predispose to DVT. | (T) * | 268 65.0 114 35.0 |
| 22. Alcohol may predispose to DVT. | (F) * | 119 28.9 293 71.1 |
| 23. Cardiac diseases may predispose to DVT. | (T) * | 298 72.3 114 27.7 |
| 24. Infections or inflammations may predispose to DVT. | (T) * | 295 71.6 117 28.4 |
| 25. Pregnancy or postpartum may predispose to DVT. | (T) * | 297 72.1 115 27.9 |
| 26. Oral contraceptives or hormonal replacement therapy may predispose to DVT | (T) * | 257 62.4 115 37.6 |
| 27. Foot and leg exercises may prevent DVT | (T) * | 333 80.8 79 19.2 |
| 28. Elevating legs is necessary to prevent DVT/VTE. | (T) * | 322 78.2 90 21.8 |
| 29. Early ambulation after surgery may prevent DVT development. | (T) * | 308 74.8 104 25.2 |
| 30. Bed rest is necessary after major surgery to prevent DVT | (F) * | 217 52.7 195 47.3 |
| 31. Heparin or low-molecular-weight heparin (LMWH) may prevent DVT development. | (T) * | 295 71.6 117 28.4 |
| 32. Fluid restriction is necessary to prevent DVT. | (F) * | 176 42.7 236 57.3 |
| 33. Elastic compression stockings may prevent DVT development. | (T) * | 257 62.4 155 37.6 |
| 34. The use of intermittent pneumatic compression devices may prevent DVT development | (T) * | 241 58.5 171 41.5 |

* Correct answer.

| Table 4: Nurses’ practice on DVT prevention working in Northwest Amhara region referral hospitals, 2021 (n = 412). |
|---------------------------------------------------------------|
| Statements on DVT prevention practice | Always | Sometimes | Never |
|------------------------------------------|-------|-----------|-------|
| N | % | N | % | N | % |
| 1. Providing information to patients and/or relatives about risks and prevention of DVT. | 266 | 64.5 | 133 | 32.3 | 13 | 3.2 |
| 2. Encouraging patients to do foot and leg exercises by themselves or relatives help if patients are unable to do so. | 255 | 61.9 | 149 | 36.2 | 8 | 1.9 |
| 3. Encouraging early ambulation surgical of patients. | 290 | 70.4 | 105 | 25.5 | 17 | 4.1 |
| 4. Assessing the DVT risks of patients regularly. | 241 | 58.5 | 154 | 37.4 | 17 | 4.1 |
| 5. Administering anticoagulants as preventive in clinic | 231 | 56.1 | 156 | 37.8 | 25 | 6.1 |
| 6. Monitoring the side effects of the anticoagulants. | 238 | 57.8 | 150 | 36.4 | 24 | 5.8 |
| 7. Educating the patients on anticoagulants. | 253 | 61.4 | 139 | 33.7 | 20 | 4.9 |
| 8. Educating the patients to avoid injury. | 249 | 60.5 | 146 | 35.4 | 17 | 4.1 |
| 9. Encouraging patients to do elevate legs. | 262 | 63.6 | 134 | 32.5 | 16 | 3.9 |
| 10. Educating the patients on sufficient fluid intake. | 253 | 61.4 | 143 | 34.7 | 16 | 3.9 |
The result of this study is lower than the studies conducted in China with 72.8% and 68.9%, respectively [14,15]. This might be due to differences in the study setting and the use of data collection tools. In this study, nurses working in different wards were included, and a tool with 34 knowledge questions has been employed; whereas in a study that was done in China, the study subjects were only orthopedic nurses and the tool had only 9 knowledge questions. However, the result of this study was higher than the studies conducted in Zagazig University of Egypt, 27.5% [16] and Port said hospitals of Egypt. 28.9% [17]. This might be due to differences in sample size on which only 90 staff nurses were included in a study conducted at port said hospitals of Egypt. And differences in the tool used (merely about thromboembolism prophylaxis) and differences in cut point as good, average, and poor.

A multivariable logistic regression analysis, variables like work experience, having training, working unit, and academic qualification were found to have a significant effect on nurses’ knowledge regarding DVT prevention.

In a multivariable logistic regression analysis, variables like work experience, having training, working unit, and academic qualification were found to have a significant effect on nurses’ knowledge regarding DVT prevention.

The result of this study is lower than the studies conducted in China with 72.8% and 68.9%, respectively [14,15]. This might be due to differences in the study setting and the use of data collection tools. In this study, nurses working in different wards were included, and a tool with 34 knowledge questions has been employed; whereas in a study that was done in China, the study subjects were only orthopedic nurses and the tool had only 9 knowledge questions. However, the result of this study was higher than the studies conducted in Zagazig University of Egypt, 27.5% [16] and Port said hospitals of Egypt. 28.9% [17]. This might be due to differences in sample size on which only 90 staff nurses were included in a study conducted at port said hospitals of Egypt. And differences in the tool used (merely about thromboembolism prophylaxis) and differences in cut point as good, average, and poor.

In a multivariable logistic regression analysis, variables like work experience, having training, working unit, and academic qualification were found to have a significant effect on nurses’ knowledge regarding DVT prevention.

Working in the Medical ward was found to be 3.175 times more likely to have good knowledge as compared to nurses working at Gyn-obs [AOR 3.175, 95% CI (1.417, 7.113)].

Significant at $P < 0.05$. 

| Variables                        | Knowledge | COR (95% CI) | AOR (95% CI) | p value |
|----------------------------------|-----------|--------------|--------------|---------|
|                                 | Good N    | Poor N       |              |         |
|                                  | ≤25 years | 13 14        | 0.654 (0.270, 1.583) | 1.725 (.591, 5.029) |
|                                  | 26–30 years | 99 82       | 0.851 (0.493, 1.467) | 1.470 (.711, 3.042) |
|                                  | 31–35 years | 73 56      | 0.918 (0.516, 1.635) | 1.457 (.737, 2.879) |
|                                  | ≥36 years | 44 31        | 1            | 1       |
|                                  | Male      | 116 94       | 0.972 (0.659, 1.434) | 1.073 (0.69, 1.699) |
|                                  | Female    | 113 89       | 1            | 1       |
|                                  | Single    | 86 86        | 1            | 1       |
|                                  | Married   | 133 90       | 1.475 (0.989, 2.207) | 1.210 (.739, 1.980) |
|                                  | Others    | 10 7         | 1.429 (0.520, 3.926) | 1.282 (0.404, 4.070) |
|                                  | UoGCSH    | 53 45        | 0.892 (0.464, 1.716) | .644 (0.311, 1.334) |
|                                  | TGCSH     | 46 31        | 1.124 (0.563, 2.243) | 1.489 (.696, 3.185) |
|                                  | FHCSSH    | 63 57        | 0.837 (0.445,1.574) | 0.770 (.377, 1.569) |
|                                  | DTYCSH    | 34 25        | 1.030 (0.495, 2.144) | 0.980 (.444, 2.166) |
|                                  | DMCSH     | 33 25        | 1            | 1       |
|                                  | Medical   | 64 23        | 3.92 (1.995, 8.595) | 3.175 (1.417,7.113) |
|                                  | Surgical  | 73 47        | 2.19 (1.066, 4.511) | 1.872 (0.883,9.434) |
|                                  | ICU       | 39 50        | 1.10 (0.521, 2.329) | 0.966 (0.448,2.083) |
|                                  | Emergency | 36 39        | 1.30 (0.604, 2.811) | 1.092 (0.496,2.406) |
|                                  | Gyn-obs   | 17 24        | 1            | 1       |
|                                  | Masters   | 45 33        | 3.117 (1.152, 8.433) | 3.48 (1.223, 9.898) |
|                                  | BSc degree | 177 134   | 3.019 (1.208, 7.547) | 3.248 (1.245, 8.469) |
|                                  | Diploma   | 7 16         | 3.92 (1.995, 8.595) | 3.175 (1.417,7.113) |
|                                  | ≥11 years | 39 16        | 2.356(1.227, 4.524) | 2.109(1.069,4.162) |
|                                  | 6–10 years | 100 80      | 1.208 (0.797, 1.832) | 1.248 (0.806, 1.931) |
|                                  | 1–5 years | 90 87        | 1            | 1       |
|                                  | Attending training on prevention of DVT | Yes 101 52 | 1.988 (1.314, 3.007) | 1.598 (1.034, 2.47) |
|                                  | No        | 128 131      | 1            | 1       |
|                                  | Availability of guideline/protocol | Yes 84 57  | 1.281 (0.848, 1.934) | 1.110 (.810, 2.117) |
|                                  | No        | 145 126      | 1            | 1       |
|                                  | Reading professional literature related to DVT | Yes 125 96 | 1.091 (0.622, 1.356) | 0.879 (0.555, 1.392) |
|                                  | No        | 104 87       | 1            | 1       |

Table 5: Bivariable and Multivariable analysis of factors associated with nurses’ knowledge regarding prevention of DVT working in Amhara region comprehensive specialized hospitals, 2021 ($n = 412$).
scorer was ICU nurses [19]. This might be explained that nurses working in medical wards may encounter DVT cases that can sensitize nurses’ knowledge about the prevention of DVT.

Being master and BSc degree in academic qualification was found to be 3.48 and 3.25 times more likely to have good knowledge about DVT prevention as compared to nurses who are diploma [AOR = 3.48, 95% CI (1.22, 9.89)], [AOR = 3.25, 95% CI (1.25, 8.47)], respectively. This finding is in line with the study conducted in Peking Union Medical College Hospital of China [20]. This could be attributed to the possibility of an increase in academic qualification increases the exposure to different academic disciplines, which directly or indirectly help nurses to develop a theoretical background of knowledge on the prevention of DVT.

Study participants whose working experience was greater or equal to 11 years were found to be 2.11 times more likely to be knowledgeable about DVT prevention compared to nurses whose working experience is less than 5 years [2.11, 95% CI (1.07, 4.16)]. This finding was consistent with the study done in Cyprus, Turkey [9]. The possible explanation might be, the increased years of working

| Variables | Practice | Good N | Poor N | COR AOR | p value |
|-----------|----------|--------|--------|---------|---------|
| Age       | ≤ 25 years | 6 | 21 | 0.301 (0.270, 1.583) | 0.468 (0.145, 1.489) | 0.204 |
|          | 26–30 years | 91 | 90 | 1.038 (0.493, 1.467) | 1.689 (0.817, 3.493) | 0.178 |
|          | 31–35 years | 67 | 62 | 1.101 (0.516, 1.635) | 1.494 (.768,3.011) | 0.248 |
|          | ≥ 36 years | 37 | 38 | 1 | 1 | 1 |
| Sex       | Male | 98 | 112 | 0.841 (0.571, 1.238) | 0.825 (0.529, 1.286) | 0.396 |
|          | Female | 103 | 99 | 1 | 1 | 1 |
| Marital status | Single | 77 | 95 | 1 | 1 | 1 |
|          | Married | 118 | 105 | 1.387 (0.930, 2.067) | 0.954 (.574, 1.555) | 0.852 |
|          | Others | 6 | 11 | 0.673 (0.238, 1.902) | 0.553 (0.160, 1.915) | 0.350 |
| Working hospital | UoGCSH | 50 | 48 | 1.196 (0.624, 2.292) | 1.163 (.575, 2.353) | 0.675 |
|          | TGCSTH | 44 | 33 | 1.531 (0.771, 3.038) | 1.441 (.691, 3.007) | 0.33 |
|          | FHCSH | 40 | 80 | 0.574 (0.303, 1.089) | 0.555 (0.272, 1.134) | 0.106 |
|          | DYTCSH | 40 | 19 | 2.417 (1.140, 5.124) | 1.705 (.743, 3.913) | 0.208 |
|          | DMCSH | 27 | 31 | 1 | 1 | 1 |
| Working ward | Medical | 45 | 42 | 2.066 (0.956, 4.465) | 1.657 (.702, 3.912) | 0.258 |
|          | Surgical | 66 | 54 | 2.357 (1.126, 4.935) | 2.114 (.932, 4.797) | 0.073 |
|          | ICU | 38 | 51 | 1.437 (0.665, 3.104) | 1.601 (.688, 3.685) | 0.278 |
|          | Emergency | 38 | 37 | 1.981 (0.900, 4.357) | 1.854 (.787, 4.3681) | 0.158 |
|          | Gyn-obs | 14 | 27 | 1 | 1 | 1 |
| Educational status | Masters | 27 | 34 | 0.610 (0.286, 1.864) | 0.419 (.147, 1.196) | 0.097 |
|          | BS degree | 161 | 167 | 0.717 (0.306, 1.683) | 0.444 (.171, 1.151) | 0.104 |
|          | Diploma | 13 | 10 | 1 | 1 | 1 |
| Work experience | ≥11 years | 40 | 15 | 3.799 (1.955, 7.384) | 3.443 (1.457, 8.133) | 0.005 * |
|          | 6–10 years | 88 | 92 | 1.363 (0.897, 2.070) | 1.215 (.732, 2.018) | 0.460 |
|          | 1–5 Years | 73 | 104 | 1 | 1 | 1 |
|          | Attend training on prevention of DVT | Yes | 144 | 151 | 1.199 (0.804, 1.789) | 1.416 (.876, 2.289) | 0.155 |
|          | No | 57 | 60 | 1 | 1 | 1 |
| Availability of guideline/protocol | Yes | 66 | 75 | 0.887 (0.590, 1.333) | 1.033 (.630, 1.694) | 0.897 |
|          | No | 135 | 136 | 1 | 1 | 1 |
| Reading professional literature related to DVT | Yes | 120 | 101 | 1.613 (1.092,2.384) | 1.498 (9.552,3.249) | 0.079 |
|          | No | 81 | 110 | 1 | 1 | 1 |
| Knowledge on DVT prevention | Good | 128 | 101 | 1.910 (1.287, 2.833) | 1.745 (1.149, 2.651) | 0.009 * |
|          | Poor | 73 | 110 | 1 | 1 | 1 |

* Significant at P < 0.05.
experience may offer chances to staff nurses to acquire knowledge from their coworkers and ultimately excel in professional development about patient care [21].

Nurses who took training related to DVT prevention were found to be 1.59 times more likely to have good knowledge than those who had not taken any training [AOR = 1.59, 95% CI (1.03, 2.47)]. This finding was in line with the study conducted in China [12]. The possible explanation might be training may sensitize nurses to retain and ensure a consistent background of knowledge [22].

The result of this study showed that only 48.8% with 95% CI (43.9, 53.7) had good practice about DVT prevention. This finding was consistent with the study conducted in São Paulo that was 44% [13]. On the contrary, the finding of the study is higher than the study conducted in Amrita Institute of medical sciences of India that was 14% [12]. This might be due to the sampling difference on which convince sampling method and only 100 nurses were included a study conducted in Amrita institute of medical science of India. And lower than a study conducted in China (55.4%) [19]. This discrepancy may be due to the study conducted in China has only assessed the practice of nurses exclusively on prophylactic prevention of DVT.

In a multivariable logistic regression analysis, variables like work experience and having good knowledge were found to have significantly associated with the practice of nurses towards DVT prevention.

Nurses with work experience of ≥11 years were found to be 3.44 times more likely to have good practice when compared to those with work experience of <5 years [AOR = 3.44, 95% CI (1.46, 8.13)]. The reason might be nurses with more years of working experience would have more chances to learn from their coworkers. Moreover, a greater year of experience creates a chance for nurses to work in different wards that help nurses to interact and act appropriately as compared to less experienced nurses [23].

Nurses who had good knowledge related to DVT prevention were found to be 1.75 more times to have good practice compared to those who had poor knowledge [AOR = 1.75, 95% CI (1.15, 2.65)]. The finding of this study is in line with the study conducted in port said hospitals of Egypt [17], and the possible justification could be having a theoretical background of knowledge enabled nurses to put their knowledge into practice [24]. Whereas it contradicted with the studies conducted in the intensive care units of Amrita Institute of Medical Sciences, Kochi, India [12]. This might be the difference in sample size and the study population where only ICU nurses with convenience sampling techniques were included in the study conducted in Amrita Institute of Medical Sciences, Kochi, India.

5. Conclusion
This study revealed that the knowledge and practice of nurses working in different wards of Amhara region comprehensive specialized hospitals, Northwest, Ethiopia, were not good enough for DVT prevention.

Having higher educational status, attending formal training, being more experienced, and working in medical wards showed a positive and significant association with good knowledge of nurses on DVT prevention; on the other hand, having good knowledge about DVT and higher working experience were found to be associated with good practice of nurses on prevention of DVT.

6. Strength and Limitations of the Study
A self-reported questionnaire measure of knowledge and practice of nurses on prevention of DVT is prone to social desirability bias and recall bias. Despite these limitations, this study clearly showed the knowledge, practice, and associated factors of nurses towards DVT prevention among nurses working at the comprehensive specialized hospitals for the first time in Ethiopia.

Abbreviations
AOR: Adjusted odds ratio
COR: Crude odds ratio
CDC: Centers for Disease Control
CMHS: College of Medicine and Health Science
DMCSH: Deberemarkos Comprehensive Specialized Hospital
DTCSH: Debretabor Comprehensive Specialized Hospital
DVT: Deep venous thrombosis
FHCSH: Felegehiot Comprehensive Specialized Hospital
HA-VTE: Hospital-acquired venous thromboembolism
ICU: Intensive care unit
PE: Pulmonary embolism
TGSTH: TibebeGenet Specialized Teaching Hospital
UoGCSRH: University of Gondar Comprehensive Specialized Referral Hospital
VTE: Venous thromboembolism.

Data Availability
All data are available upon reasonable request and the readers could contact the corresponding author.

Ethical Approval
Ethical clearance was obtained from the University of Gondar College of Medicine and Health Science School of Nursing, Ethical Review Committee.

Consent
An official letter was written by each comprehensive specialized hospital. Then permission and support letter was written to each respected department and wards. The purpose of the study was explained to the study subjects, and verbal consent was taken from the participants to confirm whether they are willing to participate or not. Confidentiality of responses was also ensured throughout the research process.
Conflicts of Interests
The authors declare that they have no competing interests.

Authors’ Contributions
Senay Yohannes carried out the study starting from conception, analysis, and interpretation of data and reviewing the manuscript. Tarkie Abebe participated in proposal writing, data analysis, interpretation, and critical review of the manuscript. Kidist Endalkachew and Destaw Endeshaw participated in reviewing, data analysis, drafting, and commenting on the manuscript. All authors are involved in writing, reviewing, and approving the final draft of the manuscript. All authors read and approved the manuscript before submitting it to the journal for publication.

Acknowledgments
The authors are grateful to all comprehensive specialized hospital administrative and technical staff, data collectors, and study participants.

References
[1] M. Di Nisio, N. van Es, and H. R. Büller, “Deep vein thrombosis and pulmonary embolism,” The Lancet, vol. 388, no. 10063, pp. 3060–3073, 2016.
[2] C. F. D. Control and P. J. A. February, “Data and statistics on venous thromboembolism,” 2020.
[3] S. Barco, “European Union-28: an annualised cost-of-illness model for venous thromboembolism,” Thrombosis and Anticoagulant Treatment in Special Populations, vol. 247, 2016.
[4] C. Danwang, M. N. Temgoua, V. N. Agbor, A. T. Tankue, and J. J. Noubiap, “Epidemiology of venous thromboembolism in Africa: a systematic review,” Journal of Thrombosis and Haemostasis, vol. 15, no. 9, pp. 1770–1781, 2017.
[5] M. H. Ahmed, H. M. Ghanem, and S. S. Khalil, “Assessment of nurses’ knowledge and practice about venous thromboembolism for cancer surgery patients,” Assist Scientific Nursing Journal, vol. 8, no. 20, pp. 13–20, 2020.
[6] F. Ahmed, S. Hussen, and T. Assefa, “Venous thromboembolism risk, prophylaxis and outcome in hospitalized patients to medical wards of university teaching hospital,” Journal of Clinical & Experimental Cardiology, vol. 10, no. 621, p. 2, 2019.
[7] J. Abboud, A. Abdel Rahman, L. Kahale, M. Dempster, and P Adair, “Prevention of health care associated venous thromboembolism through implementing VTE prevention clinical practice guidelines in hospitalized medical patients: a systematic review and meta-analysis,” Implementation Science: Iscus, vol. 15, no. 1, pp. 49–11, 2020.
[8] A. Mulatu, T. Melaku, and L. Chelkeba, “Deep venous thrombosis recurrence and its predictors at selected tertiary hospitals in Ethiopia: a prospective cohort study,” Clinical and applied thrombosis/hemostasis: Official Journal of the International Academy of Clinical and Applied Thrombosis/Hemostasis, vol. 26, Article ID 1076029620941077, 2020.
[9] K. A. Al-Mugheed and N. Bayraktar, “Knowledge and practices of nurses on deep vein thrombosis risks and prophylaxis: a descriptive cross sectional study,” Journal of Vascular Nursing, vol. 36, no. 2, pp. 71–80, 2018.
[10] J.-A. Lee, D. Grochow, D. Drake, L. Johnson, P. Reed, and G. van Servellen, “Evaluation of hospital nurses’ perceived knowledge and practices of venous thromboembolism assessment and prevention,” Journal of Vascular Nursing, vol. 32, no. 1, pp. 18–24, 2014.
[11] A. Shaaban and A. Shaaban, “Effect of nursing care protocol on deep vein thrombosis occurrence among critically neurological patients,” Port Said Scientific Journal of Nursing, vol. 8, no. 1, pp. 206–225, 2021.
[12] A. M. Antony, K. Moly, and D. Dharan, “Assessment of knowledge and self reported clinical practice on prevention of Deep Vein Thrombosis (DVT) among staff nurses,” IOSR Nurs Health Sci, vol. 5, no. 1, pp. 18–24, 2016.
[13] J. S. d. Silva, “Nurses’ knowledge, risk assessment, and self-efficacy regarding venous thromboembolism,” Acta Paulista de Enfermagem, vol. 33, 2020.
[14] Y. Wang, “Chinese orthopaedic nurses’ knowledge, attitude and venous thromboembolic prophylactic practices: a multicentric cross-sectional survey,” Journal of Clinical Nursing, vol. 30, no. 5–6, pp. 773–782, 2021.
[15] Z. Li, “Nurses’ knowledge and attitudes regarding major immobility complications among bedridden patients: a prospective multicentre study,” Journal of Clinical Nursing, vol. 27, no. 9–10, pp. 1969–1980, 2018.
[16] A. S. Mohammed, N. M. Taha, and E. M. Abdel-Aziz, “Nurses’ performance regarding venous thromboembolism prophylaxis at intensive care unit,” Zagazig Nursing Journal, vol. 14, no. 1, pp. 1–17, 2018.
[17] F. A. Khedr, A. Baker, and E. Gamal, “Nurses’ performance regarding preventive measures of pulmonary embolism in port said hospitals,” Port Said Scientific Journal of Nursing, vol. 6, no. 2, pp. 61–77, 2019.
[18] H. Oh, S. Boo, and J. A. Lee, “Clinical nurses’ knowledge and practice of venous thromboembolism risk assessment and prevention in South Korea: a cross-sectional survey,” Journal of Clinical Nursing, vol. 26, no. 3–4, pp. 427–435, 2017.
[19] T. Yan, “Nurses’ Knowledge, Attitudes, and Behaviors toward Venous Thromboembolism Prophylaxis: How to Do Better,” Vascular, vol. 29, Article ID 1708538120933782, 2020.
[20] M. Yu-Fen, “Nurses' objective knowledge regarding venous thromboembolism prophylaxis: a national survey study,” Medicine, vol. 97, no. 14, 2018.
[21] R. Skár, “How nurses experience their work as a learning environment,” Vocations and Learning, vol. 3, no. 1, pp. I–18, 2010.
[22] M. Chaghari, M. Saffari, A. Ebadi, and A. Ameryoun, “Empowering education: a new model for in-service training of nursing staff,” Journal of advances in medical education & professionalism, vol. 5, no. 1, pp. 26–32, 2017.
[23] E. J. Oyira, “Knowledge practice and outcome of quality nursing care among nurses in university of calabar teaching hospital (UCTH),” Journal of Education and Training Studies, vol. 4, no. 11, pp. 179–193, 2016.
[24] I. K. R. Hatlevik, “The theory-practice relationship: reflective skills and theoretical knowledge as key factors in bridging the gap between theory and practice in initial nursing education,” Journal of Advanced Nursing, vol. 68, no. 4, pp. 868–877, 2012.