

Evaluation of hospital nurses' perceived knowledge and practices of venous thromboembolism assessment and prevention

Jung-Ah Lee, PhD, RN, Donna Grochow, MSN, RN, Diane Drake, PhD, RN, Linda Johnson, MSN, RN, Preston Reed, PhD, and Gwen van Servellen, PhD, RN, FAAN

Venous thromboembolism (VTE) is a preventable cause of hospital death. Bedside registered nurses (RNs) are a key group that can be the first to recognize risks of patients in acute care settings. The purpose of this study was to identify bedside hospital RNs' perceived knowledge of VTE, their assessment practices, their self-efficacy in conducting VTE prevention care, and their perceived barriers to performing VTE risk assessment. An anonymous web-based survey on VTE risk assessment and prevention was conducted with RNs who provided direct patient care at two hospitals. RNs who were not directly involved in bedside patient care such as managers and educators were excluded. A total of 221 RNs completed the survey. Most participants rated their overall knowledge of VTE risk assessment between "good" (44%) and "fair" (28%). VTE assessment frequencies performed by participants varied widely. Participants reported high confidence in their ability to educate patients and families about VTE symptoms, prevention, and treatments. Participants were least confident in their own ability to conduct a thorough VTE risk assessment. Greater self-reported VTE knowledge was associated with greater VTE assessment frequency and self-efficacy for VTE preventive care. The most common perceived barriers in performing VTE risk assessment were lack of knowledge (21%) and lack of time (21%). The findings demonstrate a substantial need for focused education about VTE prevention for hospital nurses and support for hospital systems to monitor VTE care. Despite the Joint Commission emphasis on VTE risk assessment in all hospitalized patients, there remains a gap between current, evidence-based recommendations for VTE prevention and reported nursing practices. (J Vasc Nurs 2014;32:18-24)

Venous thromboembolism (VTE) manifesting as deep vein thrombosis (DVT) and pulmonary embolism (PE) is a major health care problem affecting hundreds of thousands of Americans annually. Over half of these individuals develop their

VTE in hospitals or in the 30 days after hospital discharge.¹ PE is the most common preventable cause of hospital death in the United States.² Annually, PE accounts for an estimated 300,000 deaths.² Despite ample availability of evidence-based guidelines recommending pharmacologic and mechanical prophylaxis in hospitalized patients,³⁻⁵ prevention of VTE is inadequate for many hospitalized patients with medical illnesses, including congestive heart failure, chronic lung disease, cancer, and infectious disease.⁶

Many public and private organizations, including the Centers for Medicare and Medicaid Services, the Joint Commission, National Quality Forum, the Agency for Healthcare Research and Quality, and the Leapfrog group, have developed health care provider performance measures, quality indicators, guidelines, public reporting initiatives, incentive programs, and negative reimbursements aiming to improve quality of care and reduce unnecessary health care costs related to VTE preventions.^{1,7} The Joint Commission has recently added anticoagulation therapy safety as one of the National Patient Safety Goals.⁸ Antithrombotic therapy using anticoagulants is recommended by the American College of Chest Physicians to prevent VTE.³⁻⁵

VTE risk assessment requires the coordination of care across multiple disciplines supported by a system that assists in the process of delivering and tracking outcomes of care.⁹ Multifaceted approaches, including either a paper-based or computer-based physician reminder on risk assessment and decision support, and a continuous iterative process of audit and feedback, have shown to be effective initiatives and strategic plans.^{10,11} These

From the Program in Nursing Science, University of California, Irvine, Irvine, California; Nursing Quality, Research & Education, Magnet Program, University of California, Irvine Medical Center, Orange, California; Mission Hospital, St. Joseph Health Systems, Mission Viejo, California; Patient Care of Mission Hospital, St. Joseph Health Systems, Mission Viejo, California; School of Nursing, University of California, Los Angeles, Los Angeles, California.

Corresponding author: Jung-Ah Lee, PhD, RN, Assistant Professor, Program in Nursing Science, University of California, Irvine, 100A Berk Hall (Building 802), Irvine, CA 92697-3959 (E-mail: jungahl@uci.edu).

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approaches are put in place primarily to help physicians. Still, nurses who provide care at the patient bedside may be the first health care providers to identify risks for VTE and to respond. Literature in nursing has focused on nurses' awareness of and commitment to VTE prevention.¹²⁻¹⁷ Still, it is not known how knowledgeable nurses, particularly hospital nurses, are of early VTE risk assessment and prevention using anticoagulants. Nurses working in intensive care units and any surgical unit might be more aware of VTE prevention, whereas nurses who provide care on medical units might not consider VTE risk assessment as important in their daily practice.¹

"Failure to rescue" has been identified as an important consequence of poor patient care and may be an important outcome of missed opportunities for early VTE risk assessment. Aiken et al¹⁸⁻²⁰ identify hospital-acquired PE as one of several adverse events of "failure to rescue." Evidence describing the need for nurses to receive in-service education for performance of VTE risk assessment will contribute to our knowledge for planning targeted educational programs. There is little research addressing nurses' knowledge and practice of VTE risk assessment, self-efficacy on VTE prevention care, and perceived barriers in performing nursing practices in hospitalized patients at high risk for VTE.

RESEARCH QUESTIONS

The study intended to answer two primary questions. First, how do hospital registered nurses (RNs) perceive their knowledge and practices of VTE risk assessment and prevention for hospitalized patients? Second, what barriers do these hospital nurses perceive in their practices of assessment and prevention care for VTE?

The purpose of this study was to identify bedside hospital RNs' perceived knowledge of VTE, their assessment practices, their self-efficacy in conducting VTE prevention care, and their perceived barriers to performing VTE risk assessment.

METHODS

Research design

This is an exploratory descriptive study utilizing a web-based, anonymous survey method.

Design and setting

An anonymous, voluntary, web-based survey regarding nursing practice on VTE care was conducted with bedside hospital RNs in two acute care hospitals in California. Hospital A is an academic medical center with level I trauma center and 422 patient beds. Hospital B is a large community hospital with level II trauma center and 407 patient beds.

Ethical approvals for this study were obtained from the institutional review boards for human subjects research in the two hospitals.

Survey questionnaire

The survey questions were developed by experts in VTE research and instrument development, including two nurse researchers. The committee of anticoagulation education, including anticoagulation specialized pharmacists, dieticians, clinical

nurse educators, nurse case managers, patient education specialized staff, and nursing faculty in the academic hospital, reviewed the survey for completeness and clarity of the questionnaire and data collection procedures for feasibility. The survey had 20 items to determine nurses' (1) exposure to an in-service education program or course regarding VTE risk and prevention and evaluation with a 5-point Likert scale from 1 (poor) to 5 (excellent) on the quality of the VTE education program taken; (2) self-reported VTE knowledge and current performance of VTE risk assessment with a 5-point Likert scale from 1 (poor) to 5 (excellent); (3) perceived barriers to performing VTE risk assessment (an open-ended question); (4) self-efficacy of nursing practice on VTE prevention and education for patients with a 5-point Likert scale from 1 (none of the time) to 5 (always); and (5) demographic information. The Cronbach alpha for the self-efficacy portion of the survey was 0.84, indicating very good reliability. VTE self-efficacy items are examined individually and then by calculating a composite score created by taking the mean score from all six items.

Procedure of survey

Data from hospital nursing administrators indicated that there were approximately 1,200 bedside RNs, excluding RNs working in outpatient settings, pediatric units, labor and delivery units, and psychiatric units in the two hospitals available. Invitation e-mails were sent to potential participants by way of the web-based survey. The invitations were sent twice a month for a span of 2 months to increase response rate. Participating nurses were informed of the purpose of the study and how the results of the survey would be used to develop an intensive educational program of VTE risk assessment and prevention. Individual nurses were given the opportunity to make a voluntary decision about whether to take part in the study. They were informed the survey would take approximately less than 10 minutes of the participants' time and they could complete the survey at home or at the hospital. Nurses not directly involved in bedside patient care (eg, nurse managers or nurse educators) were excluded from the survey. Compensation for survey completion followed typical practices at the respective hospitals. Therefore, participants from hospital A were not offered compensation for survey response, whereas 20 movie tickets were raffled to participants from hospital B. Hospital nursing administrators did not have access to individual survey response data.

Statistical analyses

Descriptive statistical analyses (eg, frequencies, percentages, mean, or medians with standard deviation) were performed to describe the nurses' demographic information, practices, VTE risk assessment frequency, VTE self-efficacy, and all other study variables. Chi-square, Student *t*-tests, and correlations were used when appropriate to assess the bivariate relationships of key variables. Barriers to nurses performing VTE assessment and preventive care for their patients were assessed by grouping responses into different categories. The categories were "lack of time," "lack of knowledge," lack of a standardized VTE protocol," "language barriers," or other. All statistical analyses were

conducted using Stata 11.2 (StataCorp, College Station, TX, 2009). The Cronbach alpha for the self-efficacy portion of the survey containing six items was calculated to determine reliability. $P < .05$ was considered significant.

RESULTS

Characteristics of participants

In total, 221 participants (approximately 18.4%) from two hospitals completed the survey. As can be seen in Table 1, most participants were female nurses (205; 93%). Slightly more than half of participants (116; 53%) had earned a Bachelor's in Nursing (BSN; $n = 108$ [49%]) or a Master's degree in Nursing (MSN; $n = 8$ [3.6%]). Owing to the small number of MSN respondents, this group was combined with the BSN respondents for analyses. The mean \pm standard deviation number of years of working as an RN was 13.8 ± 10.6 years and the mean \pm standard deviation number of years of working in their hospital was 7.8 ± 7.5 . Settings were grouped into four general categories; specific frequencies of nurses' working settings can be seen in Table 1. Approximately 37% of participating nurses worked in an intensive care setting, 30% in a medical setting ("medical," "oncology," or "rehabilitation"), 16% in a surgical setting ("surgical," "obstetrics/gynecology," or "orthopedics"), 5% in an emergency room/urgent care setting, and 12% in other settings. Fewer than half of participants (101; 46%) reported that they had attended an in-service education or course related to VTE care. Of these 101 participants, only 7 nurses with previous VTE education experience reported that the quality of their VTE education was excellent.

Participants from hospital A were younger and less experienced (fewer years as an RN and fewer years working in the unit) than participants from hospital B. Furthermore, participants from hospital A were more likely to have a bachelor's degree, be employed full time, work in an intensive care unit setting, and have had a previous VTE in-service education than participants from hospital B.

VTE knowledge and risk assessment practices

As seen in Figure 1, slightly fewer than one half of respondents (44%; 92/208) rated their overall knowledge of VTE as "good." Approximately 28% of nurses (58/208) responding to this question reported their VTE knowledge was "fair." Thirteen participating nurses (13/221; 5.9%) did not answer this question. The overall mean of self-reported VTE knowledge with a 5-point Likert scale was 3.0 ± 0.87 . The mean of self-reported VTE knowledge was 3.2 in the participants with previous VTE education experience and 2.8 in the participants without previous VTE education experience ($t = -3.54$; $P < .001$).

Figure 2 shows nurses' self-rated frequencies of VTE assessment with their patients. The VTE assessment frequencies varied widely from all of their patients to none of their patients. Whereas 26% (56/212) of respondents indicated completing a VTE risk assessment on all of their patients, 14% (30/212) indicated completing an assessment on none of their patients. Nine participants (of 221 [4%]) did not rate their VTE assessment frequency. The participants' overall mean of VTE risk assessment

TABLE 1

CHARACTERISTICS OF NURSE PARTICIPANTS

<i>Characteristic</i>	<i>Value</i>
Age in years (mean, SD)	41.9 (11.2)
Median (range)	40 (22-75)
Female (%)	205 (93%)
Education	
Associate degree in nursing	103 (47%)
Bachelor's or master's degree in nursing	116 (53%)
Employment status (full time)	170 (78%)
Years as RN (mean, SD)	13.8 (10.6)
Median (range)	13 (0.25-45)
Years working in the hospital (mean, SD)	7.8 (7.5)
Median (range)	5 (0.25-37)
Years working on the unit (mean, SD)	6.5 (6.5)
Median (range)	5 (0.08-32)
Type of hospital units	
ER/urgent care	12 (5%)
ICU	81 (37%)
Medical	51 (23%)
Obstetrics/gynecology	20 (9%)
Oncology	11 (5%)
Orthopedic	3 (1%)
Rehabilitation	3 (1%)
Surgical	12 (5%)
Other	27 (12%)
Previous VTE education	101 (46%)
Perceived quality of the VTE education (mean, SD)	3.2 (0.9)
Median (range, 1-5; from 1 [poor] to [5] excellent)	3 (2-5)
Excellent	7 (7%)
Very good	26 (26%)
Good	46 (46%)
Fair	22 (22%)
Poor	0

ER = emergency room; ICU = intensive care unit; SD = standard deviation; VTE = venous thromboembolism.

The *ns* vary slightly across variables owing to missing data.

frequency with their patients was 3.4 ± 1.4 . Increased VTE risk assessment frequency was associated with greater self-reported VTE knowledge ($r = 0.32$; $P < .001$).

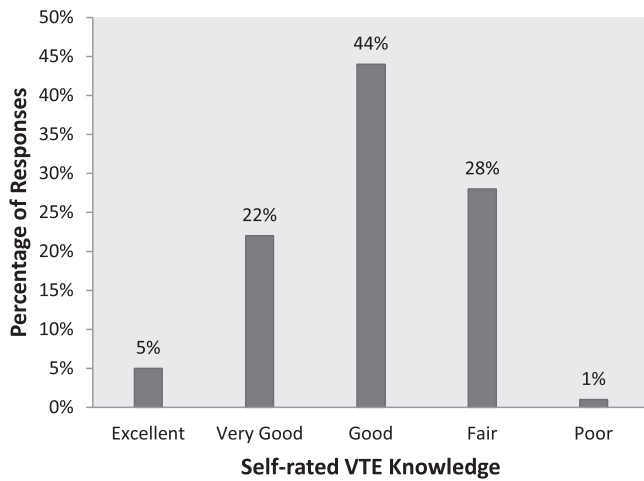


Figure 1. Nurses' perceived venous thromboembolism knowledge.

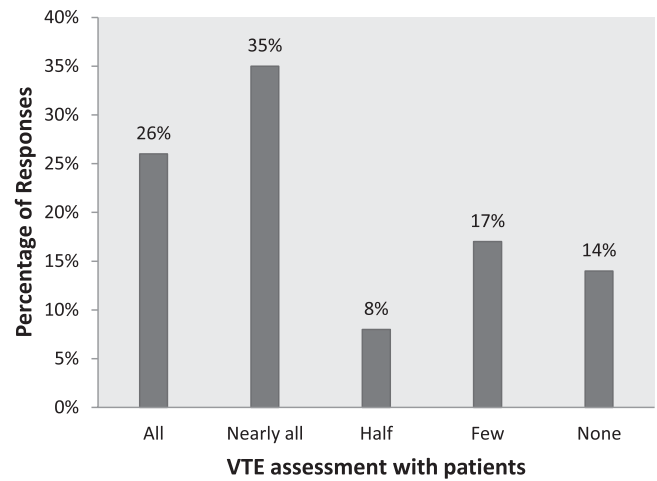


Figure 2. Nurse self-reported frequency of venous thromboembolism assessment with patients.

Self-efficacy for VTE prevention care

Table 2 provides descriptive means and frequencies for individual VTE self-efficacy items with 5-point Likert scale. As a whole, nurse respondents were confident in their ability to educate patients and their families about VTE symptoms (mean, 3.89 ± 0.85), prevention with effective use of mechanical devices (mean, 4.21 ± 0.89), and treatments with oral anticoagulation (mean, 3.88 ± 1.0). Participating nurses were least confident in their own ability to conduct a thorough VTE risk assessment (mean, 3.5 ± 1.0). Whereas 70% of participating nurses (154/220) indicated that they could educate patients on oral anticoagulant medications most or all of the time and 84% (185/220) were sure most or all of the time that they could effectively use mechanical devices for VTE prevention, only 57% (126/221) indicated the same for conducting a thorough VTE risk assessment. Greater self-reported VTE knowledge was associated with better self-efficacy for VTE prevention care ($r = 0.49$; $P < .001$).

Barriers to nursing practice on VTE risk assessment

The most common perceived barriers in performing assessment for VTE risk and prevention care that the participating RNs responded to the open-ended question with were lack of time (21%) and lack of knowledge (21%). Other barriers reposed by participating RNs were lack of a standardized tool or protocol to use (13%) and language barriers (5%). Less frequently cited barriers were "physicians do risk assessment," "no physician order," "not RN's independent role," "patient refusal to wear embolic stockings or sequential devices," "mechanical devices were not available to use," and "no barriers." Other reported barriers were, "I am not very failure with VTE risk assessment" (a nurse in an emergency room/urgent care). "It is easy to forget to do it" (a nurse in a medical unit), and "Need for the knowledge of heparin and Coumadin" (a nurse on an obstetrics/gynecology unit).

DISCUSSION

VTE is a major event in acute health care settings. Nurses are in the frontline in assessing the risk of VTE in hospitalized patients, who are almost all at high risk for VTE. We conducted

a survey aimed at describing the current nursing practice on VTE assessment and prevention in hospitalized patients. The survey included 221 participating bedside RNs from two hospitals with differing levels of experience and formal knowledge of VTE.

VTE knowledge and risk assessment practices

We found interesting results related to RNs' self-reported VTE knowledge and VTE risk assessment practices. It is noteworthy that approximately 30% of participating hospital RNs reported their overall knowledge of VTE risk assessment was fair or poor and 31% reported that they seldom completed VTE risk assessment in their patients. Fewer than half of our participants (46%) reported they attended an in-service education or course related to VTE care. However, only 7% of those who had previous VTE education reported that the quality of the VTE education was excellent. We may need to revisit the current in-service continuous education curriculum regarding VTE risk assessment and prevention offered for bedside RNs in acute care settings.

Before the surveys were conducted, neither hospital had a specific VTE risk assessment model employed by either physicians or nurses. Currently, both hospitals use a system-wide VTE risk assessment via their electronic medical records systems requiring that physicians mandatorily assess all patients upon admission and prescribe appropriate prophylactic methods according to the levels of VTE risk (eg, low, moderate, or high risk). Such VTE prevention practices were developed based on the 9th edition of American College of Chest Physicians evidence-based guidelines in 2012.⁴ Bedside nurses in the hospitals are expected to monitor changes in VTE risk in their patients and administer anticoagulants (eg, heparin or low-molecular weight heparin) if prescribed or/and apply mechanical pneumatic sequential compression devices appropriately. In addition to the adequate application of ordered pharmacologic and mechanical prophylaxis measures for VTE prevention, nurses were also expected to provide appropriate education about VTE prophylactic methods to their patients and assure patients' compliance with mechanical devices.

TABLE 2

NURSES' SELF-EFFICACY IN PRACTICING VTE PREVENTION CARE

<i>How Sure Are You That You Can.... ?</i>	<i>Mean (SD)</i>	<i>None of the Time (score of 1), (%)</i>	<i>A Little of the Time (score of 2), (%)</i>	<i>Some of the Time (score of 3), (%)</i>	<i>Most of the Time (score of 4), (%)</i>	<i>Always (score of 5), (%)</i>
Conduct a thorough VTE risk assessment.	3.50 (1.0)	11 (5)	26 (12)	57 (26)	93 (42)	33 (15)
Educate the patient on oral anticoagulants.	3.88 (1.0)	4 (2)	20 (9)	42 (19)	87 (40)	67 (30)
Effectively use mechanical devices for VTE prevention.	4.21 (0.9)	4 (2)	7 (3)	24 (11)	89 (40)	96 (44)
Educate patients and their families about the signs, symptoms, treatment, and prevention of DVT and PE.	3.89 (0.8)	0 (0)	16 (7)	45 (20)	108 (49)	52 (24)
Advise at-risk patients about lifestyle changes.	3.63 (0.9)	3 (1)	25 (11)	59 (27)	96 (44)	37 (17)
Encourage early mobilization and leg exercises.	4.05 (0.8)	2 (1)	8 (4)	25 (11)	126 (57)	59 (27)

Note. The *ns* (either 221 or 220) vary slightly across variables owing to missing data.

Self-efficacy of nursing practice on VTE

Nurses' self-efficacy in performing VTE prevention care was moderate to high. The overall mean of self-efficacy was 3.9 out of 5. Most of participating RNs (84%) reported they were sure always or most of time that they could effectively use mechanical devices for VTE prevention; 84% were sure that they could encourage patients to do early mobilization and leg exercises, and 70% were sure they could educate their patients on oral anticoagulants. Our study showed a strong association between self-reported VTE knowledge and nurses' self-efficacy on VTE preventive care; that is, greater VTE knowledge was associated with better self-efficacy for VTE prevention care. This may implicate again the importance of focused training for RNs in VTE care.

Barriers to performing VTE risk assessment and prevention care

We also surveyed barriers for nurses to perform VTE assessment for their patients. The most common perceived barrier in performing VTE risk assessments was a lack of knowledge. This qualitative result was consistent with the quantitative results of RNs' perceived knowledge of VTE and self-reported VTE assessment. Nurse educators should consider providing a comprehensive education program about VTE prevention care including VTE risk factors, risk stratification, signs and symptoms of DVT and PE, anticoagulants, and contraindications to pharmacologic and mechanical prophylaxes.

Another most common barrier in assessing patients that bedside RNs perceived was related to time constraints. Although

nurses might have competing patient care responsibilities, VTE risk assessment is important and should be given appropriate consideration. Recently, VTE has been identified by a national quality improvement initiative in Centers for Medicare and Medicaid Services, as avoidable complications as "never events," including hospital falls, line-associated infections, transfusion errors, and foreign body retained from surgery.^{21,22}

There has been little research similar to our study on bedside nurses' self-reported VTE knowledge and practice for inpatients. In 2004, Viale and Schwartz²³ conducted a survey of oncology nurses' attitudes and treatment practices for ambulatory settings focusing on VTE in patients with cancer. In their study, oncology nurses reported barriers in treating DVT for patients with cancer in outpatient settings. These barriers included reimbursement and insurance issues, lack of caregiver help, patients' inability to give self-injection, language barriers in teaching, and patients' noncompliance with their treatment regimen. The nurse survey respondents also reported areas of needed education; they included information on risk factors for VTE, VTE prevention information, and specific treatment information. The majority of these nurse respondents suggested that the best way to get information regarding VTE and risk assessment was in the form of online education.

A recent study in 2013 conducted by Gaston et al²⁴ assessed the levels of compliance with VTE risk assessment and prophylaxis best practices via auditing patient charts for a 3-month period both before and after in-house nurse education on VTE risk assessment and prophylaxis guidelines in a rural acute care hospital in Australia. The study demonstrated that compliance with and nurses' knowledge of in-house best practice guidelines on VTE risk assessment and prophylaxis use increased following

nurse education. The authors recommended that those educational sessions could be repeated at regular intervals to ensure that bedside hospital nurses' awareness can be maintained.

Implications for nursing practice

Findings from this study demonstrated that nurses who had previous VTE education reported greater self-efficacy in conducting VTE assessment and prevention care with their patients. There is a substantial need for focused education about VTE risk assessment and prevention care for hospital nurses. Although RNs are not able to prescribe pharmacologic prophylaxis (eg, heparin, enoxaparin, warfarin) to prevent VTE in hospitalized patients at risk for VTE, bedside RNs are responsible for patient evaluation of VTE risk and conducting essential risk stratification procedures. They must also use pharmacologic and mechanical methods for VTE risk reduction for their hospitalized patients whether these patients are in specialty units (eg, intensive care unit or oncology) or in general medical and surgical units.

Nurses can also play a key role in educating patients and family caregivers about VTE risk and management with or without anticoagulation therapy in transition period from hospital to next care settings. To improve patient safety and positive outcomes by providing appropriate care by nurses, hospital nurse educators can tailor this study and survey to develop, implement, and evaluate an intensive educational program on VTE assessment and care. The program should include (1) daily VTE risk assessment, (2) anticoagulation management, and (3) patient discharge education on VTE prevention and anticoagulation management at home. This intensive training program for nursing staff will aim to improve nurse competencies in VTE prevention and management in patients.

Additionally, hospital care systems regarding VTE prevention should be assessed to identify mechanisms to address barriers to VTE risk assessment throughout several departments, including medicine and pharmacy. Individual hospitals can choose to initiate the assessment of VTE care as a quality improvement process and then concurrently seek benchmarking for quality education and appropriate measures of patient outcomes associated with nursing practice on VTE care.

Limitations

This study has a number of limitations. First, the sample of the study was from two regional acute care hospitals. This may affect the generalization of our findings to other types of health care settings. Second, survey participation was not mandatory. Additionally, participants could skip questions that they did not want to answer. Thus, nurses who might not be confident may have avoided participating in this survey at all or could have not responded to questions that were uncomfortable. If this were the case, the reported levels of VTE knowledge, practice, and self-efficacy could be an overestimate of true population levels. Although our response rate was low (approximately 18%), our response missing rate was very low (0.4%-5.9%). Third, e-mail recruitment may have contributed to our low response rate. Whereas online survey response rates tend to be lower than traditional mail surveys,²⁵ the low response rate may be owing to a lack of available time to complete any non-mandatory survey, regardless of survey methodology. Finally,

given that the survey relies on nurse's self-report, there is a possibility that results could be impacted by poor memory, misunderstanding of questions, or even intentional deception. In general, these survey methods are considered familiar and acceptable approaches to gathering data on a topic that is not fully understood. To our knowledge there are no studies addressing nurses' perceived self-efficacy and corresponding practices; nor are there studies linking these variables to nurses' knowledge of VTE assessment and prevention.

In conclusion, the findings of this study demonstrated there is a substantial need for focused education for bedside nurses to prepare them to conduct VTE assessment and prevention care in acute care settings. Despite the Joint Commission emphasis on VTE risk assessment in all hospitalized patients, there may be a gap between current evidence-based recommendations for VTE prevention and daily practice in nursing. VTE care systems in hospitals may also need to be evaluated to improve patient outcomes regarding VTE in addition to education for all health care providers including not only nurses but also physicians and pharmacists whom nurses collaborate with.

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