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## Feature Article

## Venous thromboembolism knowledge among older post-hip fracture patients and their caregivers



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## ABSTRACT

Patient education about venous thromboembolism (VTE) prevention is needed to prevent complications and costly re-hospitalization. Nurses are uniquely positioned to provide vital education as patients transition from the inpatient setting to after discharge. Still, little is known about patient knowledge deficits and those of their caregivers. The purpose of this study was to explore VTE prevention knowledge in a sample of older hip fracture patients and family caregivers. At the time of hospital discharge, surveys were completed by hip fracture surgery patients ( $\geq 65$ ;  $n = 30$ ) and family caregivers ( $n = 30$ ). Participants reported needs for more prophylactic anticoagulation and side effects education. Mean education satisfaction was 3.49 out of 5 among patients and 3.83 among caregivers. Focused patient education regarding the wisdom of VTE prevention, potential risks involved, and patient and caregiver roles in advocating for better prevention measures is needed for these patients at risk for hospital readmission secondary to VTE.

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## Introduction

Venous thromboembolism (VTE) is a disease that encompasses deep vein thrombosis (DVT) and pulmonary embolism (PE) with significant morbidity and mortality.<sup>1</sup> VTE often develops in patients during their hospitalization but can also develop in patients anytime in the 30 days post-hospitalization.<sup>2</sup> The risk for VTE among patients undergoing major orthopedic surgery, particularly hip fracture surgery, is the highest among all surgical patients.<sup>3</sup> The incidence of VTE ranges from 36% to 60% after hip fracture surgery and 45–57% after total hip replacement surgery.<sup>4</sup> Deaths from VTE among these patients still occur although not very frequently.<sup>3</sup> Even if there is adequate thromboprophylaxis during hospitalization, the risk for VTE remains high during post-hospitalization due to advanced age of hip fractured patients, multiple comorbid conditions, and immobilization during early rehabilitation period.<sup>5</sup> VTE is said to be an under-recognized risk factor for readmission.<sup>6</sup>

Hip fracture surgery is an urgent surgical procedure that should be performed as soon as possible after fracture trauma. Moreover, patients with hip fracture are likely to be older than patients who plan to have elective hip or knee replacement surgeries and to have more severe comorbidities.<sup>7</sup> Hip fracture surgery is often delayed for 48 h or more after the fracture trauma occurs, and because of this, these patients can even develop DVT preoperatively.<sup>7</sup>

Hospital readmissions after hip fracture are not uncommon primarily due to on-going comorbid conditions and complications in older patients.<sup>8–10</sup> The most common reason for emergency admission after total hip arthroplasty (THA), a major orthopedic surgery as is hip fracture surgery, is thromboembolic disease.<sup>8,10</sup> A multicenter epidemiological study of a cohort of patients undergoing hip fracture surgery (7019 patients from 531 medical centers in France) showed that the rate of confirmed symptomatic VTE at 3 months post-hip fracture surgery was 1.34% (95% CI: 1.04–1.64) and 16 PE cases (including 3 fatal PEs) were reported.<sup>11</sup> Another study using nationally representative data on adverse drug events demonstrated that warfarin (33.3%) was the leading medication to cause emergency hospitalization in older Americans, followed by insulin (13.9%), and oral antiplatelet agents (13.3%).<sup>12</sup>

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Older patients after hip fracture surgery require continuous management and complex care from a diverse range of health care professionals in an assortment of settings. While transitioning from hospitals to next care settings, VTE-related risks still remain in these patients. A retrospective cohort study examined the impact of discharge destination in patients undergoing either THA or hip fracture. After adjusting for important socio-demographic factors, patients who were discharged to inpatient rehabilitation settings (4.2%) had the lowest readmission rate within 180 days compared to those to home (5.1%), home with home care (10.5%), and skilled nursing facility (12.3%).<sup>8</sup> An epidemiological study of VTE prevalence reported nursing home confinement to be one of several independent VTE risk factors.<sup>13</sup> Other factors include surgery, hospitalization for acute medical illness, trauma, and cancer.<sup>13</sup> There is little research on the safety of anticoagulation therapy in long-term care settings. Moreover, little is known about the level of VTE knowledge in patients and caregivers who will manage VTE prevention in the home and may need to monitor VTE prevention in some lower level care settings.

There is little doubt about what needs to happen to prevent VTE, and patients, community caregivers, and professionals in every care setting should be aware of what they are. First and primary, VTE can be prevented by the proper use of anticoagulants.<sup>3</sup> There have been national calls to action to prevent VTE by public agencies and private organizations, including the Centers for Medicare and

Medicaid Services (CMS), the Joint Commission, National Quality Forum (NQF), the Agency for Healthcare Research and Quality (AHRQ), the Institute for Healthcare Improvement (IHI) and Leapfrog group.<sup>14</sup> Evidence based clinical guidelines and quality improvement strategies for VTE prevention and treatment in patients during hospitalization and after discharge were developed by the collaborative work.<sup>14</sup>

Table 1 presents a summary of most recent recommendations for the prevention of VTE using the most recent evidence-based clinical practice guidelines for antithrombotic therapy and prevention of thrombosis.<sup>3,15</sup> According to these guidelines, it is highly recommended to use antithrombotic prophylaxis [e.g., low-molecular weight heparin (LMWH), fondaparinux, low dose unfractionated heparin (LDUH), adjusted-dose Vitamin K antagonist, or aspirin, and/or intermittent pneumatic compression device] for a minimum of 10–14 days for patients undergoing hip fracture surgery.<sup>3</sup> Extending thromboprophylaxis for up to 35 days from the day of surgery has also been recommended.<sup>3,16,17</sup>

Effective education of older patients and caregivers about anticoagulant medications may be critically important post-hospitalization in order to prevent adverse drug events and reduce mortality. Discharge instructions including follow-up monitoring, compliance issues, dietary restrictions, the potential for adverse drug reactions or interactions, and activity requirements or restrictions are key components in any education program for patients and their caregivers.<sup>18</sup>

**Table 1**

The summary of recommendations for the prevention of VTE in patients with hip fracture surgery from the 9th edition of evidence-based clinical practice guidelines for antithrombotic therapy and prevention of thrombosis by American Colleges of Chest Physicians (ACCP).

Recommendations with evidence

1. The ACCP expert panel recommends use of one of the following rather than no antithrombotic prophylaxis for a minimum of 10–14 days: LMWH, fondaparinux, LDUH, adjusted-dose VKA, aspirin (all Grade 1B), or an IPCD (Grade 1C).  
Remarks: The panel recommends use of only portable, battery-powered IPCDs capable of recording and reporting proper wear time on a daily basis for inpatients and outpatients. Efforts should be made to achieve 18 h of daily compliance of IPCDs. One expert panel member believed strongly that aspirin alone should not be included as an option.
2. In HFS patients receiving LMWH as thromboprophylaxis, the ACCP expert panel recommends starting either 12 h or more preoperatively or 12 h or more postoperatively rather than within 4 h or less preoperatively or 4 h or less postoperatively (Grade 1B).
3. In HFS patients, irrespective of the concomitant use of an IPCD or length of treatment, the ACCP panel suggests the use of LMWH in preference to the other agents that they have recommended as alternatives: Fondaparinux, LDUH (Grade 2B), adjusted-dose VKA, or aspirin (all Grade 2C).  
Remarks: For patients in whom surgery is likely to be delayed, the panel suggests that LMWH be initiated during the time between hospital admission and surgery but suggests administering LMWH at least 12 h before surgery. Patients who place a high value on avoiding the inconvenience of daily injections with LMWH and a low value on the limitations of alternative agents are likely to choose an alternative agent. Limitations of alternative agents include the possibility of increasing bleeding (which may occur with fondaparinux) or possible decreased efficacy (LDUH, VKA, aspirin, and IPCD alone). Furthermore, patients who place a high value on avoiding bleeding complications and a low value on its inconvenience are likely to choose an IPCD over the drug options.
4. Extending thromboprophylaxis in the outpatient period for up to 35 days from the day of surgery rather than for only 10–14 days (Grade 2B).
5. Using dual prophylaxis with an antithrombotic agent and an IPCD during the hospital stay (Grade 2C).
6. For patients with increased risk of bleeding, using an IPCD or no prophylaxis rather than pharmacologic treatment (Grade 2C).  
Remarks: Patients who place a high value on avoiding the discomfort and inconvenience of IPCD and a low value on avoiding a small absolute increase in bleeding with pharmacologic agents when only one bleeding risk factor is present (in particular the continued use of antiplatelet agents) are likely to choose pharmacologic thromboprophylaxis over IPCD.
7. For patients who decline or are uncooperative with injections or an IPCD, the panel recommends using apixaban or dabigatran (alternatively rivaroxaban or adjusted-dose VKA if apixaban or dabigatran are unavailable) rather than alternative forms of prophylaxis (all Grade 1B).
8. ACCP panel suggests against using inferior vena cava (IVC) filter placement for primary prevention over no thromboprophylaxis in patients with an increased bleeding risk or contraindications to both pharmacologic and mechanical thromboprophylaxis (Grade 2C).
9. For asymptomatic patients, ACCP panel recommends against Doppler (or duplex) ultrasound (DUS) screening before hospital discharge (Grade 1B).

**Abbreviations:** DUS = Doppler (or duplex) ultrasonography; GCS = graduated compression stockings; HFS = hip fracture surgery; IPCD = intermittent pneumatic compression device; IVC = inferior vena cava; LDUH = low-dose unfractionated heparin; LMWH = low-molecular-weight heparin; VKA = vitamin K antagonist.  
*Source:* Falck-Ytter Y, Francis CW, Johansen NA, et al. Prevention of VTE in orthopedic surgery patients: antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest 2012;141(2 suppl):e278S–325S (Pages: e279S–e280S).

**Grade of Recommendations – Levels of Evidence:**

- Strong recommendation, high-quality evidence (Grade 1A).
- Strong recommendation, moderate-quality evidence (Grade 1B).
- Strong recommendation, low- or very low-quality evidence (Grade 1C).
- Weak recommendation, high-quality evidence (Grade 2A).
- Weak recommendation, moderate-quality evidence (Grade 2B).
- Weak recommendation, low- or very low-quality evidence (Grade 2C).

*Source:* Guyatt GH, Norris SL, Schulman S, et al. Methodology for the development of antithrombotic therapy and prevention of thrombosis guidelines: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest 2012;141(2 suppl):53S–70S (page 62S).

Prevention of VTE in patients undergoing elective total hip replacement or non-elective trauma related surgery is reported to be adequate both before and during their hospitalization for surgery.<sup>19,20</sup> However, VTE prevention education in post-hip fracture non-elective surgery patients and their family caregivers is only made more effective if we understand what they know and what they don't know. The emergent nature of hip fracture surgery in these patients may signal the need for focused education since the time prior to surgery may have reduced the window of opportunity to teach them what everything they need to know.

### Study purpose

The purpose of this study was to explore VTE prevention knowledge in a sample of older hip fracture patients and family caregivers. Further, we were interested in their satisfaction with education received while hospitalized. The sample was older hip fracture patients experiencing non-elective hip fracture surgery and their caregivers. This information was deemed helpful in developing a patient-centered comprehensive hip fracture program for older non-elective hip fracture surgery patients with special emphasis on the prevention of VTE.

## Methods

### Design and sample

This study used a descriptive cross-sectional design to identify patient and caregiver knowledge of VTE prevention and the satisfaction they felt about the instruction they received during the hospitalization period. The study was conducted in two phases: Phase 1 was the collection of data from patients and Phase 2 was the collection of data from caregivers of patients on the hospital unit. Surveys of self-reported experiences and retrospective medical chart reviews were conducted with the cohort sample of patients and then, patient family caregivers. Participants of the study were hospitalized adults aged 65 years or older who received non-elective hip fracture surgery ( $n = 30$ ) and their family caregivers ( $n = 30$ ). These patients were hospitalized in an urban community acute care hospital with a level 2 trauma center. The hospital treats approximately 200 hip fracture surgeries in older adults ( $\geq 65$ ) per year. Data were collected from March, 2011 through June, 2012. The routine VTE prevention measures in the hospital included chemical prophylaxis in the form of enoxaparin, fondaparinux, and warfarin and mechanical prophylaxis as recommended by the 2008 ACCP VTE prevention clinical guidelines.<sup>16</sup> Patients on the 33-bed surgical/trauma/orthopedic unit were screened for inclusion criteria: 1) hospitalization for hip fracture surgery, 2) age 65 or older, 3) no delirium or dementia as per medical chart, 4) ability to communicate in English, and 5) currently alert and oriented. Cognitive assessment for impairment in older patients with non-elective hip fracture surgery is not routinely conducted and thus the number of potential eligible participants is unknown. However, based on medical chart reviews, approximately half of older adults with hip fracture surgery showed some types of cognitive problems (e.g., delirium) during the hospitalization.

### Procedures

Upon obtaining the approval of the study from academic and hospital Institutional Review Boards (IRBs), flyers about the study were posted on the nursing unit. Written consent forms were waived by both IRBs due to minimal risk of this survey. Nurses on the unit were consulted to identify potential patients who met inclusion

criteria. Patients were screened for inclusion criteria and exclusion for current cognitive impairment per data from the medical charts and assessment by the research nurses. The nurses administered the questionnaires in the privacy of the patients' rooms within a few hours prior to patient transfer or discharge. Participants (patients and caregivers) answered questions regarding VTE risk, symptoms, anticoagulation, satisfaction with educational information received, and perceived needs for care after discharge. Survey administration was completed in approximately 10–20 min. The nurses were present at all times to help participants understand the questions and to ensure that the survey was performed in a consistent manner throughout the study period. The medical records of patient participants were reviewed by the nurse to identify underlying medical conditions and risk factors for VTE(20) (e.g., prior history of DVT/PE, malignancy, immobilization ( $\geq 3$  days confined to bed), major surgery, cardiac diseases, limb trauma (fracture, injury), current hormonal therapy, morbid obesity ( $\text{BMI} \geq 40$ ), recent prolong travel ( $\geq 6$  h), inflammatory bowel disease, nephritic syndrome, myeloproliferative disorders, paroxysmal nocturnal hemoglobinuria, known hypercoagulable state, family history of VTE, and central or peripheral venous catheter placement). Also, information about treatment regarding VTE prevention (e.g., prophylactic antithrombotic therapy and/or mechanical prophylaxis including pneumatic compression device and/or graduated compression stockings) during their hospitalization was collected. Participants (patients and caregivers) each received \$10 compensation for their time and efforts to complete the questionnaire.

### Survey instruments

The survey consisted of four primary sections. First, there were 11 questions regarding the knowledge of risk factors and symptoms of DVT and PE. Second, 8 questions asked about their satisfaction with the anticoagulation education they received during hospitalization (5 Likert scale, 1 = Strongly disagree, 5 = Strongly agree). Third, in open-ended questions participants were guided to list any questions or concerns about their daily injections or medication related to the prevention of VTE (“Do you have any questions or concerns about these daily injections or medication related to the prevention of deep vein thrombosis or pulmonary embolism?”). The fourth section asked several questions concerning patient demographic information and hospital discharge plans. The survey was originally developed by Le Sage et al, Canadian nurses to identify patients' knowledge of VTE.<sup>20</sup> In the Canadian study older adults were excluded from the study sample. For the current study, two nurse researchers (the first author and 3rd author of the paper) and one surgical clinical nurse specialist (the second author) modified the original survey questions. With permission from the survey developers<sup>20</sup> questions were altered by translating questions to fit the appropriate English used in the United States and the language was modified to make it easier for older adults and laypersons such as family caregivers to understand and respond. Reliability estimates for the patient and caregiver satisfaction scales were good, with Chronbach's  $\alpha = 0.80$  for patients, and  $\alpha = 0.84$  for caregivers.

### Data analyses

Stata 11.2 (College Station, TX, Stata Corporation) was used to analyze the data. Descriptive statistics including frequencies and percentages were used to analyze close-ended questions. Means and standard deviations (SD) are reported for Likert-scale items. Responses from open-ended questions were categorized from most frequent to least frequent and then coded to examine frequencies. Differences between patients and caregivers were tested using

Chi-square and *t*-tests where appropriate. All tests of significance used  $\alpha = 0.05$ .

## Results

### Characteristics of participants

A total of 60 individuals who either underwent surgery (patients, 30) or were primary caregivers for someone who underwent surgery (caregivers, 30) completed the survey caregivers. The patient demographic and clinical information are shown in Table 2. The mean age of patient participants was 79 (SD = 8.36) years. Twenty-four (80.0%) of these patients were female, and the majority of patients (26, 86.7%) were Caucasian. Most patient participants (29, 96.7%) had a high school or college education. Forty

percent of patients (12 of 30) reported living alone while the remainder reported living with others – 11 (36.7%) with spouse, 4 (13.3%) with child, and 4 (13.3%) with unspecified others. The most common reason for hip fracture was a fall (29, 96.7%) at either home or elsewhere. The medical chart review indicated that several patients had VTE risk factors (2 patients had a previous VTE and 10 patients had cancer). During hospitalization, all patients received pharmacological prophylaxis and mechanical prophylaxis including graduate compression stockings (GCS) and/or intermittent pneumatic compression (IPC) to prevent VTE. More than two thirds of patients (22, 73.3%) reported that they were transitioning to a skilled nursing facility. Slightly more than half of caregiver participants were female (16, 53.3%). Nineteen caregivers (63.4%) were the child or son/daughter-in-law of the patient and 3 caregivers (10.0%) were spouses. All participating caregivers had high school or higher education.

**Table 2**

Characteristics of patient and caregiver participants.

Patient participants (n = 30) <sup>a</sup>	Frequency (percent)
Age (year)	Mean 79.0 (SD = 8.36) Median 78.5 Range 65–92
Gender (female)	24 (80.0%)
Race/ethnicity:	
Caucasians	26 (86.7%)
African American	2 (6.7%)
Asians	2 (6.7%)
Education:	
Less than high school	1 (3.3%)
High school completion	18 (60.0%)
Higher than high school graduation	11 (36.7%)
Living with:	
Alone	12 (40.0%)
Spouse	11 (36.7%)
Child	4 (13.3%)
Others	4 (13.3%)
Reason for hip fracture:	
Fall at home	13 (43.3%)
Fall – other or unspecified	16 (53.3%)
Automobile accident	1 (3.3%)
VTE risk factors:	
Previous VTE	2 (6.7%)
Cancer	10 (33.3%)
VTE prophylaxis during hospitalization:	
Pharmacologic prophylaxis	
Heparin	1 (3.3%)
Low-molecular weight heparin	23 (76.7%)
Oral anticoagulants	8 (26.7%)
Other	2 (6.7%)
None	0
Mechanical prophylaxis	
Graduate compression stockings (GCS) only	4 (13.3%)
Intermittent pneumatic compression (IPC) only	4 (13.3%)
Both GCS and IPC	22 (73.3%)
None	0
Contraindication to anticoagulant therapy	1 (3.3%)
Discharge plan:	
Home	4 (13.3%)
Skilled nursing facility	23 (76.7%)
Other or unspecified	3 (10.0%)
<hr/>	
Caregiver participants (n = 30)	
Age (year)	Mean: 60.6 (SD = 11.25)
Gender (female)	16 (53.3%)
Relationship with patient:	
Child/son or daughter-in-law	19 (63.3%)
Spouse	3 (10.0%)
Other or unspecified	8 (26.7%)
Education:	
Less than high school	0
High school completion	4 (13.8%)
Higher than high school	25 (83.2%)

SD = standard deviation, VTE = venous thromboembolism.

<sup>a</sup> n (denominator) in each item slightly varies due to missing value.

### Knowledge of VTE among patients and caregivers

Table 3 presents patient and caregiver responses to the questions about VTE and anticoagulation. Most patients and caregivers were aware of the rationale for taking daily injections of heparin or low-molecular weight heparin (e.g., enoxaparin) (respectively, 83.3% vs. 82.1%). Almost 80.0% of patients and caregivers reported they had heard of DVT, and the majority of participants (90.0%) reported that they had heard of PE. Data about knowledge of the risk factors indicated that the most frequently identified risk factor for each group was ‘immobility or bed rest for longer than 3 days’ (83.3% of patients, 86.2% of caregivers). Further risk factors identified were: ‘trauma’ (70.0% of patients, 62.0% of caregivers), and long airline travel (63.3% of patients, 75.9% of caregivers). The least frequently reported risk factor for DVT was ‘cancer’ (13.3% of patients, 26.7% of caregivers). The majority of both groups reported ‘calf pain,’ ‘swelling,’ ‘redness and warmth of leg(s),’ and ‘fever’ as signs and symptoms. The majority of participants reported ‘walking or stretching and moving the legs’ would help prevent a DVT (83.3% of patients, 79.3% of caregivers). Participant responses to identifying signs and symptoms of PE varied, with ‘difficulty breathing’ (48.3%, 56.7%) the most frequent, followed by ‘chest pain’ (34.5%, 43.3%), ‘coughing up blood’ (27.6%, 10.0%), and ‘breathing faster than normal’ (24.1%, 26.7%) for patients and caregivers, respectively.

### Sources of information related to DVT and PE

Table 4 displays information about how participants learned about DVT and PE. The most frequent source of information was ‘TV or newspaper,’ followed by ‘family member/friend,’ ‘nurse,’ ‘physician,’ or ‘pamphlet/poster.’ The ‘other’ choice was answered with participants knowing about VTE from ‘family experiences.’

### Satisfaction with anticoagulation therapy and information about VTE

Level of patient and caregiver satisfaction with anticoagulation therapy and information about VTE they received are displayed in Table 5. Patients’ mean level of satisfaction was 3.49 (range 2.83–4.30) and was caregivers, 3.83 (range 3.41–4.54). The analyses of responses to individual questions about satisfaction are also displayed in Table 5. Although the overall mean satisfaction score was not significantly different between patients and caregivers, caregivers reported slightly higher satisfaction than patients on all satisfaction question items. In particular, patients’ satisfaction with the information given to them about VTE was significantly lower than that of caregivers (2.8 vs. 3.6,  $p = 0.25$ ).



**Table 3**  
Knowledge of patients and caregivers about venous thromboembolism.

Question item <sup>a</sup>	Patients <sup>b</sup> frequency of response (%)	Caregivers <sup>b</sup> frequency of response (%)
You have been receiving daily injections of heparin or enoxaparin. Which of the following statements best described the reason(s) for these injections?	(n = 30)	(n = 28)
Prevent blood clots <sup>c</sup>	25 (83.3%)	23 (82.1%)
Prevent bleeding	1 (3.3%)	0
Prevent infection	0	0
Prevent an allergic reaction	0	0
Control blood sugar	0	0
Relieve pain	0	0
Don't know	4 (13.3%)	5 (17.9%)
Have you ever heard of deep vein thrombosis (DVT)?		
Yes	23/30 (76.7%)	23/30 (76.7%)
Which of the following might increase a person's chances of getting a DVT? <sup>d</sup>	(n = 30)	(n = 29)
Immobility or bed rest for longer than 3 days <sup>c</sup>	25 (83.3%)	25 (86.2%)
Trauma such as a broken leg <sup>c</sup>	21 (70.0%)	18 (62.1%)
Long airline travel <sup>c</sup>	19 (63.3%)	22 (75.9%)
Obesity <sup>c</sup>	14 (46.7%)	17 (58.6%)
Pregnancy <sup>c</sup>	12 (40.0%)	10 (34.5%)
Birth control pill <sup>c</sup>	8 (26.7%)	11 (37.9%)
Recent stroke <sup>c</sup>	8 (26.7%)	8 (27.6%)
Cancer <sup>c</sup>	4 (13.3%)	8 (27.6%)
Don't know	2 (6.7%)	3 (10.3%)
Which of the following are signs or symptoms of DVT? <sup>c</sup>	(n = 30)	(n = 29)
Calf pain in one leg <sup>c</sup>	23 (76.7%)	21 (72.4%)
Swelling in one leg <sup>c</sup>	21 (70.0%)	18 (62.1%)
Redness and warmth of one leg <sup>c</sup>	17 (56.7%)	18 (62.1%)
Swelling in both legs <sup>c</sup>	9 (30.0%)	8 (27.6%)
Fever <sup>c</sup>	8 (26.7%)	9 (31.0%)
Don't know	3 (10.0%)	6 (20.7%)
Which of the following would help prevent a DVT? <sup>d</sup>	(n = 30)	(n = 29)
Walking or stretching and moving the legs <sup>c</sup>	25 (83.3%)	23 (79.3%)
Drinking plenty of fluids	16 (53.3%)	16 (55.2%)
Eating lots of fiber	2 (6.7%)	1 (3.4%)
Washing and bathing regularly	1 (3.3%)	1 (3.4%)
Lots of bed rest	1 (3.3%)	0 (0.0%)
Don't know	3 (10.0%)	6 (20.7%)
Have you ever heard of a pulmonary embolism (PE)?	(n = 30)	(n = 30)
Yes	27 (90.0%)	27 (90.0%)
Which of the following are signs or symptoms of a PE? <sup>d</sup>	(n = 29)	(n = 30)
Difficulty breathing <sup>c</sup>	14 (48.3%)	17 (56.7%)
Chest pain that worsens when taking a deep breath <sup>c</sup>	10 (34.5%)	13 (43.3%)
Coughing up blood <sup>c</sup>	8 (27.6%)	9 (10.0%)
Breathing faster than normal <sup>c</sup>	7 (24.1%)	8 (26.7%)
Headache	5 (17.2%)	3 (10.0%)
Stuffy nose	2 (6.9%)	1 (3.3%)
Sore throat	2 (6.9%)	1 (3.3%)
Don't know	11 (37.9%)	8 (26.7%)

<sup>a</sup> Question items presented in this table were from the patient survey. Questions in the caregiver survey were similar to the patient survey but modified slightly for caregivers.

<sup>b</sup> Based on Chi-square tests, there was no significant difference in responses of each question between patients and caregivers.

<sup>c</sup> Indicates the correct answer.

<sup>d</sup> More than one response allowed.

### Responses to open-ended questions

At the end of the survey, open-ended questions solicited comments about additional questions or concerns they had about daily injections or medication related to prevention of VTE received. The

**Table 4**  
Sources that patients and caregivers learned about VTE.

Source <sup>b</sup>	Deep vein thrombosis <sup>a</sup>		Pulmonary embolism <sup>a</sup>	
	Patients N (%) (n = 30)	Caregivers N (%) (n = 29)	Patients N (%) (n = 29)	Caregivers N (%) (n = 30)
TV or newspaper	9 (30.0%)	11 (37.9%)	8 (27.6%)	11 (36.7%)
Family member or friend	6 (20.0%)	6 (20.7%)	8 (27.6%)	9 (30.0%)
Nurse	5 (17.6%)	9 (31.0%)	2 (6.9%)	5 (16.7%)
Physician	5 (16.7%)	5 (17.2%)	3 (10.3%)	3 (10.0%)
Pamphlet or poster	4 (13.3%)	1 (3.4%)	1 (3.4%)	0 (0.0%)
Another patient	0 (0.0%)	1 (3.4%)	0 (0.0%)	1 (3.3%)
Physical therapist	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (3.3%)
Occupational therapist	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Pharmacist	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Other	10 (33.3%)	10 (34.5%)	15 (51.7%)	12 (40.0%)

<sup>a</sup> No significant differences between patients and caregivers were found.

<sup>b</sup> More than one option can be selected.

majority of patients and caregivers reported they wanted more information about medications and expressed concerns over side effects from the anticoagulants. The patients' responses included: "want more information to read," "want to know more side effects," "not enough information given," "possible drug interactions," and "worried about my doctor finding balance between treating possible blood clots versus bruising/bleeding." The responses from caregivers included: "how long will the treatment last?," "not informed what treatment was given to mother," "wish the information would've been provided before," "want more information," and "want a flyer."

Patients and caregivers were also asked about their plan of care following hospital discharge. Most patients reported being unsure of recovery after hospital discharge whereas caregivers reported their plans to seek help for rehabilitation and exercise for their older hip fracture family member.

### Discussion

Findings from this study indicated that older patients with non-elective hip fracture surgery and family caregivers desired more education related to prophylactic anticoagulation treatment after surgery and any risks or potential side effects of this treatment.<sup>1,20–22</sup> The findings of low levels of awareness and knowledge of VTE were similar to the findings in other studies focused on different patient populations. Le Sage et al (2008) investigated the awareness and knowledge of VTE in general hospitalized

**Table 5**  
Satisfaction with anticoagulation therapy and information about VTE.

Likert items (1 = Strongly disagree, 5 = Strongly agree)	Patients Mean (SD) (n = 30)	Caregivers Mean (SD) (n = 28)
The reason for these daily injections/oral medicine has been adequately explained to me.	3.40 (1.25)	3.82 (1.31)
My questions about these injections/oral medicine were answered to my satisfaction.	3.21 (1.24)	3.71 (1.21)
I am satisfied with the information given to me about DVT and PE.	2.83 (1.37)	3.61 (1.17) <sup>a</sup>
Daily injections/oral medicine benefit patient's [my] health and safety.	4.03 (0.89)	4.44 (0.64)
I am in favor of receiving these injections/oral medicine.	4.30 (0.79)	4.54 (0.58)
I understand what the side effects are from these injections/oral medicine.	3.03 (1.27)	3.41 (1.28)
Side effects from these injections/oral medicine are tolerable [for me].	3.46 (0.74)	3.65 (1.02)
Overall mean of satisfaction	3.49 (0.76)	3.83 (0.88)

<sup>a</sup>  $p < 0.05$ .

patients. The subjects in the Canadian study were randomly selected from a hospital; however, orthopedic patients, the most at-risk patients for VTE were excluded from the study.<sup>20</sup>

Participants of the present study showed insufficient knowledge of VTE including symptoms, risk factors, and prevention strategies. Although most participants identified immobilization or bed rest for longer than 3 days as a risk factor for DVT, few participants selected cancer or recent stroke as a risk factor. Fewer than 30% of each group of participants identified swelling in both legs as a symptom of DVT. Most participants understood that walking or stretching their legs helped prevent a blood clot. However, there were some participants that failed to recognize other preventive methods for VTE, such as eating lots of fiber or lots of bed rest. Although almost all participants reported that they had heard about PE, more than a quarter of participants reported that they did not know the symptoms of PE. Interestingly, the most frequent source of information was TV or newspaper rather than health care providers.

Most participants (83% of patients and 82% of caregivers) understood that the daily injections of anticoagulants (e.g., heparin) were for the purpose of preventing blood clots, but they expressed concerns that they didn't know the potential side effects of this treatment. As previously noted orthopedic patients are at highest risk group to develop VTE despite thromboprophylaxis during hospitalization.<sup>4</sup> Patients that plan to undergo elective hip replacement surgery routinely receive detailed information prior to surgery. This is not true for patients hospitalized for non-elective surgery.

Evidence-based clinical practice guidelines for the prevention of VTE in orthopedic surgery patients suggest extending thromboprophylaxis into the outpatient period for up to 35 days from the first day of surgery rather than for only 10–14 days after surgery.<sup>3</sup> Patients and caregivers should be educated in detail about the medications, risks, and side effects that they may face post-hospitalization. Just as important is the need to foster their active participation in decisions about what VTE prevention methods should be used post discharge. In our sample, the majority of the patients and family caregivers reported wanting to know more about the anticoagulants that they may take post discharge. It is critical that they are knowledgeable and aware of the risks and needs for careful monitoring and prevention.

Although the mean scores revealed satisfaction with the education they received about anticoagulation therapy, the range in scores revealed a good deal of variation in spread with some participants clearly not satisfied. The patients from this study showed that they were least satisfied with the information given to them about VTE. This finding is similar to that from the Le Sage et al study.<sup>20</sup> In the Le Sage study, participants stated they preferred to receive written materials and verbal explanations from nurses when the nurse administered injections. Patient education via both written materials and verbal information during hospitalization has been proven more effective rather than verbal education only.<sup>23</sup> The current policy regarding VTE prophylaxis in the study hospital called for health care providers providing patients with both written and verbal information.<sup>24</sup> The hospital's nurses educated patients and caregivers on the cause, dangers, and risk factors related to VTE.<sup>24</sup> Perhaps the participants did not retain the information originally given them. Further study is needed to determine which methods of educating these patients and caregivers are most effective.

As previously stated, this study suggested that there are needs for more patient and caregiver education about VTE prevention, risks, and the treatment side effects. This information is needed to ensure a safe transition from hospital to next care settings. Patient transfers to assisted living or skilled nursing facilities may be

considered a “hand-off” in care. It is possible that this subset of patients may be overlooked with the understanding that transfer institutions will take care of the problem. The education of patients discharged home may or may not be different. Nurses should evaluate the current education level of knowledge in both patients and caregivers. VTE prevention information should be an essential part of educational package for these older patients and their caregivers. This package of information should be useful at each stage of transition from hospital to next care setting. A recent report of a promising intervention describes how transition care nurses can bridge the gap for patients from the hospital to after discharge. This program referred to as BOOST (Better Outcomes by Optimizing Safe Transitions) was shown to significantly reduce readmission rates for patients with VTE from a baseline high of PE 28% and DVT, 18% in 2010 to PE 14% and DVT, 8% in 2013–14.<sup>25</sup> Additionally, a promising approach to providing information to caregivers is outlined in an online hip fracture resource center for caregivers.<sup>26–28</sup> This information could ensure a higher level of knowledge as caregivers assist and advocate their older hip fracture surgery patient.

### Limitations

The study has several limitations related to study design. First, this study used a convenience sample from one unit in one urban hospital. It is difficult to know just how representative this sample is of all those patients undergoing non-elective hip fracture surgeries. Second, participants may have responded more positively in reporting their satisfaction of the education they received while hospitalized out of desire to please the nursing staff. An anonymous survey may have yielded more negative responses. Third, survey data came from self-reports, that are difficult to associate with objective evidence (e.g., respondents' readiness to act in cases of risk of VTE). In this study, due to an inability to implement both phases simultaneously we were not able to pair patients with their respective caregivers. Future studies should strive to pair respondents promoting the ability to assess data from VTE prevention dyads. Comparisons of the knowledge of patients versus their home caregiver counterparts could highlight the similarities and differences in knowledge deficits which would be helpful in knowing if separate educational programs are warranted for the two groups. Lastly, this study focused on patients and family caregivers. More needs to be known about the knowledge and practices of nursing home care providers since many of these patients will be discharged to skilled nursing facilities. The role of patient and family caregiver advocacy is critical to safe and effective care in these facilities.

### Conclusion

The study demonstrates that despite patient education from hospital nurses, older patients with hip fracture and their caregivers may need further VTE preventive education. In addition, satisfaction about the education that they received during hospitalization was not high. Patients and caregivers expressed a need for more information related to anticoagulation therapy, risks, and side effects.

Focused education, especially in regard to VTE prevention care during transition to home or next care setting is needed, and educational methods tailored to meet the needs of older adults and their caregivers should be considered further. These topics will assist in the development of a patient-centered comprehensive hip fracture education program for older adults and their caregivers.

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