

VENOUS THROMBOEMBOLISM PREVENTION



Getting Started Kit

Effective March 14, 2019, the Canadian Patient Safety Institute has archived the Venous thromboembolism (VTE) intervention. For additional inquiries, please contact info@cpsi-icsp.ca

Safer Healthcare Now!

Safer Healthcare Now! is a national program supporting Canadian healthcare organizations to improve patient safety through the integration of evidence in practice and the use of quality improvement methods.

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This Getting Started Kit has been written to help engage your interprofessional/ interdisciplinary teams in a dynamic approach for improving quality and safety while providing a basis for getting started. The Getting Started Kit represents the most current evidence, knowledge and practice, as of the date of publication and includes what has been learned since the first kits were released in 2005. We welcome your suggestions to improve the content, as together we make healthcare safer in Canada.

Note:

The Getting Started Kits for all *Safer Healthcare Now!* interventions are available in both French and English.

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Acknowledgements

Safer Healthcare Now! and the authors of this document would like to acknowledge and thank:



Sunnybrook Health Sciences Centre for their expertise and support in trying to optimize the prevention of hospital-acquired VTE. This and earlier versions of the *Safer Healthcare Now!* VTE Prevention Getting Started Kits were developed by Sunnybrook staff for *Safer Healthcare Now!*



The Canadian Patient Safety Institute (CPSI) is acknowledged for their financial and in-kind support of the *Safer Healthcare Now!* Getting Started Kits.

Paula Brown, BSc, BScPhm, R.Ph., PharmD for her extensive contributions to the previous version of this guide.

Dr. Greg Maynard, University of California, San Diego, whose document "*Preventing Hospital-Associated Venous Thromboembolism: A Guide for Effective Quality Improvement (2015)*," prepared for the Agency for Healthcare Research and Quality, substantially informed the revision of this Getting Started Kit. Many parts of the Getting Started Kit borrow heavily from the work of Dr. Maynard.

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Abbreviations

ACCP	American College of Chest Physicians
AHRQ	Agency for Healthcare Research and Quality
CMPA	Canadian Medical Protective Association
CoP	Communities of Practice
CPOE	Computerized Prescriber Order Entry
CPSI	Canadian Patient Safety Institute
CQUIN	Commissioning for Quality and Innovation Payment Framework
CRS	Computerized Reminder System
DVT	Deep Vein Thrombosis
ED	Emergency Department
GCS	Graduated Compression (“Antiembolic”) Stockings
HA-VTE	Hospital-Associated Venous Thromboembolism
INR	International Normalized Ratio
IPC	Intermittent Pneumatic Compression (also referred to as SCDs or Sequential Compression Devices)
LDUH	Low-Dose Unfractionated Heparin
LMWH	Low-Molecular-Weight Heparin
MAR	Medication Administration Record
PE	Pulmonary Embolism
QI	Quality Improvement
RAM	Risk Assessment Model
ROP	Required Organizational Practice
SHN	<i>Safer Healthcare Now!</i>
SSCL	Surgical Safety Checklist
TfC	Test for Compliance
VFP	Venous Foot Pump
VTE	Venous Thromboembolism (DVT and/or PE)

Background

This version of the Venous Thromboembolism Prevention (VTE) Getting Started Kit (GSK) has been updated from the 2012 version to provide practical steps that *Safer Healthcare Now!* recommends to organizations to help ensure that each of their patients at risk for VTE receives appropriate thromboprophylaxis. Following these steps will also help organizations achieve compliance with Accreditation Canada's Required Organizational Practice (ROP) on VTE prevention.

The original VTE Getting Started Kit, released in 2008, concentrated on thromboprophylaxis in two groups, hip fracture patients and major general surgery patients. From the 2010 version of the GSK and forward, the goal is preventing VTE in all at-risk hospitalized patient groups. This updated GSK provides a succinct summary of VTE prophylaxis for patients at risk (see [Section 2](#)). The GSK also provides a variety of tools and examples to assist your team in the implementation of a VTE prophylaxis strategy. The suggestions, tools and examples contained in this version of the GSK can be adapted to your site and type of practice.

Safer Healthcare Now! Venous Thromboembolism Prevention

Objectives:

1. To increase the use of appropriate thromboprophylaxis in acute care hospitalized patients.
2. To align with Accreditation Canada's Required Organizational Practice related to VTE prevention

Inclusion: Acute care in-patients

Exclusions: Day surgery or overnight-stay surgery
Pediatrics (≤ 18 years of age))
Obstetrics
Psychiatry/mental health
Rehabilitation
Long-term care

- Measures:**
1. Per cent of at-risk patients receiving appropriate VTE prophylaxis.
 2. Type of thromboprophylaxis provided.
 3. Reason that appropriate thromboprophylaxis was not used.
 4. Per cent of patients with appropriate use of order sets.
 5. Frequency of hospital-associated VTE.

1. Rationale for VTE Prophylaxis

Introduction to VTE

Venous thromboembolism comprises both deep vein thrombosis (DVT) and pulmonary embolism (PE) and is one of the most common and preventable complications of hospitalization.¹ Many risk factors for developing VTE have been identified (see [Table 1](#)), but the most common risk factor in hospitalized patients is reduced mobility. Almost every hospitalized patient has at least one of these risk factors for VTE and most have multiple risk factors.²

VTE is associated with substantial morbidity and mortality as well as a major resource burden on the healthcare system.^{4,5} Development of DVT or PE is associated with increased patient mortality; the 30-day case fatality rate for DVT is two to five per cent and for PE is 33 per cent.⁶⁻⁹

VTE is one of the most preventable cause of hospital death and morbidity.^{2,3}

Table 1 - Risk Factors for VTE^{1,2,5}

- Surgery
- Trauma (major trauma or lower-extremity injury)
- Reduced mobility, lower-extremity paresis, stroke
- Cancer
- Cancer therapy (chemotherapy, hormonal, angiogenesis inhibitors, radiotherapy)
- Previous VTE
- Positive family history of VTE
- Increasing age
- Pregnancy and the postpartum period
- Estrogen-containing oral contraceptives or hormone replacement therapy
- Selective estrogen receptor modulators
- Erythropoiesis-stimulating agents
- Acute medical illness
- Inflammatory bowel disease
- Nephrotic syndrome
- Myeloproliferative disorders
- Venous compression (tumour, enlarged lymph nodes, hematoma)
- Obesity
- Central venous catheterization
- Inherited or acquired thrombophilia

"The appropriate use of thromboprophylaxis was the most highly rated of 79 safety practices based on impact and effectiveness and was, therefore, considered to be the number one ranked patient safety practice for hospitals."¹⁰

In addition to acute consequences of hospital-associated VTE (HA-VTE), patients who develop DVT or PE are more likely to:

- Experience a clinically important bleeding episode on anticoagulation (up to five per cent) per year.
- Have recurrent thromboembolic events in the future (risk of approximately 30 per cent at five years).^{5,11}
- Develop post-thrombotic syndrome within 10 years of the acute event (30 to 50 per cent of patients with DVT) resulting in chronic leg swelling, discomfort and occasional leg ulcers.¹²
- Develop thromboembolic pulmonary hypertension.¹³

These complications represent substantial costs in terms of patient quality of life and healthcare resources.^{3,14,15}

Incidence of VTE in Various Patient Groups

Table 2 lists the DVT incidence for various hospitalized patient groups if **no prophylaxis** is given and **screening for asymptomatic DVT** is performed. Based on the significant, known rates of VTE as well as its acute and long-term consequences, it can be seen that nearly every hospitalized patient should receive thromboprophylaxis.¹⁶

Table 2 - Risk of Deep Vein Thrombosis in Hospitalized Patients*¹

Patient Group	DVT Incidence (%)
Medical patients	10-25
Major gynecologic, urologic, or general surgery	15-40
Neurosurgery	15-40
Stroke	11-75
Knee/hip arthroplasty	40-60
Hip fracture	40-60
Major trauma	40-80
Spinal cord injury	60-80
Critical care patients	15-80

*rates of DVT if no thromboprophylaxis was used and a sensitive modality was used to screen for asymptomatic DVT

Incidence of Hospital-Associated VTE (HA-VTE)

Every year, VTE is responsible for the death of more people than breast cancer, AIDS and motor vehicle collisions combined.¹⁶

PE is one of the most common preventable cause of hospital death and its prevention is the number-one strategy to improve patient safety within hospitals.^{1,10} Among patients who die in hospital, massive PE is the cause of death in approximately 10 per cent; it generally occurs without any warning and without the opportunity to intervene.¹⁷⁻¹⁹ Approximately 60 per cent of all VTE in the population originates in hospitals, either during hospitalization or in the six-week period post-discharge.¹⁹ Therefore, in Canada, there are approximately 20,000 cases of HA-VTE every year.

In a 400 bed hospital with an average rate of thromboprophylaxis use, the number of cases of HA-VTE expected per year would be approximately 200.¹⁶ More than half of these cases are potentially preventable.¹⁶

It is a misconception that VTE is mainly associated with recent surgery or trauma.¹ In fact, 50 to 70 per cent of symptomatic thromboembolic events and 70 to 80 per cent of fatal PEs occur in non-surgical patients.^{1,21} Symptomatic VTE continues to be reported in 1.3 to 10 per cent of orthopedic surgery patients within three months post-op.^{1,22}

Evidence of Benefit for VTE Prophylaxis

More than 400 randomized controlled trials and more than 30 international guidelines have established the effectiveness and cost-effectiveness of VTE prophylaxis.^{15,22-27}

The use of appropriate VTE prophylaxis has been associated with improved outcomes and lower direct medical costs. Appropriate anticoagulant prophylaxis has been shown to reduce the risk of asymptomatic and symptomatic DVT, proximal DVT, PE, and fatal PE by more than 60 per cent in a broad spectrum of hospitalized patients.^{1,16,28,29}

Costs of VTE

In addition to reducing clinically relevant thromboembolic events, appropriate thromboprophylaxis also reduces healthcare costs.^{1,3,4,15,30} On average, postoperative VTE is associated with an excess mortality of 6.6 per cent, excess length of stay of 5.4 days, and excess in-patient charges of \$10,000 (US) for DVT and \$20,000 (US) for PE per patient.^{15,16} A 2006 Canadian study of postoperative complications demonstrated that both hospital costs and median length of hospital stay doubled for patients who developed VTE after surgery.³⁰⁰ Thromboembolic complications are among the most common reasons for extended hospital stay.^{15,311}

Medicolegal issues also arise for both healthcare practitioners and hospitals when patients do not receive risk assessments for VTE or are not given appropriate VTE prophylaxis.^{32,33} Physicians have a duty to prevent VTE whenever possible. Failure of clinicians to provide appropriate measures to prevent VTE may be grounds for charges of negligence and many claims have resulted in significant sums of money being paid out in compensation.^{32,344}

In a series of 29 legal claims in the United States where thromboprophylaxis was not given when VTE risk factors were present, the claimants were successful in 90 per cent of the claims.³² Of the anticoagulant-related cases brought to the Canadian Medical Protective Association (CMPA), 45 per cent were for a delay or failure to prescribe an anticoagulant when indicated, most commonly as prophylaxis in the postoperative period.³³ In the period from 2006 to 2011, the CMPA had 242 medico-legal cases involving venous thromboembolism.³⁵ Many of the cases were related to diagnosis of VTE but many were also related to inadequate VTE prophylaxis where physicians underestimated the risk of VTE in patients.

Quality Initiatives in VTE Prophylaxis

VTE prevention is being increasingly integrated into public reporting, regulatory agencies and national quality initiative priorities.¹⁶ In the United States (U.S.), VTE Prevention is one of the areas of focus of the Partnership for Patients under the Centers for Medicare and Medicaid Services (CMS). CMS has deemed VTE a preventable hospital acquired condition in hip and knee surgery patients. Reimbursement will no longer be provided to hospitals for costs associated with VTE complications in these patients.³⁶⁶

Also in the U.S., VTE prevention is an area of focus for the National Quality Forum and the Joint Commission as well as the Surgical Care Improvement Plan. In 2008, the U.S. Surgeon General produced a call-to-action for VTE prevention.³⁷⁷

In England, a national program started in 2010 mandates that payments to hospitals are conditional on conducting a risk assessment for VTE in at least 95 per cent of all admitted patients using a nationally developed tool.³⁸⁸ Furthermore, hospitals do not receive reimbursement for patients readmitted for VTE within 30 days. A root cause analysis of all confirmed cases of HA-VTE is also required for each hospital. The national risk assessment tool for VTE was developed in conjunction with comprehensive national guidelines for appropriate thromboprophylaxis.³⁸ These initiatives, with a focus on implementation, outcomes and financial penalties for failure, leads to England now having the most comprehensive national VTE initiative in the world.³⁸³ This has resulted in an overall reduction in deaths from PE across the country.³⁹⁹

Accreditation Canada has developed Required Organizational Practices (ROPs) related to VTE prophylaxis.⁴⁰ As of January 2011, all acute care hospitals with clients greater than the age of 18 are required to meet this ROP. The ROP states that: *“The team identifies medical and surgical clients at risk of venous thromboembolism (deep vein thrombosis and pulmonary embolism) and provides appropriate thromboprophylaxis”*. There are three major and two minor tests for compliance (Table 3).

Table 3 - Accreditation Canada VTE Prevention Tests for Compliance⁴⁰

Major	The organization has a written thromboprophylaxis policy or guideline.
Major	The team identifies clients at risk for venous thromboembolism (VTE), [deep vein thrombosis (DVT) and pulmonary embolism (PE)] and provides appropriate evidence-based VTE prophylaxis.
Minor	The team establishes measures for appropriate thromboprophylaxis, audits implementation of appropriate thromboprophylaxis, and uses this information to make improvements to their services.
Major	The team identifies major orthopaedic surgery clients (hip and knee replacements, hip fracture surgery) who require post-discharge prophylaxis and has a mechanism in place to provide appropriate post-discharge prophylaxis to such clients.
Minor	The team provides information to health professionals and clients about the risks of VTE and how to prevent it.

VTE prophylaxis is also embedded in the Canadian Surgical Safety Checklist (SSCL)⁴¹¹ which has been adopted as a key patient intervention by the Canadian Patient Safety Institute. In Ontario, the Ministry of Health and the Ontario Hospital Association have made the use of the SSCL a mandatory component of hospital care.²⁰

The requirement involves “selecting an appropriate prophylaxis option, at the optimal dose, starting at the optimal time, and continuing for an appropriate duration of time”.²⁰ Ontario hospitals have required public reporting on compliance with the SSCL since July 31, 2010.²⁰

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2. Evidence-Based Appropriate VTE Prophylaxis

The American College of Chest Physicians (ACCP) sponsor what are generally considered to be the most comprehensive and most utilized evidence-based guidelines on the prevention of VTE.¹⁻⁴ *Safer Healthcare Now!* recommends the use of these guidelines because they follow a pre-specified method of identifying and evaluating the published evidence, they are peer-reviewed, and they provide graded recommendations for (or in some cases, against) thromboprophylaxis for various patient groups. The “ACCP Guidelines” are revised every three to five years and have become the international reference standard for thromboprophylaxis. **Table 4** is modified from the 2008 and 2012 ACCP Guidelines.¹⁻⁴

Table 4 - Recommended Thromboprophylaxis Options for Various Patient Groups¹⁻⁴

Patient Group	Recommendations for Prophylaxis ^{#, &, %}
Medical Patients (CHF, severe respiratory disease, or confined to bed with active cancer, previous VTE, infection, acute neurologic disease, IBD)	<p><i>If anticoagulant is <u>not</u> contraindicated:</i></p> <ul style="list-style-type: none"> • LMWH e.g. dalteparin 5000 units subcutaneously once daily OR enoxaparin 40 mg subcutaneously once daily OR tinzaparin 4500 units subcutaneously once daily • LDUH 5000 units subcutaneously twice daily or three times daily • fondaparinux 2.5 mg subcutaneously once daily <p><i>If anticoagulant is <u>contraindicated</u>:</i></p> <ul style="list-style-type: none"> • Mechanical method with IPC and/or GCS (reassess daily to consider starting anticoagulant)
Major General Surgery, Gynecologic Surgery, Thoracic Surgery, or Urologic Surgery	<p><i>If anticoagulant is <u>not</u> contraindicated:</i></p> <p><i>Low Risk: non-major surgery, fully mobile, no additional risk factors</i></p> <ul style="list-style-type: none"> • Early and frequent ambulation <p><i>Usual Risk: benign disease, no additional risk factors</i></p> <ul style="list-style-type: none"> • LMWH e.g. dalteparin 5000 units subcutaneously once daily OR enoxaparin 40 mg subcutaneously once daily OR tinzaparin 4500 units subcutaneously once daily • LDUH 5000 units subcutaneously twice daily • fondaparinux 2.5 mg subcutaneously once daily <p><i>Higher Risk: cancer, previous VTE, or multiple risk factors</i></p> <ul style="list-style-type: none"> • LMWH e.g. dalteparin 5000 units subcutaneously once daily OR enoxaparin 40 mg subcutaneously once daily OR tinzaparin 4500 units subcutaneously once daily • LDUH 5000 units subcutaneously three times daily • fondaparinux 2.5 mg subcutaneously once daily • IPC or GCS can be added to one of the above options

Patient Group	Recommendations for Prophylaxis ^{#, &, %}
	<p><i>If anticoagulant is <u>contraindicated</u>:</i></p> <ul style="list-style-type: none"> Mechanical method with IPC and/or GCS (reassess daily to consider starting anticoagulant) <p><i>*higher risk surgical oncology patients may benefit from continued prophylaxis for 30 days post-discharge</i></p>
Vascular Surgery	<p><i>Low Risk: no additional risk factors</i></p> <ul style="list-style-type: none"> Early and frequent ambulation <p><i>Higher Risk: additional risk factors</i></p> <ul style="list-style-type: none"> LMWH e.g. dalteparin 5000 units subcutaneously once daily OR enoxaparin 40 mg subcutaneously once daily OR tinzaparin 4500 units subcutaneously once daily LDUH 5000 units subcutaneously twice daily or three time daily fondaparinux 2.5 mg subcutaneously once daily
Laparoscopic Surgery	<p><i>Low Risk: no additional risk factors</i></p> <ul style="list-style-type: none"> Early and frequent ambulation <p><i>Higher Risk: additional risk factors</i></p> <ul style="list-style-type: none"> LMWH e.g. dalteparin 5000 units subcutaneously once daily OR enoxaparin 40 mg subcutaneously once daily OR tinzaparin 4500 units subcutaneously once daily LDUH 5000 units subcutaneously twice daily or three times daily fondaparinux 2.5 mg subcutaneously once daily IPC and/or GCS
Bariatric Surgery	<ul style="list-style-type: none"> LMWH (weight-adjusted dose)* LDUH (weight-adjusted dose)* With or without IPC <p><i>*higher doses of anticoagulant than the usual for non-obese patients should be used</i></p>
Hip Fracture Surgery	<p><i>If anticoagulant is <u>not contraindicated</u>:</i></p> <ul style="list-style-type: none"> fondaparinux 2.5 mg subcutaneously once daily LMWH e.g. dalteparin 2500 or 5000 units subcutaneously once daily OR enoxaparin 30 or 40 mg subcutaneously once daily OR tinzaparin 4500 units subcutaneously once daily LDUH 5000 units subcutaneously twice daily or three times daily

Patient Group	Recommendations for Prophylaxis ^{#, &, %}
	<ul style="list-style-type: none"> If surgery may be delayed, start LMWH or LDUH from admission (pre-op) to surgery <p><i>If anticoagulant is <u>contraindicated</u>:</i></p> <ul style="list-style-type: none"> Mechanical method with IPC and/or GCS (reassess daily to consider starting anticoagulant) <p><i>*patients should receive prophylaxis for at least 10 days and up to 35 days → therefore, post-discharge prophylaxis is often required</i></p>
Hip or Knee Replacement	<p><i>If anticoagulant is <u>not contraindicated</u>:</i></p> <ul style="list-style-type: none"> rivaroxaban 10 mg by mouth once daily apixaban 2.5 mg by mouth twice daily dabigatran 220 mg by mouth once daily LMWH e.g. dalteparin 5000 units subcutaneously once daily OR enoxaparin 40 mg subcutaneously once daily or 30 mg subcutaneously twice daily OR tinzaparin 4500 units subcutaneously once daily fondaparinux 2.5 mg subcutaneously once daily <p><i>If anticoagulant is <u>contraindicated</u>:</i></p> <ul style="list-style-type: none"> Mechanical method with VFP and/or IPC (reassess daily to consider starting anticoagulant) <p><i>*patients should receive prophylaxis for at least 10 days and up to 35 days → therefore, post-discharge prophylaxis is usually required</i></p>
Major Trauma or Acute Spinal Cord Injury	<p><i>If <u>anticoagulant is contraindicated</u> due to bleeding or high bleeding risk:</i></p> <ul style="list-style-type: none"> Mechanical method with IPC and/or GCS (reassess daily to consider starting anticoagulant) <p><i>If <u>no major contraindications</u> to anticoagulants:</i></p> <ul style="list-style-type: none"> LMWH e.g. dalteparin 5000 U subcutaneously once daily OR enoxaparin 40 mg subcutaneously once daily or 30 mg subcutaneously twice daily OR tinzaparin 4500 units subcutaneously once daily
Burns	<p><i>If <u>no major contraindications</u> to anticoagulants:</i></p> <ul style="list-style-type: none"> LMWH e.g. dalteparin 5000 units subcutaneously once daily OR enoxaparin 40 mg subcutaneously once daily OR tinzaparin 4500 units subcutaneously once daily

Patient Group	Recommendations for Prophylaxis ^{#, &, %}
	<ul style="list-style-type: none"> LDUH 5000 units subcutaneously twice daily or three times daily <p><i>If <u>anticoagulant is contraindicated</u>:</i></p> <ul style="list-style-type: none"> Mechanical method with IPC and/or GCS (reassess daily to consider starting anticoagulant)
Neurosurgery	<p><i>Patients with <u>high bleeding risk</u>:</i></p> <ul style="list-style-type: none"> Mechanical method with IPC and/or GCS (reassess daily to consider starting anticoagulant) <p><i>Patients <u>without</u> high bleeding risk:</i></p> <ul style="list-style-type: none"> LMWH e.g. dalteparin 5000 units subcutaneously once daily OR enoxaparin 40 mg subcutaneously once daily OR tinzaparin 4500 units subcutaneously once daily LDUH 5000 units subcutaneously twice daily
Coronary Artery Bypass Surgery	<ul style="list-style-type: none"> LMWH e.g. dalteparin 2500 or 5000 units subcutaneously once daily OR enoxaparin 30 or 40 mg subcutaneously once daily OR tinzaparin 3500 or 4500 units subcutaneously once daily LDUH 5000 units subcutaneously twice daily IPC and/or GCS <p><i>*LMWH is recommended over LDUH because of the lower risk of HIT</i></p>
Obstetrics - Postnatal [^]	<p><i>Intermediate Risk: C-section during labour, known thrombophilia, BMI >40 kg/m², prolonged hospital admission, medical comorbidities, OR two or more of the following: age greater than 35 years, obesity, parity greater than three, smoker, elective C-section, surgical procedure in the puerperium, extensive varicose veins, current systemic infection, immobility, pre-eclampsia, mid-cavity rotational operative delivery, prolonged labour (greater than 24 hours), postpartum hemorrhage greater than 1 litre or blood transfusion</i></p> <ul style="list-style-type: none"> In-hospital prophylaxis with LMWH e.g. dalteparin 5000 units subcutaneously once daily OR enoxaparin 40 mg subcutaneously once daily or 30 mg subcutaneously twice daily OR tinzaparin 4500 units subcutaneously once daily <p><i>Higher Risk: previous VTE</i></p> <ul style="list-style-type: none"> at least 6 weeks of postnatal LMWH

Abbreviations:

CHF	Congestive Heart Failure
GCS	Graduated Compression Stockings
HIT	Heparin-Induced Thrombocytopenia
IBD	Inflammatory Bowel Disease
IPC	Intermittent Pneumatic Compression
LDUH	Low Dose Unfractionated Heparin
LMWH	Low Molecular Weight Heparin
VFP	Venous Foot Pump

LMWHs are considered interchangeable, e.g.: dalteparin 5000 units subcutaneously once daily
≈ enoxaparin 40 mg subcutaneously once daily or enoxaparin 30 mg subcutaneously twice daily
≈ tinzaparin 4500 units subcutaneously once daily

& Reduced doses or avoidance of LMWH, fondaparinux, dabigatran, rivaroxaban, and apixaban should be considered if the patient has renal impairment or low body weight

% Increased doses should be considered in patients with high body weight (>100 kg)

^ Modified from the Royal College of Obstetricians and Gynaecologists Guideline No.37a⁵

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3. Adherence to VTE Prophylaxis Guidelines

Despite the overwhelming evidence supporting the use of thromboprophylaxis, and the numerous clinical practice guidelines recommending thromboprophylaxis, audits of patient care consistently find major gaps in the provision of this key patient safety intervention. In fact, the majority of patients for whom thromboprophylaxis has been demonstrated to be effective receive either no prophylaxis or inappropriate prophylaxis.¹⁻⁸

A Canadian study found that 90 per cent of medical patients had an indication for thromboprophylaxis, but only 16 per cent received it with a range of 0 per cent to 48 per cent across the 29 participating hospitals.¹

In DVT-FREE, a prospective registry of 5,451 patients with objectively confirmed DVT, only 47 per cent of the surgical patients and only 22 per cent of the medical patients had received prophylaxis before the thromboembolic event.⁹

In the IMPROVE trial, a multinational registry of acutely ill medical patients, only 39 per cent of patients hospitalized for three days or more received VTE prophylaxis.¹⁰

The ENDORSE study, a 32 country (Canada excluded), cross-sectional survey, found that, of the surgical patients at risk, only 59 per cent received ACCP recommended thromboprophylaxis, and only 40 per cent of medical patients at risk received recommended thromboprophylaxis.¹¹

Amin et al conducted a database review of more than 390,000 patients determined to be at risk for VTE and with no contraindications for thromboprophylaxis.¹² They found that only 12.7 per cent of medical and 16.4 per cent of surgical patients received appropriate thromboprophylaxis.¹²

A survey developed by the Ontario Hospital Association and sent to all Ontario hospitals in 2009, received 105 responses.¹³ Only 33 per cent of hospitals reported that major general surgery patients with an indication for VTE prophylaxis were routinely prescribed it. For hip fracture patients, only 47 per cent of centers routinely prescribed prophylaxis, and, for hip and knee arthroplasty patients, only 50 per cent routinely prescribed thromboprophylaxis.¹³ An audit of consecutive hip fracture, major general surgery, and general medicine patients in eight Toronto region hospitals, found that appropriate thromboprophylaxis was provided to 74 per cent (range, 21 to 95 per cent) in the hip fracture group, 42 per cent (range, 15 to 84 per cent) in the patients who underwent major general surgery, and 31 per cent (range, 13 to 65 per cent) in general medicine patients.¹⁴

Safer Healthcare Now! has conducted Canadian VTE Audit days in 2013 and 2014.¹⁵ In 2013, data was analyzed for 4,667 General Medicine and General Surgery patients from 118 sites in Canada, with 81 per cent receiving appropriate prophylaxis. The 2014 audit included data from 3,809 General Medicine and General Surgery patients from 110 sites across the country. Overall, in the 2014 audit, thromboprophylaxis was administered to 92 per cent of General Surgery patients and 84 per cent of General Medicine patients.

This evidence all points towards the clear conclusion that *optimizing the use of thromboprophylaxis should be a major patient safety priority for Canadian hospitals.*

Common Barriers to VTE Prophylaxis

Numerous barriers to the use of appropriate thromboprophylaxis have been identified; these occur at the individual patient or individual physician level, at the hospital level and at the system level. One of the concerns sometimes raised about the use of VTE prophylaxis is that it **may cause bleeding**. However, abundant data from meta-analyses and blinded, placebo-controlled randomized trials have shown that clinically important bleeding secondary to prophylaxis with LDUH or LMWH is a rare event.¹⁶⁻¹⁸ Studies have also shown that the probability of experiencing any adverse event (including major bleeding, non-major bleeding or thrombocytopenia) was significantly lower in patients receiving appropriate prophylaxis versus those receiving partial or inappropriate prophylaxis.¹⁹ However, patients with active bleeding or at high risk of bleeding should not receive anticoagulant prophylaxis until the high bleeding risk decreases, but should receive a mechanical method and be reassessed daily to start anticoagulant prophylaxis as soon as it is deemed safe to do so.

Other common barriers leading to poor compliance with thromboprophylaxis guidelines include: **underestimation of thromboembolic risk, lack of familiarity with recommendations, and logistical limitations** of healthcare management systems.²⁰

In 2008, the Institute for Safe Medication Practices Canada (ISMP-C) sent a national survey to each of the hospitals in Canada to gain insight into the practices related to anticoagulation. With respect to VTE prophylaxis, the principal barrier to providing optimal thromboprophylaxis, identified by 75 per cent of respondents, was that individual physicians prescribed prophylaxis for individual patients; there was **no standardization** of this common patient safety practice. Potential for bleeding and cost concerns were reported as local barriers to thromboprophylaxis use in only 17 per cent and 12 per cent of hospitals, respectively.

Other potential barriers to optimal use of thromboprophylaxis are listed in [Appendix A](#). This GSK will attempt to assist organizations in overcoming some of these barriers (see [Appendix B](#)). A key component of the process of putting evidence into practice is to identify local barriers and design interventions to overcome them. See the **VTE Prevention Change Package** in [Appendix C](#) and the **Improvement Model** in [Appendix D](#).

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4. A Formal Process of VTE Quality Improvement: The 10 Steps

Quality improvement in the area of VTE prevention (and many other areas in need of improvement) has a number of elements that greatly increase its potential for success.¹⁻⁸ For major organization-wide quality improvement initiatives, most of these steps are required to achieve long-term culture change in clinical practice - there are few short-cuts!

1. Obtain institutional support and executive sponsorship

It is essential to have institutional support and prioritization for the initiative, including a commitment to standardize the process of providing VTE prophylaxis, and reasonable support to facilitate implementation and monitoring of results.⁴ The investment expected of the institution is of time, personnel and informatics support, as well as a sharing of improvement experience and resources to support the project needs.⁷

2. Form a VTE Prevention QI team

Establishing a local inter-professional QI team that is focussed on the prevention of VTE is important to the successful implementation of interventions to ensure optimal use of thromboprophylaxis. This team should include highly motivated individuals who represent the relevant stakeholders including frontline healthcare providers.⁷

Successful VTE improvement teams generally include:

- Team Leader - this could be a physician, pharmacist, nursing, or QI leader - ideally with some expertise in VTE prophylaxis or anticoagulation.
- Team QI Facilitator - may or may not be a physician, but is generally someone with QI experience.
- Process Owners - pharmacists, nurses.
- Information Technology and Health Information System Experts.
- Other team members - may include one or more representatives from hospital administration, chief residents in medicine and surgery programs, patient representative, etc.

“QI projects should always develop from recognition of a gap between the level of care that is optimal and the care that is actually being delivered.”¹

3. Set goals and define the scope of VTE prevention efforts

Quality improvement requires setting specific goals and target outcomes. It has repeatedly been demonstrated that an organization will only improve if it has a clear and firm intention to do so. The goals should define the specific population(s) of patients that will be affected as well as the outcomes desired, and should be ambitious, deadline-specific and measurable.⁷ Agreeing on the aim is crucial, as is allocation of the people and resources necessary to accomplish the aim.

An example of an aim that would be appropriate for VTE prophylaxis could be: **“To increase the percentage of all acute care hospitalized patients who are receiving appropriate thromboprophylaxis, if indicated, to at least 90 per cent by January 2018.”**

4. Map out timelines and accountabilities

It is important to develop a roadmap for the initiative including a schedule of timelines for each component of the local intervention and a list of responsibilities.

5. Use existing evidence and tools to develop a written local policy and guideline on thromboprophylaxis

To solidify the “compelling case” for moving forward, the evidence supporting the objectives of the VTE Prevention QI team should be reviewed. The QI team should identify the risks of VTE in the target patient groups of interest and the evidence-based options for thromboprophylaxis. The team should also consider contraindications to anticoagulant thromboprophylaxis and identify alternatives for patients with these contraindications. In addition, the team should consider patient groups for whom no thromboprophylaxis is necessary. Because the literature in this area is so vast (there are more than 450 randomized trials of VTE prophylaxis and more than 30 clinical practice guidelines), the local team would save considerable time by using a few key sources of evidence such as one or two clinical practice guidelines (those produced by the ACCP and NICE) and national implementation guides (such as this Getting Started Kit and the AHRQ guide), as well as materials already utilized in other organizations (“borrow widely and shamelessly”).

As part of this step, the QI committee should create (or modify an existing) local policy and guideline on thromboprophylaxis that addresses all or most types of patients in the organization. Ultimately, the specific local guideline will be informed by the evidence above but may be modified by local factors (such as specific case mix, current status of thromboprophylaxis already in place and availability of thromboprophylaxis options) although it is unlikely to differ very much from guidelines used by other organizations. The local policy and guideline should be reviewed periodically both during the subsequent steps in the QI initiative and also afterward to take into consideration new evidence as well as local factors.

6. Measure the evidence-care gap: collect baseline data

Safer Healthcare Now! and other QI organizations recommend collecting baseline data to understand current performance in your facility and to provide your team with the information necessary to support the case for this intervention. Baseline data also helps to establish targets for improvement and motivates stakeholder involvement. This step involves an audit of a representative sample of patients in the group(s) of interest with an assessment of appropriate thromboprophylaxis that is consistent with the local (or international) guidelines. **Appropriate thromboprophylaxis** is defined as:

- a. The appropriate, evidence-based **option** for the specific patient or patient group, and
- b. The appropriate **dose** (if an anticoagulant), and
- c. The appropriate **initiation time** after admission or surgery, and
- d. Appropriate **adherence**, and
- e. Appropriate **duration**.

7. Identify barriers to optimal adherence

It is essential to identify potential barriers to optimal implementation of the local VTE policy and guidelines and to the use of recommended thromboprophylaxis both initially and as the initiative progresses. This generally involves discussions with the relevant stakeholders. Interventions to improve thromboprophylaxis use will be most effective if designed to address these barriers (e.g. knowledge barriers, process of care, etc.) specific to your institution.

8. Introduce methods to optimize adherence

The specific methods to optimize the use of appropriate thromboprophylaxis are at the discretion of the local VTE Prophylaxis team. However, the principles of evidence-based quality improvement are strongly suggested.^{4,7,9,10} In particular, it is suggested that interventions:

- a. Predispose clinicians to use the local policy/guideline (e.g. through education),
- b. Enable them to use evidence in the process of patient care (e.g. through the use of pre-printed orders or computerized physician order entry and routine reminder systems), and
- c. Reinforce improvements made (e.g. by means of audit and feedback).

9. Collect data to track performance

It is essential that institutions have ongoing reliable data collection and performance tracking. This requires measurement of key data over time that is compared within the centre, and perhaps to other centres as well. It is important to provide feedback on these

results to key hospital committees and potentially report it to the community/stakeholders, for example, in the form of a Balanced Score Card.

10. Review the results and revise implementation strategies, if necessary, to sustain improvement

Periodic audits of local adherence with the institution's policy and guideline and comparison of these results to the target goals helps to maintain commitment of the effort and identify additional barriers. If the use of appropriate thromboprophylaxis is suboptimal, the local team is encouraged to consider additional strategies to improve adherence and then to reassess the impact of these strategies. Further information can be found in [Appendix B](#), [C](#) and [D](#).

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5. VTE Prophylaxis Improvement Guide

This section of the *Safer Healthcare Now!* VTE Prevention Getting Started Kit is a practical guide to assist organizations in ensuring that patients receive appropriate VTE prophylaxis.

Safer Healthcare Now! strongly supports the use of optimal thromboprophylaxis for hospital patients at risk. This position has also been supported by Accreditation Canada which has added VTE Prophylaxis to its Required Organizational Practices, and included it in their hospital accreditation reviews since January, 2011 (see [Appendix E](#)). The main goal of this ROP is: “the team identifies medical and surgical clients at risk of venous thromboembolism (DVT and PE) and provides appropriate thromboprophylaxis.”¹ By following the *Safer Healthcare Now!* recommended approaches to prevention of VTE, not only will you ensure that your patients receive appropriate thromboprophylaxis, but you will also satisfy the Accreditation Canada VTE ROP.

The following interconnected elements are recommended to ensure patients receive appropriate, evidence-based VTE prophylaxis (and are discussed based on the Accreditation Canada Tests of Compliance):

1) An Organization-Wide, Written Thromboprophylaxis Policy or Guideline is in Place.

The cornerstone of effective thromboprophylaxis use in hospitals is the development of a written policy on thromboprophylaxis for the entire organization. A written protocol is essential to standardize VTE risk assessment and prophylaxis across the organization and to help embed this in the flow of normal patient care.²

Step 1: Development: It is important to gain consensus of the key stakeholders and ensure that they are supportive of the organizational policy. Provider inconsistency is a strong barrier to appropriate VTE prophylaxis.³ Studies have also shown that policies designed to change established practices (e.g. using anticoagulant thromboprophylaxis when only mechanical was used previously) are more difficult to implement than recommending new behaviour.⁴

Well-designed protocols:

- define what is considered «appropriate prophylaxis»;
- define the contraindications to mechanical and anticoagulant methods of thromboprophylaxis and identify alternative methods if these occur;^{2,3}
- are efficient and user-friendly; and
- still allow prescribers to use professional judgement for special patient circumstances.²

Where possible, it is best to construct a single, relatively simple VTE protocol that can be applied to most patients. This leverages the power of standardization and makes it easier to initialize the protocol and to assess its implementation.

Step 2: Field-testing of one or more advanced drafts of the VTE protocol is important to ensure that it will be useful in routine care.⁵ It is recommended to:

- Conduct **focus groups** with staff physicians, hospitalists, residents, pharmacists, and nurses for feedback on advanced drafts of the VTE protocol.
- Obtain **feedback** in order to optimize both clarity and usability of the protocol.
- Have the protocol reviewed by all services and specialties involved.
- Conduct **pilot testing** of the protocol on a small scale before attempting wide implementation.⁵

These steps encourage greater hospital staff involvement and ownership which will lead to better integration of the protocol. An example of hospital policies and guidelines on VTE prevention is found in [Appendix F](#).

Step 3: Implementation: The protocol should be written and readily accessible to all healthcare providers. A study in the UK confirmed that reliance on spoken recommendations for thromboprophylaxis by staff physicians to medical residents led to poor adoption of measures and policy failure.⁴ Observations have shown that a VTE prevention protocol is most effective when **embedded within routinely used** admission, transfer, and perioperative order sets.² This serves as a reinforcing strategy and prompts prescribers to “do the right thing at the right time” in routine patient care.³ The VTE protocol is so fundamental that it must not just exist; it must be embedded in the process of care.³ The institution should also make a commitment to support the implementation of the policy/protocol.

Step 4: Evaluate, review, and adjust as needed. As discussed below, adherence with the organization’s thromboprophylaxis guideline must be assessed periodically as part of ongoing quality improvement. When new evidence becomes available, either from the published literature or as a result of local experience or review of hospital-acquired VTE events, the organization’s thromboprophylaxis guideline should be revised.

Components of the Ideal VTE Prevention Protocol

- Agreed upon by all relevant stakeholders and applicable across all patients in the target group(s).
- Easy to access and to implement. Simplicity is very important. Limit thromboprophylaxis options and exceptions to as few as possible.
- Reliability is built into the process. The desired action is:
 - prompted by a reminder or decision aid;
 - the default action (not doing it requires active opting out);
 - standardized into the process of patient care (take advantage of habits or patterns of behaviour so deviation feels awkward) ;
 - the responsibility of all members of the multidisciplinary patient care team.²¹
- Patient VTE risk is linked to evidence-based choices for prevention - this may be a simple “yes/no” decision or various levels of risk (e.g. low or high or a formal, multicomponent risk assessment model). The VTE risk is then linked to the relevant organizational thromboprophylaxis recommendation.
- Identifies contraindications to thromboprophylaxis and provides alternatives, if appropriate.
- Embedded into the workflow / process of providing patient care. A VTE prophylaxis module embedded in standardized order sets is the most effective option.
- Does not rely on traditional methods such as chart stickers or placing risk assessment sheets in patient charts, as this will lead to disappointing results.

2) Clients at Risk for VTE are Identified and Receive Appropriate, Evidence-Based VTE Prophylaxis.

Step 1: Risk Assessment of Patients

There are two general approaches to determine the risk of thromboembolism in hospitalized patients, the individual risk assessment/thromboprophylaxis approach and the group thromboprophylaxis approach.⁶

A. Individual risk assessment/thromboprophylaxis approach. The first approach is to use a formal scoring system to estimate the risk of VTE in each patient. The risk is determined based on individual predisposing factors and the risk associated with the patient’s current illness or procedure. The risk of bleeding is also assessed to decide on the appropriate thromboprophylaxis for the individual patient. Although a number of

formal risk assessment models (RAMs) have been developed to aid in this process, there is no consensus regarding the preferred VTE risk assessment tool.

This section will summarize two formal, score-based RAMs - the Caprini score and the Padua Prediction Score (for medical patients). These models are provided as examples as they have been recommended by guidelines, have been partially validated and have been used in some organizations. A third model, the “3-Bucket Model” is a more qualitative approach to risk assessment and primarily categorizes patients based on the risk associated with the procedure they are undergoing or on their current illness. An institution may also decide to develop its own risk assessment model that complements their institutional policy or protocol.

The **Caprini score**⁷⁻¹⁰ is a quantitative model developed in surgical patients but sometimes also used in medical patients. It has been recommended in the ACCP 9th edition guidelines as a RAM for nonorthopedic surgical patients. The model consists of more than 35 weighted risk factors.

Table 5 - Caprini risk assessment model⁷⁻¹⁰

1 Point	2 Points	3 Points	5 Points
<ul style="list-style-type: none"> • Age 41-60 • Minor surgery • BMI >25 kg/m² • Swollen legs • Varicose veins • Pregnancy or postpartum • History of unexplained or recurrent spontaneous abortion • Oral contraceptives or hormone replacement • Sepsis (<1 mo) • Serious lung disease, including pneumonia (<1 mo) • Abnormal pulmonary function • Acute myocardial infarction • Congestive heart failure (<1 mo) • History of inflammatory bowel disease • Medical patient at bed rest 	<ul style="list-style-type: none"> • Age 61-74 • Arthroscopic surgery • Major open surgery (>45 min) • Laparoscopic surgery (>45 min) • Malignancy • Confined to bed (>72 hrs) • Immobilizing plaster cast • Central venous access 	<ul style="list-style-type: none"> • Age ≥75 y • History of VTE • Family history of VTE • Factor V Leiden • Prothrombin 20210A • Lupus anticoagulant • Anticardiolipin antibodies • Elevated serum homocysteine • Heparin-induced thrombocytopenia • Other congenital or acquired thrombophilia 	<ul style="list-style-type: none"> • Stroke (<1 mo) • Elective arthroplasty • Hip, pelvis or leg fracture • Acute spinal cord injury (<1 mo)

A total risk factor score is calculated:

- 0-2 : very low to low risk; VTE incidence of <1.5%
- 3-4 : moderate risk; VTE incidence 3%
- 5-8 : high risk; VTE incidence 6%
- >8 : very high risk; VTE incidence 6.5-18.3%

The Padua Prediction Score^{11,12} is designed for medical inpatients. The Padua score is based on a cohort of 1,180 patients admitted to an internal medicine ward. In this model, risk factors are given a score of 1, 2 or 3.

Table 6 - Padua Prediction Score^{11,12}

Baseline Features	Score
Active cancer ^a	3
Previous VTE (excluding superficial thrombosis)	3
Reduced mobility ^b	3
Known thrombophilic condition ^c	3
Recent (≤ 1 month) trauma and/or surgery	2
Age ≥ 70 years	1
Heart and/or respiratory failure	1
Acute myocardial infarction or ischemic stroke	1
Acute infection and/or rheumatologic disorder	1
Obesity (BMI ≥ 30)	1
Ongoing hormonal treatment	1

^aPatients with local or distant metastases and/or in whom chemotherapy or radiotherapy had been performed in the previous 6 months

^bAnticipated bed rest with bathroom privileges (either because of patient's limitations or on physician's order) for at least 3 days

^cPresence of defects of antithrombin, protein C or S, factor V Leiden, G20210A prothrombin mutation, or antiphospholipid syndrome

A total score of ≥ 4 is considered high risk. In the cohort from which this RAM was derived, VTE developed in 2.2 per cent of high-risk patients who received thromboprophylaxis and in 11 per cent high-risk patients who did not receive thromboprophylaxis.¹¹ VTE developed in 0.3 per cent of the low-risk patient who did not receive thromboprophylaxis.¹¹ However, four RAMS in hospitalized medical patients have been shown to have poor predictive utility for VTE risk.¹³

Although the strategy of formal risk assessment has been utilized in a number of hospitals, there are several limitations to this approach. The point system is somewhat arbitrary, and has not been well validated in the literature.² Individual patient RAMs require considerable effort to be completed consistently. Hurried clinicians may not accurately assign points in the RAM or may defer this process until they have more time. In addition,

the point-based systems are often too long and cumbersome to be used in order sets.² Finally, the use of a formal RAM may complicate a process which can be simplified, particularly since there are few thromboprophylaxis options from which to choose.

A compromise is to use a qualitative approach to risk assessment such as the “3 Bucket” Model³ developed at the University of California (UC) San Diego and derived from the recommendations in the pre-2012 ACCP guidelines. In the 9th edition of the ACCP guidelines, the “3 Bucket Model” has been replaced, although this approach continues to be used in many hospitals.

Table 7 - Updated “3 Bucket” Model In Use at UC San Diego³

Low risk: Observation status, expected LOS < 48 hours. Minor ambulatory surgery unless multiple strong risk factors. Medical patients ambulatory in hall and not moderate or high risk. Ambulatory cancer patients admitted for short chemotherapy infusion.	No prophylaxis; reassess periodically, ambulate.
Moderate risk (most general medical/surgical patients): Most general, thoracic, open gynecologic, or urologic surgery patients. Active cancer or past VTE/known thrombophilia in medical patient with LOS >48 hours. Medical patients with decrease in usual ambulation AND VTE risk factors (myocardial infarction, stroke, congestive heart failure, pneumonia, active inflammation/infection, dehydration, age>65).	UFH or LMWH prophylaxis*
High Risk: Hip or knee arthroplasty, hip fracture surgery, major trauma, spinal cord injury or major neurosurgery, abdominal-pelvic surgery for cancer.	IPC AND LMWH or other anticoagulant*

*For those at moderate or high VTE risk and contraindication to anticoagulation, use Intermittent Pneumatic Compression (IPC) alone until bleeding risk subsides

B. Group thromboprophylaxis approach. The second approach to determining which thromboprophylaxis method will be used is to implement routine, standard thromboprophylaxis for all patients in a large group, (e.g. major orthopedics, major general surgery, general internal medicine, etc.). The entire group would receive the same prophylaxis unless a particular patient has a contraindication to the standard option. This approach has several advantages. Although a large number of patient-specific factors can contribute somewhat to the variability in VTE risk, the most important factor is generally the patient’s primary reason for hospitalization. In contrast to individual patient assessment, group risk assessment is the basis for most randomized trials of thromboprophylaxis and for many evidence-based, clinical practice guidelines. This approach simplifies the process and, therefore, allows all healthcare providers to assist in

the policy of providing appropriate thromboprophylaxis as a result. A further simplification is to use the same modality (usually a LMWH) for almost every patient unless there are specific patient factors that require an alternative approach.^{6,14} Clinical judgement is still required in the group prophylaxis model to ensure that the prophylaxis modality and dose are appropriate for a particular individual patient.

Step 2 - Development of Order Sets

The use of standardized order sets with thromboprophylaxis embedded within them has been shown to significantly improve the proportion of patients receiving appropriate VTE prophylaxis.^{6,14,15} Introduction of a well-designed, evidence-based order set that reaches most patients has yielded VTE prophylaxis rates of 70 to 85 per cent (from baseline levels of 35-55 per cent).² Gaylis et al. showed that the use of standardized medical orders improved prophylaxis rates to 70 per cent compared to 22 per cent in the hand-written order group.¹⁶ A major additional benefit of order set use is that a broad range of safety interventions can simultaneously be included.¹⁷ Order sets can be paper or electronic, but should be designed in a way that requires prescribers to select the standard thromboprophylaxis option or to document why an alternative approach is ordered.¹⁴ A sample standardized order set can be found in [Appendix G](#).

Several common barriers can occur when constructing or implementing a VTE prophylaxis order set.

- ***Not providing enough guidance***
Centres may design order sets that list numerous options for VTE prophylaxis without providing guidance as to which choices are most appropriate. Several mechanical thromboprophylaxis options, various doses and types of anticoagulant thromboprophylaxis, combinations of mechanical and anticoagulant, and a no prophylaxis option are sometimes all listed and may appear to be equally acceptable choices (or, at least, may cause confusion for the prescriber).³ It is most helpful to reduce the number of options to those that are the preferred options and clearly specify that mechanical thromboprophylaxis is for situations when anticoagulant prophylaxis is contraindicated (and possibly as an adjunct for very high risk patients).^{3,5,6}
- ***Too much complexity***
Options for thromboprophylaxis should be simplified to make decisions easy for the prescriber to ensure that a high proportion of patients at risk receive the preferred option recommended by local policy. If possible, institutions should use only one LMWH with only one or two standard dosing regimens. Mechanical thromboprophylaxis is also best simplified to one option such as IPC or GCS, not both.
- ***Failure to revise and replace pre-existing order sets***
QI teams should examine all existing admission, transfer, and peri-operative order sets to establish that they include VTE prevention orders that are consistent with the organization's policy. Once order sets are revised, a concentrated effort is

needed to remove all of the older order sets and to ensure a continuous supply of the most current orders sets are readily available at the sites of patient contacts.

Step 3 - Computerized Reminder System

Computerized reminder systems (CRS) to alert prescribers about the risk of VTE and to recommend thromboprophylaxis have proven to be very powerful tools to increase prophylaxis rates.¹⁵ A randomized trial showed that use of a CRS significantly increased adherence with thromboprophylaxis use and reduced the incidence of VTE by 41 per cent ($p < 0.0001$).⁴

A forced stop function in computerized prescriber order entry (CPOE) is an excellent method if electronic order entry is used. This strategy requires the prescriber to address thromboprophylaxis before further order entry can take place. Combining this with electronic decision support tools can address the barrier of prescriber unfamiliarity with appropriate VTE prophylaxis.¹⁸

3) Measurement (including audits) of Appropriate Thromboprophylaxis is in Place and Used to Inform Improvement Efforts.

For patient safety practices as important as VTE prevention, it is essential to audit performance periodically on an ongoing basis to ensure continued high rates of adherence with the institution's policy. The impact of reliable audit data and feedback to patient care teams has been demonstrated to significantly improve thromboprophylaxis rates.^{3,14,15,18} Measures are needed to determine how well a system is performing and to track this over time, to determine if there are barriers to implementation of the organizational prophylaxis policy on specific units or in certain patient groups, to provide objective evidence of success (or lack of success), and to assess whether the goal has been reached and is sustained.

In the audit process, it is critical to focus on the protocol definitions of "appropriate prophylaxis" as the target outcome rather than use of "any prophylaxis".⁵ It is also essential that the results of the local audits are disseminated to organizational leaders and frontline healthcare providers. If the adherence to appropriate thromboprophylaxis falls below the target level, then focused quality improvement initiatives should be implemented to reach target. The ongoing collection and dissemination of adherence data is critical to the success of this and other local safety initiatives. See [Section 6](#) for the *Safer Healthcare Now!* recommended measures. The discussion that follows will provide a brief overview of measurement with specific details about the process and outcomes to be measured reviewed in [Section 6](#).

Process Measures vs Outcome Measures vs Balancing Measures

In general, three types of measures can be audited:

- **Process measures** examine whether the steps in a system are performing as planned and may include the percentage of patients receiving appropriate VTE prophylaxis, or usage of appropriate pre-printed order sets with a VTE component.
- **Clinical outcome measures** are used to quantify the ultimate end result - the prevention of objectively-proven, symptomatic, hospital-acquired VTE. Evidence from multiple studies confirm that adherence with the use of appropriate thromboprophylaxis will lead to fewer thromboembolic events and, therefore, to better patient outcomes. Collection of clinical outcome measures can provide real-time feedback to teams. The collection of clinical outcomes is discussed in more detail in [Section 6](#).
- **Balancing measures** determine if a new approach is having a negative impact on other areas. An example would be to determine the rates of bleeding or heparin-induced thrombocytopenia (HIT) with anticoagulant thromboprophylaxis use.

Sampling Strategies – Process of Care Measures

There are several different sampling strategies:

Simple Random Sampling

Patients are selected by using a process such as random numbers. The random numbers are obtained from either a computer or a published random number table.

Systematic Random Sampling

Patients are selected based on choosing a random starting point, and then selecting patients at specific intervals. An example would be to look at every tenth patient admitted to hospital in a one week period.

Judgment Sampling

This method is useful when knowledge of known problems or barriers directs the selection of useful participants. An example would be to audit one or more clinical services if it is known that these are areas with low rates of prophylaxis.

Consecutive Sampling

This method assesses every patient in the selected group over a period of time. Examples include assessing consecutive hip fracture patients over a one-month period or assessing every in-patient on a given day. This type of sampling is generally preferred for continuous quality improvement efforts.

The extent of measurement will depend on the specific objectives of the audit as well as the scale of the improvement effort and resources available. If there are relatively small numbers of patients, an audit of 100 per cent of the patients can be performed without much difficulty. For larger numbers, a full audit will give the most accurate data; however, this may be too time- and resource-consuming. A random sample audit is an option to get a “snapshot” of current thromboprophylaxis use and the effects of any new process changes. Sampling can reduce time and resources while still reflecting performance over time. To be accurate and to reduce bias, samples need to be as random as possible (every patient should have an equal opportunity of being selected for the audit).

To maintain consistency of data abstraction, it is best to designate one or a small number of individuals to perform this task. These abstractors should work from a formal set of inclusion and exclusion criteria and definitions of “appropriate” thromboprophylaxis. The abstractors should meet periodically to “compare notes”.

The team should monitor adherence to the VTE protocol and ensure completed admission and/or postoperative orders are present for every patient in the target group. If there is deviation from the protocol, the team should try to determine why this has occurred. The QI team should capture these occurrences, learn from them, and take steps to prevent them. The suggested steps are reviewed in [Section 6](#).

Disseminating Audit Results

The QI team must determine how and to whom the results of the audits will be reported. This might be driven by the purpose of the audit (e.g. quality improvement vs. quality control). If the purpose of the audit is to drive quality improvement, dissemination to front line staff would be important to help drive change and improvement in care. If the audit is a measure of quality control (or sustainability of improvement), it may be appropriate to disseminate the results even further to the quality of care committee, hospital administration, clinical leaders, etc. The results may also be publically reported, for example, as a component of a balanced scorecard. When displaying audit results, it is useful to show trends over time to help track improvement and ensure sustainability. Communicating audit data will help to keep teams motivated. Consider sharing information about reductions in VTE, “good catches” that were made by teams, cases of HA-VTE, improvements in patient safety, patient satisfaction, teamwork, communication, and staff satisfaction.

Examples of an audit tool can be found in [Appendix H](#).

4) Mechanisms to Identify and Provide Appropriate Post-Discharge Prophylaxis are in Place for Major Orthopedic Surgery Clients (Hip and Knee Replacement, Hip Fracture Surgery).

If the hospital provides care for major orthopedic surgery cases, a process needs to be in place to:

- **Identify patients** who require post-discharge thromboprophylaxis. Hip and knee arthroplasty, and hip fracture surgery patients should receive appropriate thromboprophylaxis for a minimum of 10 days and up to 35 days post-surgery according to the ACCP guidelines.¹⁹
- Provide a prescription for the appropriate thromboprophylaxis to the patient as well as **detailed instructions** about dosing and duration to them and/or their caregivers.
- If the patient is discharged directly home, the designated healthcare professional should confirm that the patient has received a prescription for thromboprophylaxis, has the means to cover the cost, and receives education about the medication including duration of treatment.
- **Communicate these instructions** to the rehabilitation facility for the high proportion of such patients who transition from acute postoperative care to home by way of a rehabilitation hospital or unit. See [Appendix I](#) for an example of a Thromboprophylaxis Discharge Letter.

5) Information about the Risks of VTE and its Prevention is Available to Health Professionals and Clients.

Passive dissemination of guidelines and single educational events have been shown to be ineffective as sole methods to elicit change. More active initiatives have shown greater benefit. Systematic reviews of thromboprophylaxis implementation strategies have suggested that multifaceted, interdisciplinary interventions targeting different barriers to change were much more effective than single-strategy interventions.²⁰⁻²²

Some healthcare professional education strategies that can be considered include:

- Education module(s) related to VTE and its prevention, etc. delivered in-person or using an e-learning format.
- Sharing VTE audit data and reviewing potentially preventable HA-VTE cases: HA-VTE cases help the team identify any gaps in the process of care (e.g. uncover reasons for non-adherence with the protocol, confusion regarding VTE risk assessment, other barriers) and can provide guidance for improvements to the protocol and further educational efforts. Audit data is helpful in maintaining commitment for the improvement goals.
- Teaching rounds and noon conferences: one trial showed that the use of a hospital-wide clinical pharmacy education program improved the thromboprophylaxis rate from 11 to 44 per cent ($p < 0.001$) as well as rates of HA-VTE.²³
- Patient safety leadership walk-rounds: a successful approach used at Portsmouth Hospital and King's College Hospital in the UK is to have such rounds weekly. The presence of a senior physician or administrator reminds the frontline staff of their organization's commitment to VTE prevention. These types of events help ensure that VTE prevention becomes firmly embedded in the culture of the organization.

- Pocket cards or posters: to serve as a reminder of the institutional thromboprophylaxis policy for medical residents, pharmacists, and nursing staff. These can be a helpful, quick reference if they are well designed.
- Intranet resources: a portal or site on the institution's intranet to house the thromboprophylaxis policy and any supporting documents including patient education materials and audit results.
- Local unit champions: a nursing unit could identify one or more frontline staff who accept the responsibility of being the "messenger" to bring VTE prevention information to other staff, to conduct unit mini-audits, and to provide improvement ideas to the hospital QI team.

Patient education is also an important aspect of improving VTE prophylaxis rates. Patients should be offered verbal and written information on the importance of VTE prevention at the time of admission, throughout their hospital stay, and at discharge. Some centres have developed patient information leaflets, and counsel patients on symptoms and signs to watch for after discharge.

A great resource for both healthcare professional education and patient education materials is the Thrombosis Canada site which can be accessed at: www.thrombosiscanada.ca.

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6. Measurement and the VTE Improvement Program (VIP)

Audits, followed by feedback, are effective strategies to identify the gap between evidence or hospital policy and practice, and are very effective methods to inform quality improvement. The institution's ability to provide high quality patient care can be assessed through periodic measurement of process of care indicators, adherence with local policies and/or clinical outcomes. In relation to the prevention of VTE, measurement of current practice provides important feedback to organization leadership, frontline workers, and, in some cases, to patients and the public.

The measures below have been selected to assist organizations achieve their local objectives in this area. They have been designed to measure outcomes related to the key steps in the implementation of appropriate VTE prevention. At the same time, these measures have been designed to use data that are relatively simple to obtain in practice. The measures can also be adapted so that more comprehensive data can be obtained and allow for a more in-depth analysis of current practice at an institution.

Local Audit Results

The type of audit that is selected will be determined by its objective. An audit can be prospective or retrospective; both types of audits can be approached as a snap shot of VTE prophylaxis or a more detailed VTE prophylaxis audit.

Regardless of the type of audit conducted, the purpose of an audit of VTE prophylaxis should be to provide information about the proportion of patients at risk for VTE who are prescribed appropriate (evidence-based) VTE prophylaxis. Appropriate thromboprophylaxis for each patient group is reviewed in [Section 2](#).

The advantages and disadvantages of the two approaches to auditing VTE prophylaxis (Snapshot vs. Detailed) are summarized in the table below:

Table 8 - Comparison of Snapshot vs Detailed Audits

Snapshot Audit (e.g. one-day, hospital-wide audit)	Detailed Audit (e.g. retrospective review of all General Surgery patients over a 6 month period)
Advantages: <ul style="list-style-type: none"> - Can be conducted at one point in time such as on a single day - Data can be collected using a pharmacy informatics system and/or patient charts - Provides an estimate of how often VTE prophylaxis is prescribed for patients at risk on that particular day 	Advantages: <ul style="list-style-type: none"> - Information about the patient's entire admission can be collected - Can assess the details of thromboprophylaxis for each patient including the initiation, dose, compliance, and duration - Provides an accurate measurement of the proportion of patients at risk for VTE receiving appropriate prophylaxis
Disadvantages: <ul style="list-style-type: none"> - Does not allow for assessment of the details of thromboprophylaxis such as optimal initiation, dosing, compliance and duration 	Disadvantages: <ul style="list-style-type: none"> - More resource intensive, often requires one or more dedicated person(s) to collect the data for the time period selected

Conducting a VTE Audit

Step 1: Determine the objective of the audit

The objective for conducting the audit will help to determine the type of audit selected, the audit sample and the frequency with which audits occur.

Step 2: Determine the type of audit that will be conducted

The purpose of the audit and the resources available will influence the type of audit that will be conducted. A process for collecting the information and an individual or group of individuals responsible for data collection must be identified early in the process.

Step 3: Identify the audit sample

Target Sampling Options (based on local QI priorities and resources):

1. The entire in-patient population;
2. A random sample of at least 10 per cent of the in-patient population on at least one day;
3. At least one patient care area (nursing unit) on at least one day;
4. At least one entire patient group on at least one day (e.g. arthroplasty, hip fracture, major general surgery, gynecology, ICU, general internal medicine, neurosurgery, etc);

5. A sample of consecutive admitted patients e.g. the next 50 admitted patients;
6. A sample of consecutive admitted patients for one group e.g. the next 20 admitted hip fracture patients.

Step 4: Identifying the data to be collected (measures) and how they will be collected

The process of data collection can be individualized for the institution and target patient sample. A common approach is to do a direct chart review of the patients in the target sample. This allows for collection of all data elements that will help to establish the appropriateness of prophylaxis. The audit process may utilize a data collection sheet for each patient or a form that includes multiple patients. An example of audit instructions and data collection tools can be found in [Appendix H](#). The data collection tool used at the institution should be aligned with the institutional VTE prophylaxis policy, guideline and/or order sets.

a) Determine if each patient is included in the audit.

Patients to be included in a VTE audit will be:

- Patients at risk of developing VTE (for example, exclude low risk surgery patients who are fully mobile and have no additional risk factors for VTE)
- Admitted for at least 2 calendar days
- NOT on therapeutic anticoagulation for other reasons such as treatment of VTE or stroke prevention in atrial fibrillation

b) Collect data to answer the following questions:

i. Was a preprinted order set (including VTE prophylaxis) used on admission or after surgery?

The use of order sets is a highly effective strategy to increase standardization and quality of care; assessing how often order sets are used in the target patient group provides insight into the organization's commitment to standardization of best practices. For the target patient group, how frequently are pre-printed order sets (or Computerized Prescriber Order Entry - CPOE), that contain one or more order options for VTE prophylaxis, used? Order sets may not contain recommended prophylaxis options, there may be too many choices, the specific prophylaxis order may be skipped by the care provider completing the order set, or the order may not have been carried out.

ii. What thromboprophylaxis was ordered?

If thromboprophylaxis was ordered, the audit data collection form should include the options available at your institution (including mechanical prophylaxis).

iii. Was the patient ordered appropriate thromboprophylaxis?

Thromboprophylaxis is considered appropriate when:

- It is ordered within 24 hours (1 calendar day) of admission or after surgery

- The order was consistent with evidence-based anticoagulant prophylaxis (or mechanical prophylaxis if anticoagulant is contraindicated) as described in Section 2
- *If completing a detailed, retrospective audit:* determine if prophylaxis is continued at least until discharge or for at least 10 days after discharge in patients undergoing high-risk orthopedic surgery (e.g. THR, TKR, HFS)

iv. **If appropriate thromboprophylaxis was not provided, why not?**

Categories of possible reasons for not providing thromboprophylaxis include:

- No thromboprophylaxis was ordered when indicated
- Mechanical prophylaxis alone was ordered without a bleeding contraindication
- The WRONG DRUG was ordered (e.g. rivaroxaban was provided for a general medicine patient)
- The WRONG DOSE was ordered (e.g. unfractionated heparin 5000 units subcutaneously TWICE daily rather than THREE times daily for a patient undergoing surgery for cancer)
- There was a delay in starting thromboprophylaxis >24 hours after admission or after surgery
- Thromboprophylaxis was delivered for an insufficient duration (e.g. stopped 3 days after a 6-day admission)

Step 5: Determine the frequency of audits

The frequency of audits will be determined by your intended objective and the type of audit. As an example, we recommend collecting data monthly until reaching your goal. You may continue to collect monthly data until you have sustained your goal for three consecutive months at which time you may decide to collect quarterly for a year and then semi-annually.

Process of Care Measures

The following process measures are linked to the recommended steps in implementing appropriate VTE prophylaxis (which will also assist organizations achieve compliance with the Accreditation Canada VTE ROP). The questions outlined below can also be used as a self-assessment for the institution in preparing for accreditation.

Frequency of measurement: every six months or annually

1) Does your organization have a **hospital-wide written thromboprophylaxis policy**?

- No
- Yes, we have thromboprophylaxis policies for certain patient groups but not a hospital-wide policy
- We have a fully-approved and implemented, hospital-wide thromboprophylaxis policy
- Other (please explain) : _____

- 2) Does your organization have a method to **identify hospital patients at risk for VTE and provide them with thromboprophylaxis consistent with the thromboprophylaxis policy**?
- No formal method or individual physicians make thromboprophylaxis decisions about individual patients
 - Yes, at least for some patient groups, we have a formal method to routinely identify patients at risk for VTE and routinely provide them with thromboprophylaxis consistent with the hospital policy
 - Yes, for most patient groups, we have a formal method to routinely identify patients at risk for VTE and routinely provide them with thromboprophylaxis consistent with the hospital policy
 - Yes, for all (or almost all) patient groups, we have a formal method to routinely identify patients at risk for VTE and routinely provide them with thromboprophylaxis consistent with the hospital policy
 - Yes, we apply a formal VTE risk assessment model to each admitted patient which is linked to risk-appropriate thromboprophylaxis consistent with the hospital policy
 - Other (please explain) : _____
- 3) Does your organization **audit appropriate thromboprophylaxis use**?
- No thromboprophylaxis audit has been done in the past six months
 - An audit of any thromboprophylaxis use in one (or more) patient group(s) was carried out in the past six months. Please provide details of the audit: _____
 - An audit of appropriate thromboprophylaxis use in one patient group was carried out in the past six months. Please provide details of the audit: _____
 - An audit of appropriate thromboprophylaxis use was carried out in at least 2 patient groups in the past six months. Please provide details of the audits: _____
 - Regular audits (at least once a month) of appropriate thromboprophylaxis use was carried out in at least one patient group in the past six months. Please provide details of the audits: _____
 - An audit of appropriate thromboprophylaxis use was carried out in every admitted patient at least once over the past 6 months. Please provide details of the audit: _____
 - Other (please explain) : _____
- 4) Does your organization have a formal strategy to identify every high-risk orthopedic surgery patient (THR, TKR, HFS) who requires **post-discharge thromboprophylaxis** and have a mechanism in place to ensure that these patients receive it?
- Our organization does not provide care for high-risk orthopedic surgery patients
 - Our organization does not have a formal strategy to identify high-risk orthopedic surgery patients appropriate for post-discharge thromboprophylaxis

- High risk orthopedic surgery patients are not provided with post-discharge thromboprophylaxis
 - Post-discharge thromboprophylaxis is generally provided to high-risk orthopedic surgery patients at the discretion of the individual surgeons
 - Our organization has a formal strategy to identify high-risk orthopedic patients and consistently provides post-discharge thromboprophylaxis to them
- 5) Does your organization formally **provide information about VTE and its prevention** to the majority of **health professionals** at least once every six months (grand rounds, mailing or emailing to each member of the group)?
- Our organization has not provided formal education about VTE and its prevention to health professionals over the six months
 - Our organization has provided formal education about VTE and its prevention to one or more of the following health professional groups in the past six months (check all that apply):
 - ☐ All physicians
 - ☐ All nursing staff
 - ☐ All pharmacists
 - ☐ Other healthcare professionals (e.g. physiotherapy, etc.)
 - Our organization has provided formal education about VTE and its prevention to one or more of the following health professional groups in the past six months (check all that apply):
 - ☐ Some physicians
 - ☐ Some nursing staff
 - ☐ Some pharmacists
 - ☐ Other healthcare professionals (e.g. physiotherapy, etc.)
6. Does your organization **provide information about VTE and its prevention to patients**?
- Our organization has not provided any formal education about VTE and its prevention to patients over the past six months
 - Our organization has written information about VTE and its prevention available to patients (leaflets, booklets) at key patient encounter sites (pre-surgical clinic, Admitting Department, nursing units, etc)
 - Our organization provides written information about VTE routinely to at least 50 per cent of patients (e.g. in all pre-surgery admission packages)
 - Our organization provides written information about VTE to almost every (>80 per cent) admitted patient

Clinical Outcomes

Ultimately, the objective of appropriate thromboprophylaxis is to prevent symptomatic and fatal hospital-acquired VTE (HA-VTE). Since there is evidence that providing appropriate thromboprophylaxis results in a reduction in clinically important outcomes, capturing symptomatic VTE can be very powerful in supporting quality improvement. However, symptomatic VTE is relatively uncommon, often occurs after hospital discharge, may go

undetected, and is difficult to capture comprehensively both in and out of the hospital. Therefore, ascertainment of clinical outcomes, while it is a strong measure of thromboprophylaxis success, is optional for participants in the SHN VTE intervention.

If assessing the incidence of HA-VTE, the tracking will need to be done over a long period of time since these events are relatively infrequent and more difficult to capture than process measures (clinical events may be delayed in onset and may be more difficult to track once the patients have been discharged). The definition of HA-VTE must be determined by the QI team in advance. Some methods for defining hospital-acquired venous thromboembolism are described in [Table 9](#) below. A common definition is a VTE first discovered during the course of hospitalization or within 30 days of discharge.¹

Table 9 - Methods for Defining Hospital-Acquired Venous Thromboembolism²

Method 1 (minimum)	Track the total number of DVT and PE diagnosis codes seen at the medical centre over a specified period of time. As an approximation, that number could be divided by 2 to estimate the fraction of those that are hospital-acquired. Alternatively, all VTE codes that are listed as a secondary diagnosis can be used as a surrogate for HA-VTE.
Method 2 (better)	Perform Method 1 and then review charts to retrospectively determine if DVT or PE was hospital- or community-acquired.
Method 3 (better yet)	Perform Method 2 and then retrospectively determine if HA-VTE patients were on appropriate prophylaxis before the VTE developed.
Method 4 (best)	Prospectively capture new cases of DVT or PE as they occur by setting up a reporting system with regular inputs from medical imaging, vascular labs, the Emergency Department, and Pharmacy.

Thromboembolic events can then be further differentiated into “hospital-acquired despite use of appropriate prophylaxis” versus “hospital-acquired while not receiving appropriate prophylaxis”. Although the ultimate goal is to prevent clinical thromboembolic events, this measurement is generally not recommended as the only metric for performance tracking because of the difficulty in collecting this information.¹

Irrespective of the method used to identify VTE cases, a more detailed analysis can be performed on each case to determine if they meet the inclusion as a HA-VTE. If so, a root-cause analysis can determine if the patient received optimal thromboprophylaxis during their index hospitalization or if it was suboptimal. Feedback can then be provided to the relevant members of the team who cared for the case. This feedback will be most effective if it is provided soon enough after the event that the care team will remember the patient. All cases

of HA-VTE should be entered into a database to determine any trends (specific clinical groups, nursing units, times of the year, etc).

An incident analysis of patients that develop HA-VTE can be very impactful if the time and resources are available. This process may identify improvement strategies that can be implemented to reduce the chance of similar events in future if the VTE was deemed potentially preventable.

Other measurable clinical outcomes include:

- Number of hospital-acquired VTE events over a specific time period (duration of hospital stay, 30 days, two calendar months after admission).
- Number of potentially preventable hospital-acquired VTE events over the same time period.
- Number of readmissions to hospital for VTE within two months of a discharge for a non-VTE condition.
- Number of patients with prolonged duration of hospital stay due to hospital-acquired VTE.
- Number of systems reviews of VTE events.
- Number of fatal PE.
- Number of complications of thromboprophylaxis (e.g. injury from mechanical thromboprophylaxis, clinically-important bleeding events, thromboprophylaxis-related HIT).

References (Section 6)

- ¹ Maynard G. Preventing hospital-associated venous thromboembolism: a guide for effective quality improvement, 2nd ed. Rockville, MD: Agency for Healthcare Research and Quality; October 2015. *AHRQ* Publication No. 16-0001-EF.
- ² Maynard, G. Stein J. Preventing Hospital-Acquired Venous Thromboembolism: A Guide for Effective Quality Improvement. Prepared by the Society of Hospital Medicine. *AHRQ* Publication No. 08-0075, Rockville, MD. Agency for Healthcare Research and Quality. August 2008.

7. Appendices

APPENDIX A: Possible Barriers to Optimal Use of Thromboprophylaxis

Knowledge and Awareness Factors

1. Lack of awareness that VTE is an important clinical problem:

- Lack of awareness of the VTE literature (VTE risk factors, patients at risk of VTE, magnitude of VTE risks).
- Most hospital-acquired VTE are clinically silent (asymptomatic).
- In many cases, a patient's leg or chest symptoms are attributed to the surgical procedure or the underlying disease and, therefore, VTE will not be diagnosed even if symptomatic.
- Belief that the risks of VTE have fallen substantially over the years because of improvements in patient care.
- Belief that VTE risk stops at hospital discharge.
- Catastrophic VTE is not very common.
- Catastrophic VTE is spread across the spectrum of hospital physicians and, therefore, each individual physician will not encounter catastrophic VTE very often.
- Denominator issue: if the fatal PE rate is 1/500 hip arthroplasties and the surgeon does an average of 100 THAs/year, that would be one fatal PE in five years plus the cause of death would have to be established by autopsy and the surgeon would have to know about the autopsy result.
- Reliance on personal experience ("My patients have had very few thromboembolic complications over the years." "I can't remember the last time one of my patients developed VTE.").
- Few autopsies are currently being done both in hospital patients and especially in patients in the community - therefore, even when patients die of PE, the cause is often ascribed to another condition (MI, arrhythmia, pneumonia, multi-system organ failure).
- Most hospital-acquired VTE are diagnosed after discharge - this makes it even more difficult to determine the nature of the event and to attribute it to the preceding hospitalization.
- Since most symptomatic VTE are diagnosed after discharge, since many fatal PE will not be diagnosed, since symptomatic VTE is often managed by a physician other than the original attending, the attending physician may not be aware that their patient developed VTE in association with the hospital stay.

- Lack of awareness of long-term consequences of VTE - complications of therapeutic anticoagulation, chronic venous insufficiency, thromboembolic pulmonary hypertension, chronic patient anxiety, possible exclusion from certain surgical procedures.
2. **Belief that VTE is an accepted complication of care.**
 3. **Lack of awareness that VTE is preventable:**
 - Lack of awareness of the thromboprophylaxis literature, the benefits, safety and cost-effectiveness of thromboprophylaxis.
 - Belief that thromboprophylaxis is effective in some patient groups but does not apply to the particular patient group or to the particular patient.
 - Belief that preventing fatal PE is the only important outcome and not aware that fatal PE can be reduced.
 - Belief that asymptomatic DVT reduction does not translate into reduction in clinically-important VTE.
 4. **Belief that VTE may be preventable by encouraging mobilization alone.**
 5. **Belief that the risks of thromboprophylaxis are too high:**
 - Personal experience with bleeding (and attributing it to the thromboprophylaxis).
 - Concerns about increased risk of wound infection associated with prophylaxis use.
 - Co-morbid conditions may raise concerns about prophylaxis (recent bleeding, renal failure, thrombocytopenia, advanced age).
 6. **Belief that the costs of thromboprophylaxis are too high.**
 7. **Lack of awareness of evidence-based thromboprophylaxis guidelines:**
 - Disagreement with guidelines in general ("too cookbook", "too rigid", biased synthesis, challenge to autonomy, not practical).
 - Disagreement with the specific thromboprophylaxis guideline (interpretation of the evidence, applicability to the patient, net cost-benefit, local approach not included).
 - Perceived lack of clarity within guidelines (e.g. unclear definitions of mobility/mobilization).
 - Discrepancies in approach and/or in specific recommendations among various guidelines.

Individual Implementation Factors

(Assumes that there is awareness that VTE is an important, preventable complication of hospital stay)

1. Lack of time:
 - Physician too busy to think about this.
2. Too many options:
 - Which agent, when to start, what dose, how long?
3. Other patient priorities are more immediate.
(e.g. ICU, acute surgical or medical illness).
4. Patients are too heterogeneous/risk stratification is too complex/patient is too old, cancer, DNR/patient is too young, likely to mobilize quickly.
5. Regional anesthesia concerns.
6. Forget to prescribe.
7. Lack of national body recommendation (CMPA, Royal College).
 - Lack of specialty organization recommendations/guidelines.
8. Lack of local hospital priority.

System/Organizational Implementation Factors

(Assumes that there is awareness that VTE is an important, preventable complication of hospital stay)

1. Lack of education about VTE and thromboprophylaxis.
 - Medical school, postgraduate training, CME, hospital policies.
2. Individual physicians prescribing for individual patients.
3. Lack of physician buy-in.
4. Organization not aware that thromboprophylaxis isn't being used.
5. No local champion.
6. Perception that implementation is complex.
 - Which option(s), which dose, when to start, how long?
7. Perception that thromboprophylaxis is too expensive.
 - There may be resistance from Pharmacy, administration.
 - Another priority may not be implemented.
 - Whose budget will implementation come from?

8. No implementation system in place.

- Thromboprophylaxis not embedded in order sets or CPOE

9. No monitoring of thromboprophylaxis use

- No audits, feedback, M&M rounds, etc.

APPENDIX B: Strategies to Increase Appropriate Use of Thromboprophylaxis

Strategies	Examples*
System-wide (national) strategies	
Excellent quality, evidence-based guidelines	ACCP Guidelines on the Prevention of VTE
	International Consensus Statement
	The Joint Commission/National Quality Forum (USA)
	National Institute for Health and Clinical Excellence - NICE (UK)
	Specialty Guidelines
Endorsement by national bodies	US Surgeon General "Call to Action"
	Society of Hospital Medicine (SHM)
	American Society of Clinical Oncology (ASCO)
	National Comprehensive Cancer Network (NCCN)
	American College of Obstetricians and Gynecologists (ACOG)
	Royal College of Obstetricians and Gynaecologists of England (RCOG)
	Eastern Association for the Surgery of Trauma (EAST)
Hospital accreditation	Accreditation Canada
	The Joint Commission (USA)
	Healthcare Commission (UK)
National or international quality improvement campaigns	<i>Safer Healthcare Now!</i>
	Surgical Care Improvement Project (SCIP) - USA
	IHI 5 Million Lives Campaign - USA
	WHO Surgical Safety Checklist
	OHA Surgical Safety Checklist
	National Institute for Health and Clinical Excellence (NICE) implementation support program - UK

Geerts W. Prevention of venous thromboembolism: a key patient safety priority. J Thromb Haemost 2009; 7 (Suppl. 1): 1-8.

Strategies	Examples*
Public reporting of thromboprophylaxis adherence	www.hospitalcompare.hhs.gov
	Premier
	Leapfrog
Pay-for-reporting and pay-for-performance	Centers for Medicare and Medicaid Services (CMS) - USA
	Surgical Care Improvement Project (SCIP)
	Physician Quality Reporting Initiative (PQRI)
	Blue Cross
	Commissioning for Quality and Innovation Project Framework (CQUIN) - England
"No pay" for complications	Centers for Medicare and Medicaid Services (CMS)-USA
Medical-legal influences	Concerns about litigation
Local Strategies	
Hospital leadership to support and participate	Commitment to support evidence-based standardization of care
	Senior leadership - CEO, program heads, department heads
	Hospital boards
	Interdisciplinary QI team
	Clinical champions, opinion leaders
Provider education/awareness raising	Of physicians, pharmacists, nurses
	During undergraduate education
	During postgraduate training
	Grand rounds, newsletters
	Dissemination of guidelines or other educational materials
	Involve hospital media relations department
	Interactive education sessions/educational outreach
Implement written policy/care pathway/decision support Wide-spread dissemination	Hospital-wide preferred
	Clinical program or specific patient care unit Involvement of front-line staff
	Bring the policy to the bedside

Strategies	Examples*
Routine VTE risk assessment and protocol-driven thromboprophylaxis	Done by admitting physician using a simple paper or electronic risk assessment model
	Embedded in the hospital computerized patient information system
	Done by other health professionals after admission (pharmacists, nurses)
Hospital patient safety initiatives	<i>Safer Healthcare Now!</i> Getting Started Kit, AHRQ VTE Prevention Quality Improvement Guide
	Society of Hospital Medicine Guide for Effective Quality Improvement
Audit and feedback	Individual provider feedback
	Small scale - local unit
	Hospital wide
	Local public reporting
Provider reminder systems	Pocket cards, posters, computer screensavers
	Daily pharmacist review of patients
	Daily nursing review of patients
	Targeted computer alerts
Order sets	Paper pre-printed order sets
	Mandated by the hospital
	Computerized provider order entry (CPOE)
Default policy	Opt-out for prophylaxis orders
Financial and other incentives	Patient safety measures linked to remuneration
Involve patients	Education
	Encourage questioning of staff about safety practices
Sentinel event investigation, reporting	System review for fatal and symptomatic events
*The examples are not intended to be comprehensive - there are other national and local strategies to improve thromboprophylaxis use	

APPENDIX C: VTE Prevention Change Package

*Although each of these steps are important, those indicated by ** are considered to be the key strategies

Change Concepts	Change Ideas*	Measures
Provide leadership	<ul style="list-style-type: none"> **Establish hospital executive leadership commitment to VTE prophylaxis as a key patient safety initiative 	<ul style="list-style-type: none"> Confirmation of commitment (letter, e-mail, funding, etc.) from senior leadership
Develop alliances and cooperative relationships	<ul style="list-style-type: none"> Involve the key departments (surgery, medicine, pharmacy, nursing, quality and risk management) 	<ul style="list-style-type: none"> List of individuals involved in the process along with titles and departmental affiliations
Consider people as in the same system	<ul style="list-style-type: none"> Establish a multidisciplinary team that meets regularly to discuss successes and gaps in performance related to VTE prophylaxis as well as priorities, strategies, and progress in improvement 	<ul style="list-style-type: none"> Composition of team Frequency of meetings per year
Emphasize natural and logical consequences	<ul style="list-style-type: none"> Gain consensus among physicians on VTE risk assessment and prophylaxis **Establish an organization-wide written thromboprophylaxis policy or guideline 	<ul style="list-style-type: none"> Product: written policy or guideline
Improving Predictions	<ul style="list-style-type: none"> **Develop an approach to risk assessment where most hospitalized patients are considered at risk of VTE and focus assessment efforts on identifying patients that are not at risk and do not require prophylaxis /OR Include a VTE risk assessment checklist or tool in the pre-printed order sets for hospitalized patients 	<ul style="list-style-type: none"> Documentation of the VTE risk assessment approach (in policy or protocol)
Reach agreement on expectations	<ul style="list-style-type: none"> **Identify goals for VTE prophylaxis and measure progress towards goals 	<ul style="list-style-type: none"> Product: target rates of appropriate prophylaxis Plan for measuring achievement of target (audit strategy)

Change Concepts	Change Ideas*	Measures
Use a coordinator	<ul style="list-style-type: none"> Identify person(s) responsible for implementing and monitoring processes for improvement 	<ul style="list-style-type: none"> Name of individual who will be coordinator
Conduct training	<ul style="list-style-type: none"> Provide education and training to all key stakeholders on the risks of VTE and VTE prophylaxis <ul style="list-style-type: none"> Educate and train medical, surgical, nursing, pharmacy and other allied health staff on VTE risk assessment and prophylaxis: Grand Rounds Newsletters/ Bulletins <ul style="list-style-type: none"> key references, guidelines Workshops Information /education with feedback from audits, etc. 	<ul style="list-style-type: none"> Dates, content and target audience of any educational sessions Product: any educational materials circulated to staff with indication of intended audience Documentation of any other educational efforts being made
Use reminders	<ul style="list-style-type: none"> Provide healthcare professionals with reminders of VTE risk and prophylaxis (e.g. chart reminders, pocket cards, information sheets placed in nursing communication binders, posters in staff lounges, etc.) 	<ul style="list-style-type: none"> Product: copy of the reminder tool being used
Coach target group to use a product or service	<ul style="list-style-type: none"> Design and implement a VTE awareness campaign for healthcare professionals, patients, and families Market VTE as a key patient safety concern in the hospital (through posters, patient education sheets, patient directed messages on hospital TV, etc.) <ul style="list-style-type: none"> Provide patient information sheets on VTE in admission and pre-op packages as appropriate 	<ul style="list-style-type: none"> Copy of any AV or written material that has been prepared for patients Dissemination strategy - when and how information is being disseminated to patients and/or their families

Change Concepts	Change Ideas*	Measures
Standardization (create formal process)	<ul style="list-style-type: none"> Establish guidelines for identifying patients at risk of VTE and providing appropriate, evidence-based VTE prophylaxis <ul style="list-style-type: none"> Develop local clinical guidelines for pre- and postoperative VTE risk assessment Develop local clinical guidelines for VTE risk assessment in non-surgical hospitalized patients (e.g. medicine, oncology, nephrology, etc.) Develop clinical guidelines for pre-and postoperative VTE prophylaxis <ul style="list-style-type: none"> Develop clinical guidelines for VTE prophylaxis in all non-surgical hospitalized patients (e.g. medicine, oncology, nephrology, etc.) 	<ul style="list-style-type: none"> Documentation of how patients will be assessed for risk of VTE
Reduce classifications	<ul style="list-style-type: none"> Incorporate evidence-based VTE prophylaxis options into the pre-printed order sets for hospitalized patients providing a place for physicians to indicate if thromboprophylaxis is contraindicated or not warranted 	<ul style="list-style-type: none"> Product: provide copies of all order sets where VTE prophylaxis has been incorporated
Use constraints	<ul style="list-style-type: none"> **Make the use of pre-printed order sets with embedded VTE prophylaxis a mandatory part of routine patient care 	<ul style="list-style-type: none"> Product: audit of how frequently pre-printed order sets are used Proof of incorporating the use of order sets into patient care policies or protocols
Exploit variation	<ul style="list-style-type: none"> Identify patients who have undergone major orthopedic surgery and require post-discharge prophylaxis <ul style="list-style-type: none"> Establish a process to ensure that patients receive at least 10 days of VTE prophylaxis after major orthopedic surgery (during hospitalization or post-discharge) 	<ul style="list-style-type: none"> Product: documentation of the strategy utilized for capturing these patients Copy of letter or discharge prescription that accompanies patients on discharge

Change Concepts	Change Ideas*	Measures
Exploit variation (contd.)	<ul style="list-style-type: none"> For patients who are discharged prior to 10 days, ensure a process for prescribing and/or communicating the need to prescribe thromboprophylaxis post-discharge 	
Use proper measurements	<ul style="list-style-type: none"> **Measure the rates of appropriate thromboprophylaxis use: <ul style="list-style-type: none"> <u>Prior to implementation</u> of interventions to establish a baseline rate of appropriate thromboprophylaxis <u>Shortly after implementation</u> (e.g. 3-6 months) to measure the effects of the interventions <u>On a regular basis</u> to ensure sustainability of improvement efforts and drive further improvement Use a standardized audit form that includes measures of: <ul style="list-style-type: none"> When prophylaxis was initiated (within 24 hrs of admission or post-op) What type of prophylaxis was prescribed Duration of the prophylaxis (until discharge or post-discharge for orthopedic patients) 	<ul style="list-style-type: none"> Baseline audit results 3-6 month audit results Regular audits (monthly) results Copy of audit form Summary of reasons for not receiving appropriate prophylaxis
Give people access to information	<ul style="list-style-type: none"> Feedback the results of the audit to all key stakeholders and front line healthcare professionals <ul style="list-style-type: none"> Provide audit results to prescribing physicians and healthcare teams (RN, pharmacist, etc.) Provide results to senior leadership Publicly report results of quality improvement initiatives through national programs and hospital website Report results on a regular basis to VTE Prophylaxis improvement team 	<ul style="list-style-type: none"> Copy of feedback letter and/or communication tool Documentation of communication to various stakeholder groups (to whom and when)

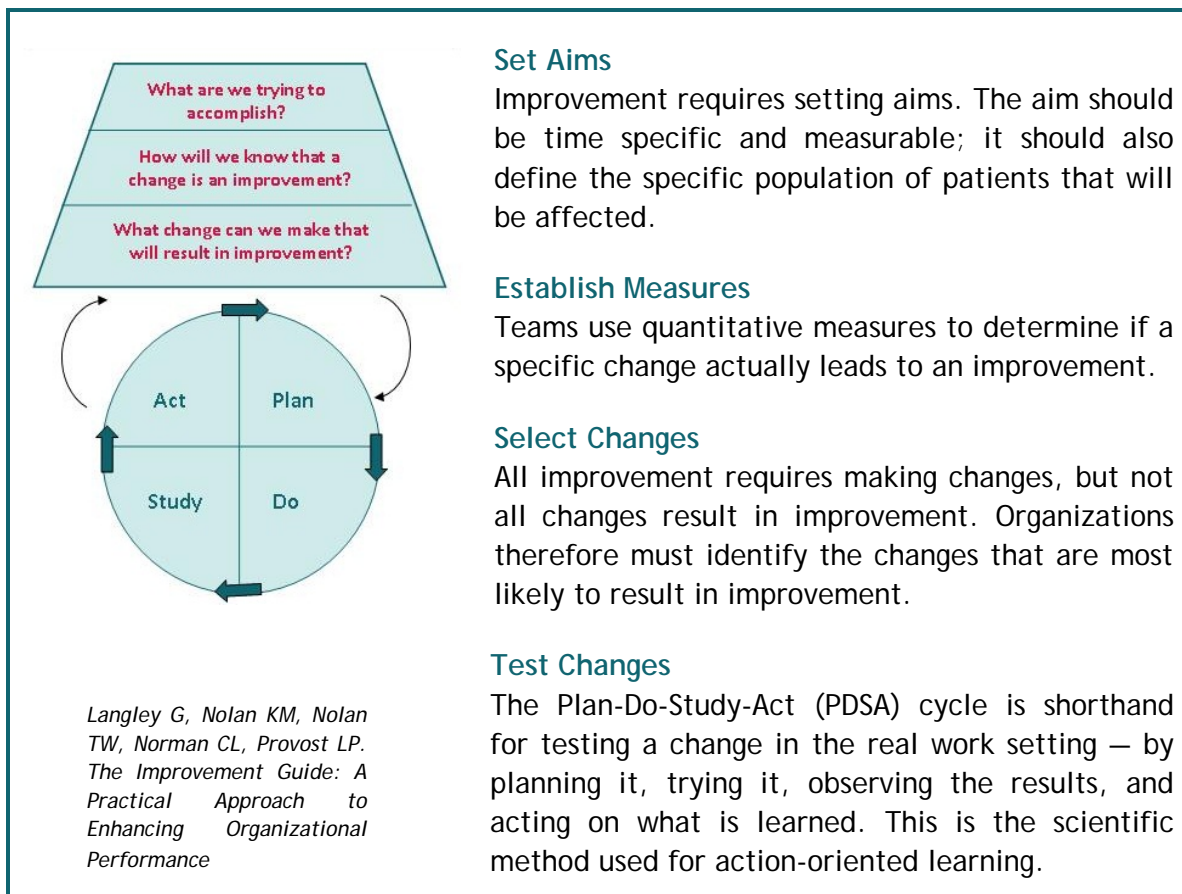
APPENDIX D: Plan-Do-Study-Act Cycle

Using the Model for Improvement to Accelerate Change

The **Model for Improvement**, developed by Associates in Process Improvement, is a simple yet effective tool not meant to replace change models that organizations may already be using, but rather to accelerate improvement. This model has been used very successfully by hundreds of healthcare organizations in many countries to improve many different healthcare processes and outcomes.

The Improvement Model has two parts:

- Three fundamental questions, which can be addressed in any order.
 1. What are we trying to accomplish?
 2. How will we know that a change is an improvement?
 3. What changes can we make that will result in improvement?
- The Plan-Do-Study-Act (PDSA) cycle to test and implement changes in real work settings. The PDSA cycle guides the test of a change to determine if the change is an improvement.



A. Set Aims (Goals and Objectives)

Improvement requires setting aims. An organization will not improve without a clear and firm intention to do so. The aim should be time specific and measurable; it should also define the specific population of patients that will be affected. Agreeing on the aim is crucial; so is allocating the people and resources necessary to accomplish the aim.

Setting an aim can assist teams to focus on what they are hoping to achieve when implementing strategies to reduce venous thromboembolism (VTE). The aim should be time-specific, measurable and define the specific population who will be affected.

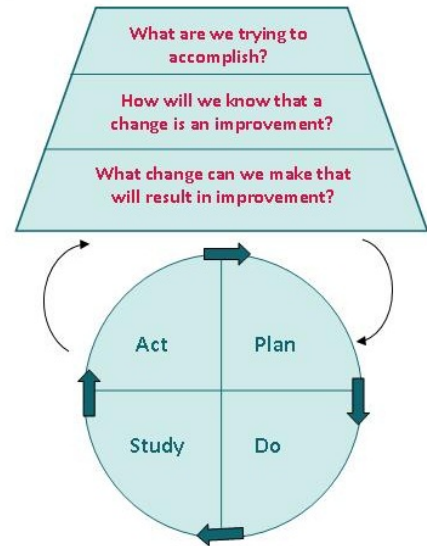
The following is an example of an aim at organizational level:

Increase the percentage of all adult hospitalized patients who are receiving appropriate VTE prophylaxis, if indicated, to 90 per cent by September 2010. Prophylaxis will be in accordance with American College of Chest Physicians 2008 evidence based clinical practice guidelines and will meet the tests for compliance set out in Accreditation Canada's VTE Required Organizational Practice (ROP).

As teams work on different ideas, the aims should be specific to what it is they are hoping to achieve at that point.

B. Establish Measures

Measurement is a critical part of testing and implementing changes; measures tell a team whether the changes they are making actually lead to improvement. Measurement for improvement should not be confused with measurement for research. This difference is outlined in the chart below:



	Measurement for Research	Measurement for Learning and Process Improvement
Objective	To discover new knowledge	To bring new knowledge into daily practice
Tests	One large “blind” test	Many sequential, observable tests
Biases	Control for as many biases as possible	Stabilize the biases from test to test
Data	Gather as much data as possible, “just in case”	Gather “just enough” data to learn and complete another cycle
Duration	Can take long periods of time to obtain results	“Small tests of significant changes” accelerates the rate of improvement

Three Types of Measures

Use a balanced set of measures for all improvement efforts:

1. Outcome Measures

How is the system performing? What is the result?

- *Appropriate Venous Thromboembolism Prophylaxis rate - The percentage of eligible patients receiving appropriate thromboprophylaxis for a target patient group.*

2. Process Measures

Are the parts/steps in the system performing as planned?

- *Order Set Use - The percentage of patients in the sample group who had an order set used for admission or post-surgical procedure.*

3. Balancing Measures

Are changes designed to improve one part of the system causing new problems in other parts of the system? This measure often addresses staff satisfaction and workload issues.

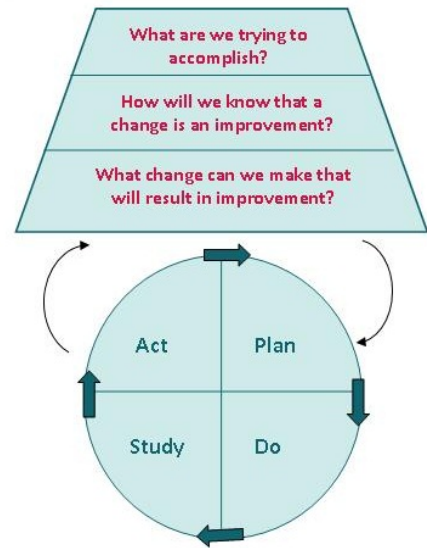
- *Does increased anticoagulant thromboprophylaxis increase the rate of bleeding, heparin-induced thrombocytopenia (HIT)?*
- *Provider satisfaction - The rating in a monthly survey of provider satisfaction with respect to efforts for the prevention of VTE.*

Measuring for improvement starts with collecting baseline data to determine the seriousness of the problem to help motivate stakeholders. Then, collect data regularly to track the effectiveness of change over time.

C. Select Changes

While all changes do not lead to improvement, all improvement requires change. The ability to develop, test, and implement changes is essential for any individual, group, or organization that wants to continuously improve. There are many kinds of changes that will lead to improvement, but these specific changes are developed from a limited number of change concepts.

A change concept is a general notion or approach to change that has been found to be useful in developing specific ideas for changes that lead to improvement. Creatively combining these change concepts with knowledge about specific subjects can help generate ideas for tests of change. After generating ideas, run Plan-Do-Study-Act (PDSA) cycles to test a change or group of changes on a small scale to see if they result in improvement. If they do, expand the tests and gradually incorporate larger and larger samples until you are confident that the changes should be adopted more widely.



D. Test Changes

Once a team has set an aim, established its membership, and developed measures to determine whether an intervention leads to an improvement, the next step is to test a change in the real work setting. The Plan-Do-Study-Act (PDSA) cycle is shorthand for testing an intervention — by planning it, trying it, observing the results, and acting on what is learned. This is the scientific method used for action-oriented learning.

Reasons to Test Changes

- To see if the change will result in improvement.
- To decide which of several proposed changes can lead to the desired improvement.
- To evaluate how much improvement might be expected from the change.
- To decide whether the proposed change is likely to work in the actual environment of interest.
- To decide which combinations of changes are likely to have the desired effects on the important measures of quality.
- To evaluate costs, social impact, and side effects from a proposed change.
- To minimize resistance upon implementation.

Steps in the PDSA Cycle

Step 1: Plan

Plan intervention and assessment, including a plan for collecting data:

- State the objective of the initiative.
- Make predictions about what will happen and why.
- Develop a plan to test the change (Who? What? When? Where? What data need to be collected?).

Step 2: Do

Try out the interveniton on a small scale:

- Carry out the intervention.
- Measure the selected outcome(s) of interest
- Document problems and unexpected observations.

Step 3: Study

Set aside time to analyze the data and study the results:

- Analyze the data.
- Compare the findings to your predictions.
- Summarize and reflect on what was learned.

Step 4: Act

Refine the intervention, based on what was learned from the test:

- Determine what modifications should be made.
- Prepare a plan for the next test.

Example of a Test of Change (Plan-Do-Study-Act Cycle)

Depending on the aim, teams choose promising changes (interventions) and use Plan-Do-Study-Act (PDSA) cycles to test a change quickly on a small scale, see how it works, and refine the change as necessary before implementing it on a broader scale. The following example shows how a team started with a small-scale test.

Implementing Venous Thromboembolism Prevention interventions:

<p>PLAN:</p>	<p>Question for this cycle: How might the use of a Hospitalist admission order used by General Practitioners help improve the number of patients receiving appropriate VTE prevention?</p> <p>Theory: The admission order will serve as both a reminder and provide some structure for making appropriate clinical choices which should result in more patients receiving appropriate prophylaxis.</p> <p>Detailed plan: On Tuesday two GPs Hospitalists will test the order with five consecutive patients they admit or for a period of up to three days, whichever occurs first. The Hospitalist will review cases for appropriate prophylaxis and compare this to the rate for the preceding three days (or 10 patients).</p>
<p>DO:</p>	<p>The GPs both admitted five patients within three days using the admission order. They found the form easy to use and helpful, but suggested some modifications to the layout to make it clearer. For one admission the form was not used as the patient had clinical conditions not addressed on the form. The Hospitalist reviewed the admissions and recorded appropriateness.</p>
<p>STUDY:</p>	<p>The team reviewed the information and determined the rates of appropriateness had increased from four out of eight patients to four out of five patients with the use of the admission order. The GPs believed that the major benefit of the order was having details available to show the appropriate clinical practice for patients presenting with different conditions and as a reminder of the hospital's recommended prophylaxis options.</p>
<p>ACT:</p>	<p>They revised the form and added a section to address additional clinical conditions.</p> <p>Future cycles: Confirm the new form is an improvement (with the two GPs) and then expand the test to include additional GPs admitting patients to this site.</p>

Implement Changes

After testing a change on a small scale, learning from each test, and refining the change through several PDSA cycles, the change is ready for implementation on a broader scale—for example, for an entire pilot population or on an entire unit. Implementation is a permanent change to the way work is done and, as such, involves building the change into the organization. It may affect documentation, written policies, training, and other aspects of the organization's infrastructure that are not heavily engaged in the testing phase. Implementation also may benefit from the use of the PDSA cycle.

Example: Hospitalist Admission Order

Testing the change: Multiple cycles were completed to refine the order set and to increase the belief by the team that the admission order would work appropriately in the future. The tests included multiple patients on different days admitted by different GP Hospitalists.

Implementing a change: Once the team was reasonably sure the admission order would work they decided to make it permanent. The first cycle was to test the training approach to be used for new GPs joining the organization. This was followed by tests of a revised prophylaxis policy, IT support for the electronic version of the form and by tests of how to best communicate the new practice to patients and families. As the team learned and made adjustments, the form became imbedded in common practice within the organization. Data of appropriate VTE prophylaxis continued to be collected (but less frequently) to assure the new practices and use of the form continued.

Spread Changes

Spread is the process of taking a successful implementation process from a pilot unit or pilot population and replicating that change or package of changes in other parts of the organization or other organizations. During implementation, teams learn valuable lessons necessary for successful spread, including key infrastructure issues, optimal sequencing of tasks, and working with others to help them adopt and adapt a change.

Spread efforts may benefit from the use of the PDSA cycle. Units adopting the change need to plan how best to adapt the change to their unit and to determine if the change resulted in the predicted improvement.

As experience develops and measurement of the success of your VTE reduction strategies represents sustained improvement the process can be implemented for more patients in more areas. Evaluate at each new step before adding more units to the process. Retest the pilot process on new units in order to identify any revisions that may be needed. The roll-out across an organization requires careful planning to move through each of the major implementation phases.

The IHI's '*A Framework of Spread: From Local Improvements to System-Wide Change*' (www.ihl.org/IHI/Results/WhitePapers/AFrameworkforSpreadWhitePaper.htm) will assist teams to develop, test and implement a system for accelerating improvement by spreading change ideas within and between organizations. This paper will assist teams to "prepare for a spread; establish an aim for spread; and develop, execute, and refine a spread plan." Some issues to address in planning for spread include training and new skill development, supporting people in new behaviours that reinforce the new practices, problem solving, current culture regarding change, degree of buy-in by staff, and assignment of responsibility.

Further information on sustaining and spreading improvements can be accessed by using the following link: www.ihl.org/IHI/Results/WhitePapers/AFrameworkforSpreadWhitePaper.htm

APPENDIX E: Accreditation Canada's VTE ROP

Accreditation Canada supports the efforts of *Safer Healthcare Now!* to increase the use of optimal thromboprophylaxis in Canadian hospitals and, since January, 2011, VTE Prophylaxis has been added as a Required Organizational Practice (ROP) that is included in hospital accreditation reviews. The main goal of this ROP is that "the team identifies medical and surgical clients at risk of venous thromboembolism (DVT and PE) and provides appropriate thromboprophylaxis."¹ Meeting five specific *Tests for Compliance* are required to establish full compliance with the ROP. Following the SHN recommended approaches to prevention of VTE will satisfy Accreditation Canada's VTE ROP.

ote: The ROP only applies to patients ≥ 18 years of age in acute care hospitals.

The VTE Tests for Compliance are:

1. The organization develops and implements an organization-wide, written thromboprophylaxis policy or guideline.
2. The organization identifies clients at risk for VTE and provides appropriate evidence-based, VTE prophylaxis.
3. The organization establishes a measurement and audit process to track the use of appropriate thromboprophylaxis and uses this information to guide quality improvement.
4. The organization implements strategies to ensure that major orthopedic surgery clients (hip and knee replacements, hip fracture surgery) who require post-discharge prophylaxis are provided it.
5. The organization provides information to health professionals and clients about the risks of VTE and its prevention.

¹ Accreditation Canada. Required Organizational Practices. April 2016. Available from: <https://accreditation.ca/rop-handbooks>

APPENDIX F: Thromboprophylaxis Guideline /Protocol

VENOUS THROMBOPROPHYLAXIS POLICY AND GUIDELINES

[Version Date: 2015Dec01]

I. POLICY STATEMENT

Venous thromboembolism (VTE) is one of the most common complications of hospitalization and the most common preventable cause of hospital death. It is Sunnybrook policy that best practices be followed to ensure that hospitalized patients are assessed for their risk of VTE and receive appropriate thromboprophylaxis, if indicated.

SUNNYBROOK THROMBOPROPHYLAXIS POLICY

1. Every hospitalized patient should be assessed for VTE risk at the time of admission to hospital, at the time of a significant change in clinical status, at the time of transfer from one type of care unit to another, and at discharge; **AND**
2. Optimal, evidence-based thromboprophylaxis should be provided to every hospitalized patient in whom it is indicated based on their risk of thrombosis, their risk of bleeding, and available options at Sunnybrook.

II. THROMBOPROPHYLAXIS GUIDELINES

DEFINITIONS:

Venous thromboembolism (VTE) is a thromboembolic event ("blood clot") that develops within the venous system and includes both deep vein thrombosis and pulmonary embolism.

Deep vein thrombosis (DVT) is a thrombus ("blood clot") occurring in one or more deep veins, especially in the legs, where it may produce leg swelling and/or pain.

Pulmonary embolism (PE) is a thrombus that arises in a deep vein and embolizes to one or more of the pulmonary arteries where it may result in breathlessness, chest pain, hemoptysis, syncope, or death.

Thromboprophylaxis (TP) refers to the use of anticoagulant medication or mechanical methods to prevent VTE from developing in patients who are at risk.

BACKGROUND AND RATIONALE FOR THROMBOPROPHYLAXIS POLICY:

- Approximately 60% of the entire population burden of VTE is related to hospitalization (i.e., the VTE occurs either during the hospital stay or within a relatively short time after discharge).
- Without thromboprophylaxis, ~20% of hospital patients will develop asymptomatic DVT (with a range of up to 80%).

- DVT and PE produce unpleasant symptoms and considerable anxiety for patients, and may lead to death.
- The investigation and management of patients with suspected and proven VTE consumes considerable resources: VTE doubles hospital length of stay and costs of hospital care.
- VTE is the most common preventable cause of hospital death.
- More than 450 randomized trials demonstrate that the rates of DVT, symptomatic VTE, fatal PE, and all-cause mortality are reduced by the use of TP.
- Evidence-based guidelines have recommended the routine use of TP for most hospitalized patients since 1986.
- TP has been shown to reduce hospital-acquired VTE and is cost-saving.
- The use of TP has been ranked as the number one patient safety practice for hospitals.
- Since 2011, Accreditation Canada has made the provision of TP a Required Organizational Practice for Canadian hospitals.
- Therefore, routine evaluation of hospital patients for VTE risk and provision of TP are standards of care.

PRINCIPLES GUIDING THE SUNNYBROOK THROMBOPROPHYLAXIS GUIDELINES

1. **Appropriateness** defined by an appropriate:
 - a. modality for the patient's risks of VTE and bleeding
 - b. dose (if an anticoagulant)
 - c. timing after admission, after surgery or after transfer within the institution
 - d. compliance
 - e. duration
2. **Simplicity** - limit the available options consistent with patient safety and costs. For example, only one non-pharmacologic method of TP is used (ThromboEmbolic Deterrent stockings [TEDs]) and only one low molecular weight heparin (LMWH) is to be used for TP (enoxaparin).
3. **Standardization** - keep the number of TP options to a minimum both within and between patient groups.
4. **Routine** - since the overwhelming majority of hospital patients require TP, routine TP will be ordered unless there is an appropriate active decision to not provide it ("opt out").
5. **Continuous** - doses of LMWH are not held unless there is evidence of active bleeding or there is a substantial increase in bleeding risk. In particular, there is no need to withhold the QHS administration of LMWH for patients who are anticipated to have an invasive procedure the following day AND there is no need to withhold the AM administration of LMWH for most patients who are anticipated to have an invasive procedure that day.

6. ***Embedded in order sets*** - the use of routine pre-printed (and eventually computer) order sets is the most effective strategy to ensure that best practices are followed. As new order sets are developed at Sunnybrook, the appropriateness of a TP modality and its consistency with the official TP policy and guidelines is to be addressed.
7. ***Reassessment*** - at transitions of care within the hospital (post-operative, transfer to or from the ICU, transfer to another service), a reassessment of TP should be made. At the time of transfer to another acute care hospital, rehabilitation centre, long-term care facility, nursing home, or discharge home, a decision should be made to discontinue TP (as in most situations) or to recommend and, in some cases to arrange for, TP to continue after the transition.
8. ***Periodic review*** - the specifics of this policy are to be reviewed yearly (or more frequently if new evidence becomes available).

GENERAL APPROACH TO THROMBOPROPHYLAXIS AT SUNNYBROOK

The underlying principle guiding the use of thromboprophylaxis at Sunnybrook is that all patients at risk receive it. The general approach to TP at Sunnybrook involves three steps:

STEP 1: Is thromboprophylaxis NOT INDICATED?

- For patients who are fully mobile and expected to have a length of stay less than two calendar days, TP is generally not needed. Most patients who undergo out-patient or overnight-stay surgery do not require active TP.
- If no specific TP is provided, patients should be encouraged to be as mobile as possible.
- If a patient's clinical status changes significantly, a decision about TP should be reassessed at that time.

STEP 2: Is anticoagulant thromboprophylaxis CONTRAINDICATED?

- For patients who are actively bleeding or have a high risk of bleeding, anticoagulant TP is not given. In this situation, bilateral, properly measured and fitted, calf-length TEDs are placed.
- These patients should be reassessed daily for proper use of the stockings and bleeding risk. When the high bleeding risk decreases, LMWH should be started.
- For patients with heparin-induced thrombocytopenia (HIT), either currently or in the past, LMWH is contraindicated. In this setting, the TE Service should be contacted for advice - the most appropriate TP is generally fondaparinux 2.5 mg SC once daily.

STEP 3: PROVIDE THROMBOPROPHYLAXIS (see Appendix 1)

- **For most patients**, the recommended TP is enoxaparin 40 mg once daily, generally "once daily at 2200 h = QHS."
- In general, for **weight less than 40 kg**, it is recommended that a dose reduction to enoxaparin 30 mg SC once daily be used.

- In general, for **weight greater than 100 kg**, it is recommended that a dose increase to enoxaparin 40 mg SC BID be used. For weight >120 kg, even higher doses should be considered (e.g. enoxaparin 0.4 mg/kg SC BID).
- A dosage reduction is recommended for prophylactic doses of enoxaparin for patients with **severe renal impairment (creatinine clearance <30 ml/min)**. For most patients with severe renal impairment, the dose reduction is to enoxaparin 30 mg SC once daily.
- For patients greater than 100 kg and with severe renal impairment (creat clear <30 ml/min), the recommended enoxaparin dose is generally 30 mg SC Q12H.
- The 1st dose of enoxaparin is generally given at 2200 hours ("QHS") on the day of admission or the surgical day (occasionally started at 1000 hours that day or the following day).

References:

- Geerts WH, et al. Prevention of venous thromboembolism. American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th edition). *Chest* 2008;133(Suppl):381S-443S.
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- Falck-Ytter Y, 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(Suppl):e278S-e325S.

Appendix 1: Specific Thromboprophylaxis Recommendations¹

Patient group	Recommended Thromboprophylaxis options ^{2,3,4}	Initiation	Duration ⁵
High bleeding risk ⁶	<ul style="list-style-type: none"> Properly-fitted, bilateral calf-length TEDs used continuously (except for bathing) 	<ul style="list-style-type: none"> ASAP after emergency admission Just <u>prior to</u> surgery for elective surgical procedures 	<ul style="list-style-type: none"> Until bleeding risk allows the use of enoxaparin
Heparin-induced thrombocytopenia (HIT) (current or previous)	<ul style="list-style-type: none"> Suggest TE consult No heparin or LMWH fondaparinux 2.5 mg SC once daily 	<ul style="list-style-type: none"> As soon as the diagnosis of HIT considered 	<ul style="list-style-type: none"> Discharge <u>and</u> platelet count >120x10⁹/L
Burn unit patients	<ul style="list-style-type: none"> Use Burn Unit order sets enoxaparin 40 mg SC QHS 	<ul style="list-style-type: none"> When there is evidence of primary hemostasis 	<ul style="list-style-type: none"> Until discharge
Cardiovascular surgery	<ul style="list-style-type: none"> See CVS Antithrombotic Management Guideline Use CVS order sets In most cases, the prophylaxis is enoxaparin 30 mg SC QHS 	<ul style="list-style-type: none"> See CVS order sets 	<ul style="list-style-type: none"> Until discharge
Critical care	<ul style="list-style-type: none"> Use Critical Care order sets In most general critical care patients, the prophylaxis is enoxaparin 40 mg SC QHS For patients at high risk of bleeding, properly-fitted, bilateral calf-length TEDs until enoxaparin can be started 	<ul style="list-style-type: none"> 1st dosing time after admission, if appropriate See Critical Care order sets 	<ul style="list-style-type: none"> Until discharge Include thromboprophylaxis in transfer orders
General surgery	<ul style="list-style-type: none"> Use one of three General Surgery order sets (Hepatopancreaticobiliary, Colorectal surgery, Access) In most cases, the prophylaxis is enoxaparin 40 mg SC QHS For patients undergoing hepatobiliary/pancreatic/gastric cancer surgery, TEDs are started preop and used continuously along with enoxaparin For patients at high risk of bleeding, properly-fitted, bilateral calf-length TEDs until enoxaparin can be started 	<ul style="list-style-type: none"> 0-1 hour preop (if no epidural or HPB surgery) <u>or</u> 4 hours after insertion of epidural <u>or</u> For HPB surgery, start at 2200 hours on day of surgery or next AM 	<ul style="list-style-type: none"> Until discharge For selected, high risk cancer patients → continue enoxaparin 40 mg SC or rivaroxaban 10mg once daily for ~30 days

Patient group	Recommended Thromboprophylaxis options ^{2,3,4}	Initiation	Duration ⁵
Gynecology	<ul style="list-style-type: none"> • Use Gynecology order set • In most cases, the prophylaxis is enoxaparin 40 mg SC QHS • For patients at high risk of bleeding, properly-fitted, bilateral calf-length TEDs until enoxaparin can be started 	<ul style="list-style-type: none"> • 1st dosing time after ER admission or postop <u>or</u> • The following morning if there are bleeding concerns 	<ul style="list-style-type: none"> • Until discharge
Hip & knee arthroplasty	<ul style="list-style-type: none"> • Use Arthroplasty order set • In most cases, the prophylaxis is rivaroxaban 10 mg PO QAM • For patients with an indwelling epidural catheter, enoxaparin 40 mg SC QAM is given until the epidural is removed and then the patient is switched to rivaroxaban 10 mg PO once daily • For patients with severe renal dysfunction (CrCl <30 mL/min), do NOT use rivaroxaban; use enoxaparin 30 mg SC QAM or warfarin or heparin U SC TID 	<ul style="list-style-type: none"> • Morning after surgery 	<ul style="list-style-type: none"> • 15 days • 28 days if high risk (e.g. previous VTE after TJR)
Hip fracture	<ul style="list-style-type: none"> • Use Hip Fracture admission and postop order sets • enoxaparin 40 mg SC once daily starting postop • enoxaparin 30 mg SC once daily if weight less than 40 kg or CrCl <30 mL/min 	<ul style="list-style-type: none"> • If surgery is delayed, start enoxaparin 30 mg SC QHS on admission 	<ul style="list-style-type: none"> • At least 10 days (generally 2-3 weeks)
Internal medicine (and medical subspecialties)	<ul style="list-style-type: none"> • Use Internal Medicine admission order set • For most patients, enoxaparin 40 mg SC QHS • enoxaparin 30 mg SC once daily if weight less than 40 kg or CrCl <30 mL/min • For patients at high risk of bleeding, properly-fitted, bilateral calf-length TEDs until enoxaparin can be started 	<ul style="list-style-type: none"> • 1st dosing time after admission 	<ul style="list-style-type: none"> • Until discharge
Lower extremity amputation	<ul style="list-style-type: none"> • enoxaparin 40 mg SC QHS 	<ul style="list-style-type: none"> • 1st dosing time after surgery 	<ul style="list-style-type: none"> • Until discharge from rehab

Patient group	Recommended Thromboprophylaxis options ^{2,3,4}	Initiation	Duration ⁵
Neurosurgery	Three options: <ul style="list-style-type: none"> For patients at high risk of bleeding → properly-fitted, bilateral calf-length TEDs enoxaparin 40 mg SC once daily Start with bilateral calf-length TEDs and switch to LMWH when risk of bleeding decreases 	<ul style="list-style-type: none"> For TEDs, start just prior to surgery for elective surgical procedure and ASAP after admission for major neurotrauma or nontraumatic intracranial hemorrhage For enoxaparin, no sooner than day after surgery 	<ul style="list-style-type: none"> Until discharge
Oncology (medical and radiation)	<ul style="list-style-type: none"> See Oncology Thromboprophylaxis Guideline Use Oncology admission order set enoxaparin 40 mg SC QHS For patients at high risk of bleeding, properly-fitted, bilateral calf-length TEDs until enoxaparin can be started 	<ul style="list-style-type: none"> 1st dosing time after admission 	<ul style="list-style-type: none"> Until discharge Consider benefits vs risk of post-discharge thromboprophylaxis
Spinal cord injury	<ul style="list-style-type: none"> TE service should manage the thromboprophylaxis for these patients enoxaparin 40 mg SC QHS once there is evidence of primary hemostasis After approx. 1-5 days, the dose of enoxaparin is generally increased to 40 mg BID After 7-14 days, most patients transition to rivaroxaban 15 mg PO once daily 	<ul style="list-style-type: none"> ASAP after admission (once hemostasis is evident) 	<ul style="list-style-type: none"> Until discharge from rehab
Spine surgery	a) Uncomplicated <ul style="list-style-type: none"> Mobilization alone b) Complicated (combined ant/post procedure, cancer, leg weakness) <ul style="list-style-type: none"> enoxaparin 40 mg SC daily Consider TE consult if active cancer or neurologic deficit 	<ul style="list-style-type: none"> Evening or morning after surgery 	<ul style="list-style-type: none"> Until discharge

Patient group	Recommended Thromboprophylaxis options ^{2,3,4}	Initiation	Duration ⁵
Stroke - ischemic	<ul style="list-style-type: none"> • Use Stroke admission order set • For most patients, enoxaparin 40 mg SC QHS • enoxaparin 30 mg SC daily if weight less than 40 kg or CrCl <30 mL/min • For patients at high risk of bleeding, properly-fitted, bilateral calf-length TEDs until enoxaparin can be started 	<ul style="list-style-type: none"> • 1st dosing time after admission 	<ul style="list-style-type: none"> • Until discharge
Stroke - hemorrhagic	<ul style="list-style-type: none"> • Use Stroke admission order set • Bilateral, properly-fitted, calf-length TEDs • After approx. 5-7 days, consider switch to enoxaparin as for ischemic stroke 	<ul style="list-style-type: none"> • On admission 	<ul style="list-style-type: none"> • Until discharge
Trauma	<ul style="list-style-type: none"> • For patients at high risk of bleeding, properly-fitted, bilateral calf-length TEDs until enoxaparin can be started • Usual risk patients: enoxaparin 40 mg SC QHS High risk patients (complex lower extr fracture): enoxaparin 40 mg SC BID • For selected, high risk patients (e.g. spinal cord injury, major lower extremity fracture) who will require rehab, enoxaparin is often replaced by rivaroxaban 15 mg PO once daily to be continued until discharge from rehab • TE service will assess all trauma admissions and will follow selected trauma patients as needed 	<ul style="list-style-type: none"> • ASAP after admission (once hemostasis is evident) 	<ul style="list-style-type: none"> • Until discharge from rehab
Urology	<ul style="list-style-type: none"> • Use Urology order sets • In most cases, the prophylaxis is enoxaparin 40 mg SC once daily • For patients at high risk of bleeding, properly fitted, bilateral, calf-length TEDs until enoxaparin can be started 	Options: <ul style="list-style-type: none"> • 1-0 hour preop • 1st dosing time after surgery • Morning after surgery if there are bleeding concerns • 1st dosing time after ER admission or postop 	<ul style="list-style-type: none"> • Until discharge

Abbreviations: ASAP = as soon as possible; ER = Emergency; TEDs = ThromboEmbolic Deterrent stockings

Footnotes to the Table:

1. Not every patient group is included here - use the recommendations for the group on the list that is most similar or individualize TP consistent with the Sunnybrook policy.
2. Although the recommended options apply to most patients in each risk group, individual patient factors may suggest an alternate approach.
3. For all patients in whom it is possible and appropriate, early and frequent mobilization and ambulation are essential.
4. In general, for weight less than 40 kg or creatinine clearance <30 mL/min, it is suggested that the prophylactic LMWH dose be reduced to the next lower pre-filled syringe dose (e.g., from enoxaparin 40 mg to 30 mg SC once daily). In general, for weight greater than 100 kg, it is suggested that the LMWH dose be doubled (e.g., from enoxaparin 40 mg once daily to 40 mg SC BID).
5. The duration of thromboprophylaxis is not based on mobility status alone.
6. Contraindications to anticoagulant TP are: active, clinically-important bleeding, platelets less than $30 \times 10^9/L$, major bleeding disorder, current or previous heparin-induced thrombocytopenia (a contraindication to heparin and LMWH). Relative contraindications to anticoagulant TP are: recent intracranial hemorrhage, recent perispinal bleeding, recent high bleeding risk surgery.

APPENDIX G: Example of a Standardized Order Set - General Internal Medicine with Thromboprophylaxis Module



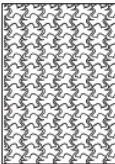
HEALTH SCIENCES CENTRE

PHYSICIAN'S ORDERS

**General Internal Medicine
Standard Admission Orders**

DATE: _____ YYYY / MM / DD TIME (h): _____

PATIENT IDENTIFICATION

		SIGNATURE OF NURSE	
YES	NO	Doctor Must Check Off Appropriate Orders	
Admitting Team and Diagnosis			
		1. Admit to General Internal Medicine	
		2. Team: <input type="checkbox"/> Blue <input type="checkbox"/> Green <input type="checkbox"/> Red <input type="checkbox"/> Yellow <input type="checkbox"/> Orange	
		3. Attending Physician: _____ (Print Name)	
		4. Admission Diagnosis: _____	
Monitoring and General Care			
		5. Monitor vital signs every _____ hours	
		6. Monitor fluid intake and output every _____ hours	
		7. Measure patient's weight <input type="checkbox"/> on admission <input type="checkbox"/> daily <input type="checkbox"/> Other _____	
		8. Glucose point of care testing <input type="checkbox"/> every _____ hours for 48 hours then reassess	
		9. Discontinue foley catheter when patient arrives to ward	
		10. Foley catheter to straight drainage; insert catheter if not already inserted	
Respiratory			
		11. Maintain oxygen saturation at: <input type="checkbox"/> greater than 92% OR <input type="checkbox"/> between 88% to 92%	
		12. Administer oxygen by Venturi mask ONLY, do not use nasal cannula	
Fluids			
		13. Saline lock	
		14. Intravenous fluid _____ at _____ mL/h with <input type="checkbox"/> No potassium <input type="checkbox"/> Potassium chloride at <input type="checkbox"/> 20 mmol/L OR <input type="checkbox"/> 40 mmol/L	
Diet and Activity			
		15. Diet: <input type="checkbox"/> regular <input type="checkbox"/> healthy heart <input type="checkbox"/> no added salt <input type="checkbox"/> diabetic _____ kcal <input type="checkbox"/> Dysphagia diet <input type="checkbox"/> NPO <input type="checkbox"/> NPO, may give oral medications <input type="checkbox"/> NPO, may give oral medications crushed and mixed in applesauce <input type="checkbox"/> Other diet order: _____	
		16. Activity: <input type="checkbox"/> as tolerated <input type="checkbox"/> Other _____	
Doctor's Signature:		PRINT NAME:	Pager:

DISTRIBUTION: White Original - Chart Yellow Copy - Pharmacy

PR 99979
(2010/06/18)

Page 1 of 2



PATIENT IDENTIFICATION

[illegible]

Excerpt from:

Guidelines for Prevention and Treatment of Venous Thromboembolism

Indication	Recommendations for Prophylaxis
Medical patients (e.g. congestive heart failure, severe respiratory disease, confined to bed with active cancer, previous venous thromboembolism, sepsis, acute neurologic disease, inflammatory bowel disease, etc.)	<p>➔ Enoxaparin 40 mg SC daily at bedtime* OR</p> <p>➔ Enoxaparin 30 mg SC daily at bedtime for patients with CrCl less than 30 mL/min** OR weighing less than 40 kg</p> <p>For patients at high risk of bleeding only, properly measured, bilateral, below-the-knee TED stockings. Reassess daily for conversion to enoxaparin.</p>
Stroke, hemorrhagic	<p>➔ Properly measured, bilateral, below-the-knee TED stockings initially; reassess daily for conversion to enoxaparin. When "safe":</p> <p>➔ Enoxaparin 40 mg SC daily at bedtime* OR</p> <p>➔ Enoxaparin 30 mg SC daily at bedtime for patients with CrCl less than 30 mL/min** or weighing less than 40 kg</p>
Stroke, non-hemorrhagic	<p>➔ Enoxaparin 40 mg SC daily* at bedtime</p> <p>➔ Enoxaparin 30 mg SC daily at bedtime for patients with CrCl less than 30 mL/min** or weighing less than 40 kg</p> <p>For patients at high risk of bleeding only, properly measured, bilateral, below-the-knee TED stockings. Reassess daily for conversion to enoxaparin.</p>

* Consider increasing the dose of enoxaparin to 40 mg SC BID for patients weighing more than 100 kg

** Consider giving enoxaparin 40 mg SC daily for patients with CrCl less than 30 mL/min and weighing greater than 100 kg

APPENDIX H: Audit Tool and Instructions

Thromboprophylaxis One-Day Audit

January 26, 2017

Instructions for Pharmacists:

1. On the day of the audit, you will receive three reports:
 - a. An *Active Patient Census* for your unit for that day.
 - b. An *Audit Data Collection Table* with the names and MRNs of all the patients on the unit with boxes for checking the appropriate anticoagulant.
 - c. *Drug Usage Evaluation Reports* summarizing the patients on your unit who have been ordered anticoagulants (e.g. Fragmin, warfarin, etc) and have an order entered in the pharmacy system as of 7:30am on January 26, 2017.
2. Please complete your *Audit Data Collection Table* checking the most appropriate boxes. Patients can have more than one box checked off if they are on multiple anticoagulants (e.g. someone on Fragmin being transitioned to warfarin). Please also include your name and pager number on the form in case there is a need to clarify any data.
3. For any patients who do not appear to be on anticoagulants (either therapeutic or prophylactic), please complete a *Supplemental Data Collection Sheet*. A separate sheet needs to be filled out for each patient not on anticoagulants.
4. For the *Supplemental Data Collection Sheet*:
 - a. begin by completing the unit, the patient's MRN, and your name.
 - b. for Part A, using the patient's chart, please choose the most appropriate reason for the patient not receiving anticoagulation.
 - c. for Part B, using the patient's chart, please check off whether a pre-printed order form was used that included an option for thromboprophylaxis.
5. Once you have gone through the patients on your unit, please ensure that your *Audit Data Collection Table* is complete. Every patient should have at least one checkmark in the row beside their name.
6. Please also try to keep track of the amount of time that it took you to complete the audit per unit and record that on the coloured sheet in your package.
7. Please return all completed forms by 4 pm on January 26, 2017.

NOTE: All data must be collected on January 26, 2017.

If at any time you have any questions, need assistance, or feel unable to complete data collection on your unit due to time restrictions, please page.

Thank you very much for your participation in this audit.

Audit tool (Example for patients with an indication for thromboprophylaxis):

Eligible patient	Is there a formal pre-printed order set that contains one or more orders for thromboprophylaxis used on admission or after surgery?	Type of Thromboprophylaxis Delivered	Receiving appropriate Thromboprophylaxis	*Reason Recommended Thromboprophylaxis Was Not Used
Patient identifier	<input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/> Mechanical prophylaxis <input type="checkbox"/> heparin <input type="checkbox"/> dalteparin (Fragmin™) <input type="checkbox"/> enoxaparin (Lovenox™) <input type="checkbox"/> nadroparin (Fraxiparine™) <input type="checkbox"/> tinzaparin (Innohep™) <input type="checkbox"/> fondaparinux (Arixtra™) <input type="checkbox"/> warfarin <input type="checkbox"/> dabigatran (Pradaxa™) <input type="checkbox"/> rivaroxaban (Xarelto™) <input type="checkbox"/> apixaban (Eliquis™)	<input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/> No thromboprophylaxis <input type="checkbox"/> Mechanical prophylaxis alone was used without a bleeding contraindication <input type="checkbox"/> Wrong DRUG was used <input type="checkbox"/> Wrong DOSE was used <input type="checkbox"/> Delay in starting > 24 hours after the end of surgery OR > 24 hrs after admission to hospital <input type="checkbox"/> thromboprophylaxis was delivered for an insufficient duration

Supplemental Data Collection Sheet for Patients NOT on Therapeutic or Prophylactic Anticoagulants

Unit: _____

Data Collected By: _____

MRN: _____

Part A:

Please check off the most appropriate reason for patient not receiving anticoagulation:

- ☐ Thromboprophylaxis **WAS ORDERED** but the order was not pulled or was not in WORx
Order For: _____
- ☐ Therapeutic anticoagulation **WAS ORDERED** but did not appear in WORx
Order For: _____
- ☐ Thromboprophylaxis is **NOT INDICATED**
Why?
 - ☐ Patient is fully mobile
 - ☐ Patient was admitted yesterday and being discharged today
 - ☐ ACS (patient currently on clopidogrel and ASA)
 - ☐ Other (please specify): _____
- ☐ There is a documented **CONTRAINDICATION** to thromboprophylaxis
Why?
 - ☐ Active bleeding
 - ☐ High risk of bleeding (e.g. potential GI bleed, platelets <50 000, Hb <70)
 - ☐ Other (please specify): _____

Is there an order for TED stockings?

 - ☐ Yes
 - ☐ No
 - ☐ No, not an option due to amputation/injury/severe peripheral vascular disease
- ☐ Thromboprophylaxis was **INDICATED** but **NOT ORDERED**.

Part B:

Was there an admission or pre-operative pre-printed order set used for this patient that included DVT prophylaxis?

- ☐ Yes
- ☐ No

If yes, was the DVT prophylaxis section filled out?

- ☐ Yes
- ☐ No

APPENDIX I: Example of Thromboprophylaxis Discharge Letter



CLINICAL THROMBOEMBOLISM DISCHARGE LETTER

To: St. John's Rehab

Re: Mr. John Smith Date: Aug 30, 2016

Dear Doctor:

This patient is being discharged from Sunnybrook Health Sciences Centre on anticoagulants as:

VTE prophylaxis post-hip fracture

I recommend that the patient remain on

enoxaparin 40mg subcutaneously daily for 2 more weeks
(until Sept 13, 2016)

☐ Please aim to keep the Prothrombin Time (INR) in the target range of _____ to _____.

☒ I have / have not arranged follow-up of this patient.

Date	INR	Warfarin dose

If you have questions, please call at one of the numbers below:

☒ William Geerts, MD, FRCPC
Consultant physician
(416) 480-5953 or (416) 480-4244

☐ Anne McLeod, MD, FRCPC
Consultant physician
(416) 480-5376 or (416) 480-4244

☐ Richard Jay, MD, FRCPC
Consultant physician
(416) 480-6161 or (416) 480-4244

☐ Rita Selby, MD, FRCPC
Consultant physician
(416) 480-5105 or (416) 480-4244

Version: 2013 Jul 16

8. Measurement

APPENDIX J: Measurement - Technical Descriptions

- Technical Description of the Measurement Worksheets:

Implementation Stages - Definitions apply to all interventions and measures

Baseline Stage (Pre-intervention) - Data collected for Baseline should be collected prior to implementing small tests of change and reflect the current process.

Early (Partial) Implementation Stage - The team has set a clear aim(s) for the Prevention of Venous Thromboembolism intervention, identified which measures will indicate if the changes will lead to improvement, and started to implement small tests of change (PDSA) to identify and refine processes, procedures and practices which will lead to improvement and achieving the aim. When the team is close to goal they are ready to move to Full Implementation.

Full Implementation Stage (At Goal) - The processes, procedures and practices are finalized and have led to significant improvement. These practices on the selected unit are being consistently applied and monitored, showing a sustained performance at or close to goal. The team has achieved their aim(s) and is ready to spread to other areas.

As of June 1, 2016, *Safer Healthcare Now!* is no longer collecting data and Patient Safety Metrics is no longer available. Our Central Measurement Team continues to offer expert measurement coaching and consultation.

1.0 Per cent of Patients Receiving Appropriate Venous Thromboembolism Prophylaxis - Technical Description

Intervention: Prevention of Venous Thromboembolism (VTE)

Definition: Appropriate Venous Thromboembolism Prophylaxis rate: The percentage of eligible patients receiving appropriate thromboprophylaxis for the target patient group. Please provide the data described below using the results of (a) an audit of appropriate thromboprophylaxis use as described in the Getting Started Kit) in (b) at least one patient group (the target group).

Goal: Improve per cent of patients receiving appropriate VTE Prophylaxis to a target of at least 80% in one year.

CALCULATION DETAILS:

Numerator Definition: The total number of patients in the audit sample who received appropriate VTE prophylaxis as described in the VTE Getting Started Kit ([Section 2, Table 4](#)).

Numerator Exclusions: None

Denominator Definition: The total number of patients in the audit sample during this reporting period who are at risk according to the VTE Getting Started Kit ([Section 1, Table 1](#)).

Denominator Exclusions: Excludes patients on therapeutic anticoagulation, patients with a LOS < 2 calendar days (can also consider excluding patients on alternate level of care (ALC) / awaiting placement, etc.)

Calculate as: Number of patients receiving appropriate VTE prophylaxis / Total number of patients in sample [x 100] = Per cent of Patients Receiving Appropriate Venous Thromboembolism Prophylaxis

Measurement Period Length: Measure periodically (e.g. monthly)

Definition of Terms:

- **Appropriate Venous Thromboembolism Prophylaxis:** Appropriate thromboprophylaxis use as described in the Getting Started Kit ([Section 2, Table 4](#) and [Section 4, Item 6](#))
- **Target patient group:** Identified by the team or institution and could include, for example: all acute care patients, all patients admitted under General Medicine.
- **Eligible patients:** Patients in the sample with an indication for Thromboprophylaxis (see the Background section and [Section 1, Table 1](#))

COLLECTION STRATEGY:**Data Collection Approach:**

Sampling Plan: It is suggested that the sample include at least 20 patients

Include one of the following options:

1. A sample of consecutive admitted patients for one group e.g. the next 20 admitted general surgical patients every month.
2. At least one entire patient group on at least one day (e.g. arthroplasty, hip fracture, major general surgery, gynecology, ICU, general internal medicine, neurosurgery, etc.)
3. At least one patient care area (nursing unit) on at least one day/month.
4. A random sample of at least 10% of the in-patient population on at least one day/month.
5. A sample of consecutive admitted patients (e.g. the next 50 admitted patients/monthly.)

Report the monthly rate for the last several months (minimum three months). This will serve as your baseline. Continue to track the measure monthly. If possible, track the rate in an annotated run chart, with notes reflecting any interventions you made to improve.

2.0 Type of Thromboprophylaxis Delivered - Technical Description

Intervention: Prevention of Venous Thromboembolism (VTE)

Definition: The percentage of eligible patients receiving appropriate thromboprophylaxis (right drug, right dose, right start, right duration) for the target patient group.

Goal: 100% of patients receive prophylaxis

CALCULATION DETAILS:

Numerator Definition: The total number of patients who received specific thromboprophylaxis for the target patient group for the reporting period.

Individual Numerators: The total number of patients who received individual thromboprophylaxis types as listed below:

- (1) Mechanical prophylaxis (IPC, GCS)
- (2) heparin
- (3) dalteparin (Fragmin™)
- (4) enoxaparin (Lovenox™)
- (5) nadroparin (Fraxiparine™)
- (6) tinzaparin (Innohep™)
- (7) fondaparinux (Arixtra™)
- (8) warfarin
- (9) dabigatran (Pradaxa™)
- (10) rivaroxaban (Xarelto™)
- (11) apixaban (Eliquis™)
- (12) other: _____
- (13) none

Numerator Exclusions:

- None

Denominator Definition: The total number of patients in the audit sample during this reporting period who are eligible for inclusion based on the criteria listed in the VTE Getting Started Kit (see the Background section).

Denominator Exclusions:

- None

Individual Type of Prophylaxis: The measurement worksheet is designed to allow the team to monitor use of each of the types of prophylaxis listed above on an individual basis. The use of each element will be visually displayed on the run chart titled *“Individual Type of Prophylaxis”*. The team will be able to use this information to identify gaps in practice (e.g. more education required for healthcare professionals).

Measurement Period Length: Measure periodically (e.g. monthly).

Definition of Terms:

- None

Calculate as: Number of patients who received specific thromboprophylaxis options for the target patient group in the monthly sample / Number of patients who had an indication for thromboprophylaxis.

Comments: None

COLLECTION STRATEGY:

Data Collection Approach:

Sampling Plan: It is suggested that the sample include at least 20 patients

Include one of the following options:

1. A sample of consecutive admitted patients for one group e.g. the next 20 admitted general surgical patients every month
2. At least one entire patient group on at least one day (e.g. arthroplasty, hip fracture, major general surgery, gynecology, ICU, general internal medicine, neurosurgery, etc.)
3. At least one patient care area (nursing unit) on at least one day/month
4. A random sample of at least 10% of the in-patient population on at least one every month
5. A sample of consecutive admitted patients e.g. the next 50 admitted patients/monthly

Report the monthly rate for the last several months (minimum three months). This will serve as your baseline. Continue to track the measure monthly. If possible, track the rate in an annotated run chart, with notes reflecting any interventions you made to improve

Data Accuracy: Data accuracy is enhanced when all definitions are used without modification.

3.0 Reason Recommended Thromboprophylaxis Was Not Used (Optional Measure) - Technical Description

Intervention: Prevention of Venous Thromboembolism (VTE)

Definition: The reason why eligible patients DID NOT receive thromboprophylaxis recommended for the target patient group.

Goal: 100% of patients receive prophylaxis

CALCULATION DETAILS:

Numerator Definition: The total number of patients in the denominator who DID NOT meet the recommended standard of practice for thromboprophylaxis or their surgery-specific target group because (select the reason below that best aligns):

1. No thromboprophylaxis was used
2. Mechanical prophylaxis alone was used without a bleeding contraindication
3. The wrong DRUG was used
4. The wrong DOSE was used
5. There was a delay in starting > 24 hours after the end of surgery or OR > 24 hrs after admission to hospital
6. The thromboprophylaxis was delivered for an insufficient duration

Numerator Exclusions:

- None

Denominator Definition: The total number of patients during this reporting period in the audit sample selected who are eligible for inclusion based on the criteria listed in the VTE Getting Started Kit (see the [Background section](#) and [Section 1, Table 1](#)) who DID NOT receive appropriate thromboprophylaxis.

Denominator Exclusions:

- Patients who are not eligible to receive thromboprophylaxis

Measurement Period Length: Measure monthly.

Definition of Terms:

- None

Calculate as: The total number of patients in the denominator who DID NOT meet the recommended standard of practice for thromboprophylaxis for their specific target group due to one of the reasons listed in the “numerator” above / the total number of patients who met the criteria for inclusion during this month who DID NOT receive appropriate thromboprophylaxis x 100.

Comments: None

COLLECTION STRATEGY:**Data Collection Approach:****Sampling Plan:**

It is suggested that the sample include a representative sample (e.g. 20-50 patients, as described below).

Include one of the following options:

1. A random sample of at least 10% of the in-patient population on at least one day
2. At least one patient care area (nursing unit) on at least one day
3. At least one entire patient group on at least one day (e.g. arthroplasty, hip fracture, major general surgery, gynecology, ICU, general internal medicine, neurosurgery)
4. A sample of consecutive admitted patients e.g. the next 50 admitted patients
5. A sample of consecutive admitted patients for one group e.g. the next 20 admitted hip fracture patients

Data Accuracy: Data accuracy is enhanced when all definitions are used without modification.

4.0 Per cent of Appropriate Use of Order Sets for Venous Thromboembolism Prophylaxis - Technical Description

Intervention: Prevention of Venous Thromboembolism (VTE)

Definition: Appropriate Order Set Use: The percentage of patients in the target patient group (audit sample) for whom a pre-printed order set (or CPOE) was used on admission or following surgery. The pre-printed order set (or CPOE) must include orders for VTE Prophylaxis. All patients in the target group (audit sample) are eligible for inclusion regardless of VTE risk or whether prophylaxis was ordered. *Target groups may include a specific patient group, such as patients undergoing Hip or Knee arthroplasty or could cover a patient service (e.g. patients admitted under General Medicine). Use separate sheets for monitoring individual patient groups.*

Goal: To incorporate appropriate VTE prophylaxis into order sets with a goal of using them for a target of 100% of admission or post-operative orders.

CALCULATION DETAILS:

Numerator Definition: The total number of patients in the audit sample who had a formal, pre-printed order set or CPOE with VTE prophylaxis used on admission or after surgery and that was completed appropriately. *Indicate the target group you have selected to monitor.*

Numerator Exclusions: None

Denominator Definition: The total number of patients who are included in this month's audit sample who are at risk for VTE according to the Getting Started Kit (see the [Background Section](#) and [Section 1, Table 1](#))

Denominator Exclusions: Excludes patients on therapeutic anticoagulation, patients with a LOS < 2 calendar days (can also consider excluding patients on alternate level of care (ALC) / awaiting placement, etc.)

Calculate as: Number of patients with an order set, completed appropriately, used for admission or post-operatively/ Total number of patients in sample [x 100] = Per cent of Appropriate Use of Order Sets or CPOE for Venous Thromboembolism Prophylaxis.

Measurement Period Length: Measure periodically (e.g. monthly)

Definition of Terms:

- **Order Set:** A set of orders either in paper format or as part of Computerized Provider Order Entry (CPOE) used for admitting patients to hospital or after a surgical procedure. For this measure the pre-printed order set (or CPOE) must include orders for VTE Prophylaxis and must be completed appropriately.

- **Target patient group:** Identified by the team or institution and could include, for example: all acute care patients, all patients admitted under General Medicine, a random sample of 20 patients admitted for General Surgery, etc.
- **Eligible patients:** all patients in the sample

COLLECTION STRATEGY:

Data Collection Approach: Sampling Plan

- Would be based on the sample group previously identified by the institution or team
- At least 50 patient should be included in the sample

May include one of the following options:

1. A sample of consecutive admitted patients for one group (e.g. the next 50 admitted general surgical patients/ every month)
2. At least one entire patient group on more than one day (e.g. arthroplasty, hip fracture, major general surgery, gynecology, ICU, general internal medicine, neurosurgery, etc.)
3. At least one patient care area (nursing unit) on more than one day/month
4. A random sample of at least 10% of the in-patient population on at least one day/month
5. A sample of consecutive admitted patients e.g. the next 50 admitted patients every month

Report the monthly rate for the last several months (minimum three months). This will serve as your baseline. Continue to track the measure monthly. If possible, track the rate in an annotated run chart, with notes reflecting any interventions you made to improve. If your organization reports data quarterly, we strongly encourage you to disaggregate this data and report monthly.

5.0 Description of the Organization

Intervention(s): Prevention of Venous Thromboembolism (VTE)

Definition: For each participating hospital, baseline information about the hospital will be collected and updated annually using this standard reporting form. The following process measures are linked to the recommended steps in implementing appropriate VTE prophylaxis (which will also assist organizations achieve compliance with the Accreditation Canada VTE ROP).

Goal: Does not apply to this worksheet

WORKSHEET COMPLETION DETAILS:

This worksheet is designed for the annual collection of healthcare facility-specific information relevant to Venous Thromboembolism.

Process Measures:

- 1) Does your organization have a **hospital-wide written thromboprophylaxis policy**?
 - No
 - Yes, we have thromboprophylaxis policies for certain patient groups but not a hospital-wide policy
 - We have a fully-approved and implemented, hospital-wide thromboprophylaxis policy
 - Other (please explain) : _____
- 2) Does your organization have a method to **identify hospital patients at risk for VTE and provide them with thromboprophylaxis consistent with the thromboprophylaxis policy**?
 - No formal method or individual physicians make thromboprophylaxis decisions about individual patients
 - Yes, at least for some patient groups, we have a formal method to routinely identify patients at risk for VTE and routinely provide them with thromboprophylaxis consistent with the hospital policy
 - Yes, for most patient groups, we have a formal method to routinely identify patients at risk for VTE and routinely provide them with thromboprophylaxis consistent with the hospital policy
 - Yes, for all (or almost all) patient groups, we have a formal method to routinely identify patients at risk for VTE and routinely provide them with thromboprophylaxis consistent with the hospital policy
 - Yes, we apply a formal VTE risk assessment model to each admitted patient which is linked to risk-appropriate thromboprophylaxis consistent with the hospital policy
 - Other (please explain) : _____

- 3) Does your organization **audit appropriate thromboprophylaxis use**?
- No thromboprophylaxis audit has been done in the past 6 months
 - An audit of any thromboprophylaxis use in one (or more) patient group(s) was carried out in the past 6 months. Please provide details of the audit: _____
 - An audit of appropriate thromboprophylaxis use in one patient group was carried out in the past 6 months. Please provide details of the audit: _____
 - An audit of appropriate thromboprophylaxis use was carried out in at least 2 patient groups in the past 6 months. Please provide details of the audits: _____
 - Regular audits (at least once a month) of appropriate thromboprophylaxis use was carried out in at least one patient group in the past 6 months. Please provide details of the audits: _____
 - An audit of appropriate thromboprophylaxis use was carried out in every admitted patient at least once over the past 6 months. Please provide details of the audit: _____
 - Other (please explain): _____
- 4) Does your organization have a formal strategy to identify every high-risk orthopedic surgery patient (THR, TKR, HFS) who requires **post-discharge thromboprophylaxis** and have a mechanism in place to ensure that these patients receive it?
- Our organization does not provide care for high-risk orthopedic surgery patients
 - Our organization does not have a formal strategy to identify high-risk orthopedic surgery patients appropriate for post-discharge thromboprophylaxis
 - High risk orthopedic surgery patients are not provided with post-discharge thromboprophylaxis
 - Post-discharge thromboprophylaxis is generally provided to high-risk orthopedic surgery patients at the discretion of the individual surgeons
 - Our organization has a formal strategy to identify high-risk orthopedic patients and consistently provides post-discharge thromboprophylaxis to them
- 5) Does your organization formally **provide information about VTE and its prevention** to the majority of **health professionals** at least once every 6 months (grand rounds, mailing or emailing to each member of the group)?
- Our organization has not provided formal education about VTE and its prevention to health professionals over the 6 months
 - Our organization has provided formal education about VTE and its prevention to one or more of the following health professional groups in the past 6 months (check all that apply):
 - ☐ All physicians

- ☐ All nursing staff
 - ☐ All pharmacists
 - ☐ Other healthcare professionals (e.g. physiotherapy, etc.)
 - Our organization has provided formal education about VTE and its prevention to one or more of the following health professional groups in the past 6 months (check all that apply):
 - ☐ Some physicians
 - ☐ Some nursing staff
 - ☐ Some pharmacists
 - ☐ Other healthcare professionals (e.g. physiotherapy, etc.)
6. Does your organization **provide information about VTE** and its prevention to **patients**?
- Our organization has not provided any formal education about VTE and its prevention to patients over the past 6 months
 - Our organization has written information about VTE and its prevention available to patients (leaflets, booklets) at key patient encounter sites (pre-surgical clinic, Admitting Department, nursing units, etc.)
 - Our organization provides written information about VTE routinely to at least 50% of patients (e.g. in all pre-surgery admission packages)
 - Our organization provides written information about VTE to almost every (>80%) admitted patient

COLLECTION STRATEGY:**Data Collection Approach:**

- The data is available from the VTE Prevention working group at the healthcare facility