Workbook for Improvement

Optimize Prevention of Venous Thromboembolism at your Medical Center

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Introduction

This workbook is designed to enhance the efficiency of your quality improvement effort. It leverages resources at the SHM website, particularly the VTE Quality Improvement Resource Room.

The workbook is built on well proven principles of quality improvement, personal experiences, and evidence-based medicine. In order to implement an effective venous thromboembolism (VTE) prevention regimen in your setting, redesign is needed. This workbook should enable you to engineer processes which *reliably* enable the healthcare team to:

1. stratify each patient for their risk of developing VTE
2. provide each patient with the most appropriate and evidence-based regimen based on this level of risk and the presence or absence of contraindications to pharmacologic prophylaxis
3. periodically reassess these changing factors, so that the prophylaxis regimen the patient receives is adjusted as the patient's VTE risk and bleeding risk changes

The workbook is broken up into 22 different sections and 4 appendices. You and your improvement team should not feel obligated to pore over every detail of every section, or follow the sections in the exact order in which they are presented. In fact, you will find it difficult to stick to one particular sequential order, and the activities taking place in these different sections often take place in parallel.

One special word of caution, however. We strongly discourage using these materials to build an order set or protocol which you try to implement without following the general improvement framework presented in the rest of the workbook. This framework calls for a multidisciplinary team effort, specific goals, reliable and practical metrics, and monitoring and learning from variation from your protocol. Ignoring these principles is a guarantee of continued mediocrity.

Hospitalists are uniquely positioned to act as agents of important change in patient care. All too often, financial pressures and excessive patient loads block opportunities for a more varied career and improved patient care. Following these methods can allow you to demonstrate the value of quality improvement work to your medical center and insurers, both because of the outcomes obtained, and because of the cost savings often inherent in a higher quality of care. Demonstrating value in quality improvement and cost savings can lead to protected time for hospitalists to improve the quality and safety of the hospitalized patient.

Stay tuned for future workbooks in other quality improvement resource rooms on the SHM web site.

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1. Reviewing the Literature (and What Others Have Done)

The best hospitalist programs are taking ownership of common problems in the hospital. Implicit in *ownership* is a thorough grasp of the most important literature. Also essential is an awareness of successful tactics that others have used to address the problem, in this case to prevent VTE. While your local experts on VTE should be invited into the effort, hospitalists should strive to stand on equal footing when it comes to the VTE prophylaxis literature and techniques for effectively implementing a prophylaxis protocol. To assist you in this, the SHM's VTE Quality Improvement Resource Room has aggregated much of the key literature, tips from others, and representative examples of risk assessments and order sets. Being able to speak intelligently about VTE is a key step in becoming an effective champion for optimizing prevention of VTE. The slide set presentation in the VTE Resource Room is designed to provide an overview of the topic of VTE prevention and its literature. Reviewing this material should augment your comfort as a local expert on the topic. Feel free to adapt the slide sets for your own formats or lectures.

TASKS:
Hospitalist(s) responsible for reviewing and synthesizing literature

Hospitalist: _____ Pager: _____

Hospitalist: _____ Pager: _____

a. Review key literature discussed online in the ACP Journal Club. Review also the recommendations from the recent 7th ACCP consensus conference.

b. Briefly review risk assessment models in Appendix E. (A more detailed examination of these models will occur in later sections.)

Timeline for beginning and completing:_____

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2. Quality Improvement (QI) Resources

Any team wishing to effectively improve VTE prophylaxis in their institution should understand the basics of effective implementation and improvement. Having an improvement framework sketched will dramatically enhance the team's chances of realizing breakthrough improvement. At least one or two hospitalists in your group should become very familiar with the general framework for improvement and with proven QI tools. Medical center resources - such as a patient safety officer, QI leader, or QI facilitator - may be available at your institution. You should identify these individuals and enroll them in your cause in the earliest stages.

TASKS:

a. Identify the in-hospital QI resources:

In-house resource #1 Name: _____ Contact: _____

In-house resource #2 Name: _____ Contact: _____

b. Review the slide presentation on Quality Improvement Theory in the VTE Resource Room.

c. Get more information on a few key tools at the web sites in Appendix A:

There are many tools for QI. Each tool has particular strengths in different times in the improvement process. A few are particularly important and are useful in almost every project. Process flow mapping is an important step in designing or redesigning a process to make it more efficient and reliable. Process flow mapping also lends itself to producing protocols and clinical algorithms and is essential to identify where things can go wrong, either informally or more formally via a failure modes effect analysis (FMEA). We also view run charts are nearly essential, since they help the team follow and communicate progress towards goals. We recommend a working familiarity with these tools, either by the in-house expert, or by the hospitalists that are (or will become) your improvement team resources. You can find more in-depth information on these (and other tools) at the locations listed in Appendix A. This workbook will guide you further on some of these key improvement tools in Sections 6, 7, and 18.

Task **2a** assignment: _____
Task **2b** assignment: _____
Task **2c** assignment: _____

Timeline for beginning and completing: _____

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3. Pulling the team together

You should review the slide presentation on Quality Improvement Theory in the VTE Resource Room prior to embarking on this section. You have probably already recruited a few team members for the VTE prevention effort. Your VTE Prevention team should include:

Team Leader: This is usually going to be a physician hospitalist leader. This physician is responsible for calling meetings, taking minutes, and communicating directly with administrative and appropriate medical staff committees. The team leader should be a respected member of the medical staff with some topic expertise on VTE prophylaxis.

Team Facilitator: The team facilitator's main duties are maintaining team rules, helping the team leader stay on track by calling upon effective team techniques, and introducing the appropriate QI tools for practical use by the team. Mastery of QI tools at the onset of the project is not necessary. What *is* necessary is a willingness to learn QI tools and introduce them to the team as necessary. Mastery of VTE literature is not important for this position. The team facilitator can sometimes be the same person as a team leader, but for more ambitious projects or for projects involving buy-in from disparate physician and nursing groups, a separate facilitator is very strongly recommended.

Process Owners: The frontline personnel involved in the process of providing VTE prophylaxis in the hospital are essential for an effective team wishing to optimize VTE prevention.

TASK:

- ***a.*** Fill out the names and contact information for your VTE prevention team. *(You may identify only 3-4 key personnel at the outset, but may draft others onto the team as additional roster needs become clear.)*
- ***b.*** Construct a team roster and group e-mail to help the team communicate.

Task **3a** assignment: _____
Task **3b** assignment: _____

Timeline for forming team and calling first team meeting together: _____
(We recommend trying to enroll a range of personnel early, within 2-3 weeks)

The next page contains a roster for a VTE prevention team.

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VTE Prevention Team Roster

Team Leader: Name_____ E-mail _____
Phone_____Pager_____
(Team Leader is often, but not always, a hospitalist.)

Team Facilitator: Name_____ E-mail_____
Phone_____ Pager_____

Content Expert: Name_____E-mail_____
Phone_____ Pager_____
(Local expert with expertise in the VTE literature, often a pulmonary-critical care specialist or hematologist.)

Hospitalist #2 Name_____ E-mail_____
Phone_____ Pager_____

Hospitalist #3 Name_____ E-mail_____
Phone_____ Pager_____

Sr. Administrator Name_____ E-mail_____
Phone_____ Pager_____

Pharmacist Name_____ E-mail_____
Phone_____ Pager_____

QI staff rep Name_____ E-mail_____
Phone_____ Pager_____

HIS data pull Name_____ E-mail_____
Phone_____ Pager_____

Nurse supervisor Name_____ E-mail_____
Phone_____ Pager_____

Nurse (ward) Name_____ E-mail_____
Phone_____ Pager_____

Nurse (unit) Name_____ E-mail_____
Phone_____ Pager_____

Other Name_____ E-mail_____
Phone_____ Pager_____

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4. Establishing Team Rules

At your very first team meeting, the team rules need to be established and everyone needs to agree explicitly to them. The facilitator is usually the person tasked with gaining consensus on the team rules and for enforcing them.

Use the team rules below as a starting point. The team should modify the rules as needed, then officially record and acknowledge them.

TASK:

a. Establish team rules and post a large, readable version at each team meeting (Appendix B)

Task **4a** assignment: _____ *(Team Facilitator)*

Team Ground Rules…

- ❑ All team members and opinions are equal
- ❑ Team members will speak freely and in turn
  - We will listen attentively to others
  - Each must be heard
  - No one may dominate
- ❑ *Problems* will be discussed, analyzed, or attacked (not *people*)
- ❑ All agreements are kept unless renegotiated
- ❑ Once we agree, we will speak with "One Voice" (especially after leaving the meeting)
- ❑ Honesty before cohesiveness
- ❑ Consensus vs. democracy: each gets his say, not his way
- ❑ Silence equals agreement
- ❑ Members will attend regularly
- ❑ Meetings will start and end on time
- ❑ _____
- ❑ _____

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5. Establish General Aims

Establishing good goals is essential to maintain focus and motivate the team. Eventually your aim should be specific, measurable, time-defined, and should specify the inpatient sub-population. A 'stretch' goal should be established. It should be aggressive enough to mandate a change in design from your current process in order to achieve it.

One important task is to define the scope of your efforts. Do you want to focus on just one ward or service? Will you focus on medical patients, surgical patients, or both? Hospital medicine groups should not be satisfied with merely improving the performance of their own physicians, but it may be reasonable to start small and then spread your improvement methods to other areas. On the other hand, even if the scope of your effort includes all patients in your hospital or system, the interventions you choose should be piloted on a small scale. Bottom line: Think BIG! Don't bite off more than you can chew initially, but serial testing and learning on a small scale can make even very large projects more manageable.

Until you establish metrics for whether or not your efforts will be judged an improvement, you need a general goal or aim to solidify team resolve and communicate with others.

The task is outlined on the next page.

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TASK:

a. Establish General Aims:

General Aim #1: _____

_____

General Aim #2: _____

_____

Task **5a** assignment: _The Improvement Team__
Due Date: _First team meeting__

Examples of General Aims:
General Aim #1:
*Provide **appropriate VTE prophylaxis** for all patients admitted to _____.*

General Aim #2:
*Reduce **hospital acquired VTE** from **these wards**.*

As your team develops, your challenge is to define the bolded portions of these general goals and determine how you are going to measure success (or lack thereof) of your implementation. A later challenge will be to develop timelines for when you will achieve your goals (see "Metrics" Sections 14 & 15).

Examples of Mature Aims: (borrowed from UCSD)
Mature Aim #1:
95% of all patients admitted to medical surgical wards will be on appropriate VTE prophylaxis as defined by our protocol within six months.

Mature Aim #2:
We will reduce the rate of hospital acquired VTE from the baseline of xxxx events per 1000 patient days by half to xxxx / 2 per 1000 patient days within 12 months.

Sections 14 & 15 of this workbook will assist you in generating similarly mature aims/goals.

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6. What is the Current Process for VTE Prevention?

Drawing a map of the current process can be very informative. What you learn by doing this can be frankly *eye-opening*: identify wasted/duplicative efforts, lack of consensus on the current process, or hidden complexities and opportunities to streamline/simplify.

Answer some of the following questions and incorporate into your process map:

- What is the current system for providing prophylaxis?
- What standardized order sets or protocols are in place now, and for which patients? Are they incorporated into Surgical or Orthopedic order sets?
- What are pharmacy costs for prophylactic LMWH and SQ heparin?
- Are IPC devices (venodynes or squeezers) used in your institution? Are they on the patient, or on the floor?
- How comfortable is the nursing staff with pushing physicians for orders? For VTE risk assessment?
- Is digital radiology imaging or reporting available?
- Are any protocols in place for screening for VTE, or for vena cava filter placement?

TASKS:

a. Draft a *pro forma* process map to depict the *status quo*.

Look at the Macro and Sub-Process map for Insulin infusion (courtesy of Mark Williams and Janet Nagamine) in Appendix C as an example of the level of detail you want to get to in the process of delivering appropriate VTE prophylaxis. Use the VTE Macro Process map also in Appendix C as a starting point for your efforts to map out each macro-process and the hierarchical sub-process steps for delivering appropriate VTE prophylaxis to each patient.

b. Enlist key stakeholders, particularly process owners, to modify the process map and revise it based on this input.

This valuable step can often help you perform a formal FMEA or redesigned process map to validate and standardize.

Task **6a** assignment: _The Improvement Team_
Task **6b** assignment: _____*(Team Leader)*

Timeline for beginning and completing: _Second team meeting_

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7. Failure Mode Effects Analysis – What Could Go Wrong?

In the previous section, the team should have mapped out the process of delivering VTE prophylaxis to each patient. The next step is to identify what can *and does* go wrong with these steps under your current system, then prioritize which "failure modes" are the most important ones to address in your redesign and improvement efforts. Failure modes effect analysis (FMEA) is a formal method to help you in this endeavor. However, you may find that some steps in your process map are so obviously unreliable or faulty that they become the natural focus of your efforts with any formal analysis. Review FMEA principles from the 2005 SHM Annual Meeting presentation available in the Member Resource Center at the SHM website. Download tools from the websites in Appendix A.

Consider the preventable factors that may lead to greater VTE risk (excessive sedation, restraints, or central lines, for instance), as well as inadequate prophylaxis (poor physician awareness, failure to administer or maintain ordered prophylactic measures, changing patient characteristics, lack of agreement on relative and absolute contraindications to pharmacologic prophylaxis, etc)

TASKS:

a. Summarize key current "failure modes" in your VTE prophylaxis process and sub-process steps. Propose countermeasures for the "things that can go wrong."

   Identify at least 2-3 areas from the process map where you could get the most 'bang for the buck' if you standardized or redesigned part of the process flow.

b. Review the list of failure modes and countermeasures from UCSD on the following page. Revise your list as needed.

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***UCSD Example*: Failure Modes and Problems with Process**

- ⊗ *VTE risk assessment not routine or standard*
- ⊗ *AC risk assessment not routine or standard*
- ⊗ *Most "appropriate" prophylaxis option for each level of risk not conveniently available for prescriber*
- ⊗ *Protocols: Ortho has 4, Surgery has 4, Medicine has 0, they don't all agree.*
- ⊗ *IPC noncompliance*
- ⊗ *Excessive sedation; unnecessary central lines, restraints*
- ⊗ *VTE and AC risk can and do change, but no reassessment*
- ⊗ *Platelet monitoring not always done when heparin ordered*
- ⊗ *Prophylaxis stopped at discharge even when risk continues in some patients after discharge.*
- ⊗ *Peri – procedure and post-trauma: widely different impressions of when it is safe to start anticoagulation*
- ⊗ *Differing opinions on what is "appropriate" even among our experts*

AC = anticoagulation

***UCSD Example*: Countermeasures and Process Changes to Address Failure Modes**

- ⊕ *Standardize VTE risk assessment*
- ⊕ *Standardize AC risk assessment*
- ⊕ *Consensus / evidence-based agreement on appropriate and preferred options for each combination of VTE and AC risk.*
- ⊕ *Integrate assessments of VTE risk and AC risk into VTE prophylaxis orders.*
- ⊕ *Offer VTE consultation help with VTE prophy issues.*
- ⊕ *Schedule VTE and AC risk re-assessments q 72 h.*
- ⊕ *Link platelet count monitoring to heparin orders.*
- ⊕ *MD must "opt out" of preferred choices.*
- ⊕ *Tracking variation for protocol / preferred choices, modify protocol and behavior.*
- ⊕ *Coordinate efforts with teams working on decubitus prevention, delirium, and decubitus issues.*

Your summary of failure modes and countermeasures:

Task **7a**assignment: The Improvement Team
Task **7b** assignment: The Improvement Team

Timeline for beginning and completing: _____

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8. Identifying the Impact of Improving VTE (first estimate)

To be a champion for positive change, hospitalist leaders will need to secure early support for putting resources into a project. Generally, you should find some easy way to present the local potential, even before you've developed any baseline metrics for how often patients develop hospital acquired VTE in your hospital, or how often patients are not placed on proven VTE prophylactic regimens for their level of VTE risk. These estimates are derived both from the literature and from an easily executed query calculating the number of episodes of VTE diagnosed in your hospital. Exact estimates are not important. You are just trying to paint a picture of what the impact *could* be for an effective program to optimize prevention of VTE in your medical center. Later, as you start to collect information on the actual performance of VTE prevention in your setting, these estimates can be refined.

TASK:

a. Generate early estimate of impact of optimizing VTE prophylaxis:

Step 8a1. Estimate the number of all VTE events diagnosed at your medical center.

Codes for PE: 415.1, 415.11, 415.19.
Codes for DVT: 451.1, 451.2, 451.8, 451.9 (LE, UE, other, not spec)
Codes for clots complicating lines/infusion/transfusion: 996.61, 996.62, 999.2

Alternate method: Many hospitals diagnose about 1 VTE per adult bed per annum, so an estimate for a 500 bed hospital would be 500 VTE in a year.

Estimated total # of clots diagnosed at your medical center _____

Step 8a2. Estimate the number of hospital-acquired VTE events at your medical center.

The literature suggests (and UCSD evidence verifies) that 40-50% of VTE diagnosed at medical center diagnostic facilities are hospital acquired. To obtain the number of VTE that are most likely hospital acquired, take the number from Step a1 and multiply by 0.5.

Estimated # of hospital-acquired VTE events at your medical center _____

Step 8a3. Estimate the number of potentially preventable hospital-acquired VTE events at your medical center.

The literature suggests that VTE prophylaxis is grossly underutilized, with 30-60% utilization of appropriate VTE prophylaxis being common. For this early estimate take the 8a2 estimate and multiply again by 0.5. This is a conservative estimate of how many patients in your hospital are suffering from a potentially preventable VTE event. Once you examine a sample of hospital-acquired VTE, you may well find the percentage of patients on appropriate prophylaxis is much lower than 50%.

Estimated # of potentially preventable hospital-acquired VTE events _____

(At UCSD, in one of our 350 bed medical centers, this formula generated an estimate of 90 cases of preventable VTE per year.)

Task **8a** assignment:_____

Timeline for beginning and completing:_____

In later workbook sheets, you will have the opportunity to incorporate this information into a memo to administration to generate support.

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9. Obtaining Support from the Institution

Your team needs support from the medical center leadership to enhance your improvement effort. Getting institutional buy-in and administrative support is essential. By now you should have enough information to formally approach the medical center leadership. A direct line to administrative support for your effort, either by a direct reporting structure or by involvement of a senior administrator on the team, should be in place before you go any further.

TASK:

- **a.** Draft a memo to administration using the template in Appendix D. Discuss the memo directly with an administrator. If a formal project outline is required use the template "Executive Summary for QI Initiative" also in Appendix D.

Task **9a** assignment: _____ *(Team Leader)*

Timeline for completing: _____

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10. Stakeholder / Committee / Special Group Reporting and Approval Process

Identifying all the stakeholders and defining who needs to buy in and be aware of your efforts is important to enhance early adoption, offer legal protection for information you uncover, and plan educational efforts. Typically, these groups will include:

1. Pharmacy and Therapeutics committee
2. Nursing groups
3. Orthopedics / Surgery / Trauma leaders
4. Patient Safety committee
5. OR or Perioperative Committees
6. chief residents and / or residency program directors
7. Departmental committees

TASKS:

a. Identify key stakeholders, committees, and special groups that need to be aware of your efforts to improve VTE prophylaxis.

Stakeholders:

Committees:

Special Groups:

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b. Clarify reporting structure and approval process for your order sets, interventions, and resource approval.

Reporting Structure:	Approval Process

Assignment of Task **10a**: _____ *(Team Leader)*
Assignment of Task **10b**: _____ *(Team Leader)*
Timeline for beginning and completing: _____

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11. Risk Assessment Models for VTE: Adapting the Right One for Your Institution

Recall General Aim #1 from Task 5.

*Provide **appropriate VTE prophylaxis** for all patients admitted to _____.*

To define your medical center's performance, you have to specifically define what you will consider "appropriate prophylaxis." This definition is also the starting point for devising strategies to assure that each patient receives the appropriate prophylaxis throughout their hospitalization. You should strive to define what "appropriate prophylaxis" is for the spectrum of patients/situations in your improvement effort. Does your effort reach across the entire medical center? Only adults? Only medical patients? We recommend that you try to generate a VTE prophylaxis protocol for the *majority* of adult patients at your institution, both medical and surgical. But your team ultimately has to make that decision. The steps to define "appropriate prophylaxis" are:

1. Choose your favored VTE risk assessment model.
2. Choose appropriate or acceptable alternatives for each level of VTE risk *(take the opportunity to reduce the more costly options when you draft your order sets)*
3. Define absolute and relative contraindications to pharmacologic prophylaxis, and what to do if they exist (IPC appropriate if you can't use pharmacologic prophylaxis)

The first step, choosing your favored risk assessment model, is key. The VTE risk assessment model will be incorporated into your audit tools and into order sets / protocols, so think very carefully about this. No one model has been prospectively validated as superior to others, and many factors should be taken into account when you choose the model.

The ideal VTE risk assessment model would have the following characteristics:

1. Applicable across all patients you see (medical and surgical)
2. Easy to access and use. Simpler is better! Remember you will eventually ask physicians / nurses to use this risk assessment several times during a patient's admission.
3. Each level of risk should be linked to logical and evidence-based choices for prevention.
4. It should incorporate contraindications for prophylaxis into the model, and encourage IPC devices for these patients.

(See Task 11 on next page.)

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TASK 11:
Review VTE risk assessment models in Appendix E. Make notes about the models or features that best meet the criteria above for the effort at your medical center.

Task **11** assignment: __Team_____

Timeline for completing: _____

Notes on VTE Risk Assessment Models:

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12. Contraindications to Pharmacologic Prophylaxis

All VTE prophylaxis order sets and protocols need to make some provision for the existence of contraindications to pharmacologic prophylaxis. There are many such tables and references to draw upon. One example appears below. Be wary of being too liberal in defining the contraindications: many patients with 'relative contraindications' develop DVT, and they usually end up on full dose anticoagulation. You should put some thought into how you will define some of these parameters, for instance, "Suspected active hemorrhage" may need better definition for the purpose of your audits. Many patients will have some drop in Hgb and Hct when they are ill, so your definition may have to include some specific guidance about how large a drop may constitute grounds for withholding pharmacologic prophylaxis.

Contraindications or other Conditions to Consider with Pharmacologic VTE Prophylaxis		
❑ **ABSOLUTE** ▪ Definite active hemorrhage ▪ Severe trauma to head or spinal cord *with hemorrhage* in the last 4 weeks ▪ Other_____	❑ **RELATIVE** ▪ History of cerebral hemorrhage ▪ Suspected active hemorrhage ▪ Craniotomy within 2 weeks ▪ Intraocular surgery within 2 weeks ▪ GI, GU hemorrhage within the last month ▪ Thrombocytopenia (<50K) or coagulopathy (PT > 18 seconds) ▪ End stage liver disease ▪ Active intracranial lesions/neoplasms ▪ Hypertensive urgency / emergency ▪ Other_____	❑ **OTHER CONDITION** ▪ Immune mediated HIT ▪ Epidural analgesia with spinal catheter (current or planned)

TASK 12:
Using the table above and the expertise of your team, create a table of contraindications to pharmacologic prophylaxis for your institution. Review the table with key stakeholders and revise using their input.

Task **12** assignment: _____

Timeline for completing: _____

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13. Choosing the Prophylactic Agents for Each Level of Risk (and More About Choosing Your Risk Assessment Model & Piloting It)

In this section, your team should explore local factors that may play a role in selecting your agents of choice for each level of VTE risk. Accounting for these local factors, you should *then* move on to draft *your* VTE risk assessment model. (Again, your model should contain VTE prevention options for each level of risk as well as operational definitions of contraindications for pharmacologic prophylaxis.) You will be exploring not only which options are most appropriate for each level of risk, but which agents, given your own local factors, should be the *preferred* agents for each level of risk.

Should IPC be a first line "appropriate" choice for patients at moderate risk of VTE?
At UCSD, we originally wanted to keep IPC as an option for patients at moderate risk for VTE (in spite of a lack of solid evidence in the literature for medical patients). Our audits revealed about 55% compliance with IPC, however, and we then adapted the approach of the ACCP Consensus conference, which relegates IPC to patients with contraindications for pharmacologic prophylaxis but also as a secondary method to enhance the effectiveness of pharmacologic prophylaxis.

Which patients need IPC in addition to pharmacologic prophylaxis?
At UCSD, we decided the very high risk MUST have it, while other patients COULD have it.

Which patients should have Heparin 5000 units q 12 hours as an option vs Heparin 5000 units q 8 hours?
We initially had 4 levels of VTE risk (similar to Model 3 in Appendix E). We allowed Heparin 5000 units q 12 h as a choice for patients at moderate VTE risk (which described many of our medical ward patients), but advocated the higher frequency 5000 units q 8 h for high risk patients (which typified our sicker medical and critical care patients).

Eventually we collapsed our moderate and high risk categories into a single category because:

1. poor compliance with IPC eliminated that as a viable first line method.
2. many of our patients on heparin 5000 units q 12 h were still developing VTE
3. it would greatly simplify our risk assessment tool and order sets if we eliminated it as an option for all patients unless they were 50 kg or less.

Your team may very logically make alternative choices based on your local factors.

Should we offer UFH 7,500 q 12 h as an option?
At first glance this is an attractive choice, as it retains q 12 h dosing and pharmacodynamically should deliver the same protection as offered by the clinical trial proven UFH 5000 q 8 h regimens. Unfortunately, we found that our pharmacy or nurses had to draw up 7500 unit doses on special order, while the 5000 unit doses came pre-packaged from the distributor. Your situation may vary, but for us the 7500 unit dose carried too many labor, cost, and potential safety issues.

Should LMWH or UFH be our first line (default) choice for VTE prophylaxis in moderate to high risk patients?

This is a difficult decision for many institutions, and your task is to make a team decision that is best for your patients and nurses, while still being fiscally responsible.

To make an informed decision, you need to take into account:

1. Pharmacy cost
2. Cost of administration (q 8 hours vs q day.)
3. Patient satisfaction / Nursing satisfaction
4. Lower incidence of HIT with LMWH reported by some
5. Danger of using LMWH as default (will you forget to use UFH in patients with renal insufficiency, or do you have a reminder process that works in these situations?)
6. Roughly equivalent performance (some would argue a slight edge exists for LMWH, especially in the critically ill patients)

At UCSD we found the following:

	Pharmacy cost	Admin time / cost	Total cost
LMWH q day	$16	10 min / $5.33	$21.33
UFH q 8 h	$1	30 min / $16.00	$17.00

(Time / cost estimates using GRASP methodology)

While there was only a $4.33 difference in cost per patient day between these two options, and the q day dosing of LMWH is attractive to patients and nurses, we decided to use UFH 5000 q 8 h as our default option. We had two main reasons. First, $4.33 per patient day in a 350 bed medical center can add up quickly. Second, we do not yet have a reliable method in place to discourage the use of LMWH in patients who have or develop renal insufficiency during their hospitalization. With time, our team may change its thinking or approach. Your team needs to make these decisions based on your own environment.

TASK:
Answer each question above and then draft YOUR VTE risk assessment model replete with VTE prevention options for each level of risk and with operational definitions of contraindications for pharmacologic prophylaxis.

Pilot your instrument on 5 medical patients and 5 surgical patients using a PDSA worksheet. Use that experience to refine or revise the instrument. Pay attention to ease of use, simplicity, and applicability to each patient you see. Typify each patient in terms of "appropriate prophylaxis" or "not on appropriate prophylaxis."

Task **13** assignment: _____
Timeline for completing: _____

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14. Key Metric: Prevalence of appropriate VTE prophylaxis (finalizing Aim #1)

Having defined what your team will consider "appropriate prophylaxis" you now have a way to audit charts with precision. You can determine if a given inpatient sub-population is receiving VTE prophylaxis that matches your definition of "appropriate."

Auditing several charts in a "before and after" fashion is one option, but trending over time is a much preferred method. Trending over time allows you to see the effect of multiple different interventions or changes in team strategy over time. It also makes it easier to chart and incorporate ongoing feedback to your protocol.

TASK SET:

a. Devise a plan to define, audit, and run-chart the metric, "Prevalence of appropriate VTE prophylaxis"

Step 14a1: Choose a sampling strategy.

A random sample of 20 charts a month is probably sufficient. You should probably limit audits to those in the hospital for > 24-48 hours.

Step 14a2: Identify who will collect, collate, and manage data.

Step 14a3: Determine if you are going to collect 'active' or discharged cases.

Sampling on active patients may be more informative, especially if you consider contacting the MD if prophylaxis is "inappropriate" by your audit. In doing so you may gain valuable insight into barriers of prophylaxis, find valid reasons to refine your protocol, or create an opportunity to improve care and educate providers as you collect data.

Step 14a4: Trend percentage of patients on 'appropriate' prophylaxis over time using Excel or statistics / charting software.

See section 18 in the workbook section on run charts and the web references in Appendix A.

Task **14**a assignment: ____Team_____
Timeline for completing: _____

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TASK:
Your team must now refine the first of the original general aims. To do this you'll put an expectation of time on achieving the aim and define the inpatient sub-population in question.

Recall General Aim #1:
*Provide **appropriate VTE prophylaxis** for all patients admitted to _____.*

At this point, having established a definition for appropriate VTE prophylaxis, you have all the information you need to go from the general aim #1 to a specific one.

b. Change General Aim #1 to a Specific Aim

Provide appropriate VTE prophylaxis (as defined by your protocol) to _____% of patients on _____ wards / services by _____.

At every team meeting this specific aim should be re-verified and run charts showing where you are now should be presented as soon as they become available.

Task **14**b assignment: ____Team_____
Timeline for completing: _____

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15. Key Metric: Incidence of hospital acquired VTE (finalizing Aim #2)

The team must now prepare to refine the other original general aim. As in Task 14b you'll put an expectation of time on achieving the aim and define the inpatient sub-population in question. But the team still needs to define the bold type terms below.

*Recall General Aim #2: Reduce **hospital-acquired VTE** by ___% from **these wards**.*

There are several ways to find the "*hospital-acquired VTE*" events and to define it in your local setting:

Minimum: Track total # cases diagnosed in your medical center via techniques described earlier in the workbook (Section 8); assume half of cases diagnosed are hospital acquired.
Better: Track total # cases DVT and PE diagnosed in your medical center, pull charts post-discharge, and retrospectively determine if hospital or community-acquired.
Better yet: Same as above, but also determine if the patients who acquired VTE in the hospital were on appropriate VTE prophylaxis or not when they developed the hospital acquired VTE.
Best: Capture new cases of DVT and PE as they occur in your hospital by working with your radiology department, or if you have digital imaging for US, CT scans, V/Q scans, and angiograms you can devise methods to find the cases in real time.

A common definition for "hospital acquired" would be a clot first discovered during the course of hospitalization, or discovered within 30 days of a prior hospitalization.

The first method is very simple and can be done with no effort, but you won't have confidence that you are reducing hospital acquired VTE without some form of chart review.

The "Better yet" option introduces the concept that you can actually get more from the chart review than just a classification of "hospital-acquired" versus "community acquired." The VTE can now also be classified as "hospital acquired while on appropriate prophylaxis" versus "hospital-acquired while not on appropriate prophylaxis." This option would also allow you to look for other factors that led to the formation of a hospital-acquired clot. For example, was the patient sedated or restrained? Did the patient have a central line associated clot, and if so, was the line really needed at the time the clot formed? Given the time and resources, you could do a mini-root cause analysis to generate other potential strategies to prevent hospital acquired VTE.

The "Best" option has all of the advantages listed above, but with the additional advantages that chart review is much easier when the patient is still in the hospital. And the chart review can also be more efficient if you have the capability to query your digital imaging system to screen all pertinent imaging studies on a regular basis. In our 350 bed facility a nurse practitioner screens all pertinent studies from the prior day, identifies all new hospital acquired clots, and completes a thorough chart review on all new hospital

acquired VTE. The whole process takes less than an hour on each weekday. It can be done very efficiently because we were able to use a "wizard" on our digital imaging and reporting system that pulls up all pertinent diagnostic studies, complete with their reports, at the click of a button.

You may well come up with another method that is more useful and expedient in your setting.

Once you define "hospital-acquired VTE" and how you will find them, you have another decision. Will you simply track the raw number of hospital-acquired VTE, or do you want to control for the number of patients or patient-days? Controlling for patient days at risk for VTE does add a little more work, but would reduce some of the "noise" in your data by controlling for the probability that more hospital-acquired VTE will occur when you have a full census. At UCSD, for example, each month we calculate the total number of patient days for adult inpatients in the hospital > 48 hours and use that as the denominator. We use the total number of hospital-acquired VTE events is used as the numerator. This helped us generate a specific aim:

> *We will reduce the rate of hospital-acquired VTE from the baseline of xxxx events per 1000 patient days by half to xxxx / 2 per 1000 patient days within 12 months.*

Another option to consider: if you can track the number of days between hospital-acquired VTE events and/or hospital-acquired preventable VTE events, a "days between events" would be a great way to demonstrate progress (each event is a point on the x axis, while the number of days between events appears on the y axis).

OK, enough background and options. Now it's time for your team to decide, given the resources at your hospital, how you will measure the incidence of hospital acquired VTE.

TASK SET:

a. Devise a plan to define, audit, and run-chart the metric, "Incidence of hospital -acquired VTE"

15a1: Define your method of finding "hospital-acquired VTE"
15a2: Pilot your method and revise
15a3: Start plotting your data in run charts (adding control limits is optional) to follow the trend over time (see Section 18 on run charts)

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Task 15a1 assignment: _____
Timeline for completing: _____

Task 15a2 assignment: _____
Timeline for completing: _____

Task 15a3 assignment: _____
Timeline for completing: _____

Task 15a4 assignment: _____
Timeline for completing: _____

TASK:
Your team must now refine the other original general aim to specify time, inpatient sub-population, and a measurable level of achievement.

*Recall General Aim #2: Reduce **hospital-acquired VTE** by ___% from **these wards***

15b. Change General Aim #2 into a specific one

We will reduce hospital acquired VTE for the inpatient population _____ by _____ % from the baseline measure _____ by _____ months.

Task 15b assignment: _____
Timeline for completing: _____

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16. Balancing Measures (and Other Measures)

You now have two important aims: one a measure of process, the other a measure of outcome. But the team needs to consider the potentially detrimental effects of the planned intervention.

For example, as balancing measures your team may decide to track the incidence of heparin induced thrombocytopenia, or bleeding episodes, or the cost of using more pharmacologic prophylaxis.

In addition, you may want to collect subjective or objective data about the intervention, ease of use of an order set, impact of VTE prophylaxis protocol on costs, length of stay, or cost per case.

TASK:
Choose at least one balancing measure. Define methods for collecting and collating. Trend it on a run charts.

Add other balancing measures if the team feels they are important.

Task 16 assignment: _____
Timeline for completing: _____

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17. Financial Impact

Assessing the financial impact of interventions to optimize prevention of VTE is important to demonstrate return on investment, garner support for time spent on QI activities, and prioritize your effort as one that is financially as well as medically important. Your assessments of financial impact can be incorporated into slide shows and conversations with your administration. Your medical center may be able to use information from this project and others to obtain better rates or more market share from insurers, you should discuss this with your administration as well.

Step 1.
Estimate the number of preventable VTE

Review the estimates obtained in Step 8a3 for the number of preventable hospital-acquired VTE events per annum occurring at your institution. Update this estimate to make it more accurate when you have accumulated the data from your improvement effort. Insert estimate for total # of preventable VTE here: _____

Step 2.
Estimate or ascertain what percentage are DVT vs PE, using the total number of VTE events.

If you do not have local data from earlier work, an estimate of 75% DVT and 25% PE would be reasonable and reflects the UCSD experience.

_____ preventable DVT _____ preventable PE

Step 3.

(_____preventable DVT X $7,001) = $_____

(____ preventable PE x $12,148) = $_____

Total incremental costs from preventable VTE per year $_____

Source:
AHRQ – Statistics from the HCUP-3 nationwide inpatient sample for 1994: DRG.

Step 4.
Adjust for inflation using this Inflation Calculator from the Bureau of Labor and Statistics consumer price index page: http://www.bls.gov/cpi/home.htm. This will reflect the potential (or real) dollar savings for the current year.

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TASK:
State the burden of preventable VTE per year at your medical center using the above calculations.

Revise as needed to reflect the savings from the decline in preventable VTE which occurs as a result of your efforts.

Subtract the incremental costs incurred from the increase in LMWH which may happen with your protocol if you track those figures.

These estimates are conservative, in that they do not include follow-up and outpatient costs. Also, they are savings that should accrue year after year if you are able to 'hold the gains.'

Again, your medical center may be able to use information from this VTE quality improvement project and others to achieve better market share or negotiate better rates from insurers. You should discuss this with your administration as well.

Task 17 assignment: _____
Timeline for completing: _____

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18. Building Run Charts (Optional: Statistical Process Control charts)

While audits performed "before-and-after" your VTE prophylaxis order set / protocol implementation might be helpful to some degree, trending over time with run charts is much preferred. Run charts have several advantages over before-and-after audits: it's easier to see the effect of different aspects of your interventions as they occur, you get a quicker picture of whether or not something is working, it is easier to separate out the impact of your intervention from secular trends, and our brains simply interpret the graphical display of run charts more innately than they do tables or columns.

TASK:
Build run charts by plotting your metrics over time.

You can review a lot of information and see examples at the web sites in Appendix A.

The IHI website even has an 'improvement tracker' available with free registration. Alternately, a member of your team should become proficient at data management and building run charts using databases, spreadsheets, and statistical software.

To lend further credibility to your run charts and to be able to discern earlier when a difference reflects a real change (versus inherent variability in the process), adding control limits is a very useful technique. The websites in Appendix A are a good point for starting to learn about control limits. While this method is very useful, it is often not essential for QI work. Details of the techniques are beyond the scope of this workbook.

Task 18 assignment: _____
Timeline for completing: _____

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19. Planning Your Implementation / Intervention

Your team may come up with half a dozen interventions to optimize prevention of VTE in your medical center. One intervention *every* team should implement is a standardized order set / protocol that:

> 1) encourages an assessment of VTE risk on admission and frequent intervals throughout the patient's stay, and
> 2) links the patient's level of risk for VTE to rational choices for VTE prophylaxis for that patient.

It sounds simple, doesn't it? As always, the devil is in the details. An order set / protocol will usually fail unless the team pays attention to these details.

A review of some principles for effective implementation is in order:

Principle #1
Keep it simple. There will inevitably be trade-offs between the depth of detail in guidance you want to give providers and the simplicity of your approach. The great majority of the time, simpler is better. Your VTE risk assessment model should be simple enough to perform in seconds and fit easily on a pocket card or half an order sheet.

Principle #2
You can't interrupt the workflow. Don't become short sighted about the importance of this particular intervention to reduce hospital acquired VTE. Remember that this is never the primary focus of a care giving team, and they are likely attending to hundreds of other tasks. Involve front line workers to make sure your plans are feasible. Get their input for how to make implementation go smoothly.

Principle #3
Design reliability into the process. Human beings are incapable of doing anything reliably 100% of the time in the complicated health care setting. Part of your team's job is to engineer higher reliability into the process of evaluating each patient's VTE risk and applying the correct prophylactic measure for that patient. If your protocol relies solely on these traditional methods you will be disappointed with the results:

- Common equipment, standardized order sets
- Personal Check Lists
- Working harder next time
- Feedback of information on compliance
- Awareness and training

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All of the above methods can be helpful, but to achieve breakthrough improvement you must design in at least one of the following methods into the VTE prevention process to insure a high degree of reliability:

- Decision aids and reminders built into the system
- Making the desired action the default
  - Must opt out (not in)
- Redundancy
- Scheduling
- Take advantage of habits and patterns

Examples of these methods as they apply to VTE prophylaxis:
Incorporate your DVT prophylaxis order sets into other order sets.

Have the order set automatically order your default choices that will serve the great majority of your inpatients. For example, in a paper order setting your orders would automatically order:

Intermittent Pneumatic Compression devices, may remove for ambulation or PT.
Heparin 5000 units sc q 8 hours
Platelet count every other day while on heparin or enoxaparin

Physicians could easily opt out of these options, or pick reasonable substitutes (*see sample paper order set),* but the reliability of the VTE process is markedly enhanced by making the option that serves the majority of your patients the default option.

This can be done even more easily if you have CPOE at your institution (*see example on next page).*

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UCSD DRAFT: CPOE ORDER SET FOR DVT PROPHYLAXIS

This box is checked automatically as a default. It must be unchecked to opt out of it.

❑ Patient is ambulatory and has NO VTE risk factors (link table of risk factors), early ambulation only

OR

❑ Apply intermittent compression devices, continue until discharge, may remove temporarily for PT, ambulation.

This box is checked automatically as a default. If an alternate anticoagulant is chosen – or if a contraindication is clicked - this box is then automatically 'de-selected.'

AND 1 of the following (for most inpatients, at moderate to high risk of VTE)
❑ UFH 5000 units sc q 8 hours
❑ UFH 5000 units sc q 12 hours (weight less than 50 kg or age > 75 years)
❑ Enoxaparin 40 mg sc q day (do not use if serum creatinine > 2)

OR 1 of the following (for patients at very high risk of DVT: hip fracture / replacement, abdominal / pelvic cancer surgery patients, multiple major trauma, acute spinal cord injury with paresis)
❑ Enoxaparin 30 mg sc q 12 hours
❑ Arixtra 2.5 mg sc q day
❑ Other anticoagulant _____ drug dose freq (start to type drug to go to appropriate cpoe order)

This box gets checked automatically for all choices that involve UFH or enoxaparin.

OR
❑ Patient has contraindications to pharmacologic prophylaxis (link to table)

❑ Platelet count every other day

CAUTION: Epidural in place? Consult with anesthesia before ordering any anticoagulant.

❑ Consult VTE prophylaxis team (page xxx-yyyy)
Reason for consult_____
Consult called _____Yes _____No

Date/Time_____ Signature_____ PID#_____

Summary: In the digital/CPOE version of this example, IPC and UFH 5000 units SC q 8 hours would be pre-checked, along with a platelet count every other day. If no heparin is used, the platelet count lab is "de-selected." If the MD chooses the first option, NO DVT risk factors, no prophylaxis, or chooses no anticoagulation, the patient is scheduled for a repeat assessment in 3 days.

To apply more high reliability design features to enhance reliability of the VTE prevention process, consider:

- Mandating re-evaluation of VTE risk and prophylactic protocols at all transfers, and with discontinuation of any anticoagulants
- Scheduling repeat evaluations at regular intervals (3-4 days)
- Empowering and encouraging nurses to build a VTE risk assessment into their nursing routine and contact MD for change in prophylaxis if the ordered prophylaxis does not match the VTE risk category of the patient

Principle #4
Pilot your protocol / order set on a small scale before attempting wide implementation. Inevitably there will some glitches with your initial order set. It's best to 'fail faster' by piloting on a small scale, so you can get the glitches out of the way before you implement more broadly. The pilot can be as simple as a paper algorithm you ask 3-4 doctors to use, or trying the order set on one ward.

Principle #5
Monitor the use of your protocol and order set: expect variation from the protocol and learn from it. Reduce variation from your protocol over time. Rolling out the protocol is really only a beginning. You need to learn from variations of your process. Why isn't the order set being used in some areas? Can we integrate it into other heavily used order sets? Which service needs our focused educational efforts? Which patients just don't 'fit' with our protocol - can we change the protocol so that it fits more patients and situations? The idea is to squeeze variability out of the process and retain variation based on tailoring to accommodate the patient.

TASK:
Build your order set / protocol with the above principles in mind, pilot on a small scale, revise based on a rapid cycle evaluation with a PDSA worksheet, and implement! Be sure to design in at least one high reliability design feature.

Task 19. assignment: _____
Timeline for completing: _____

Your team should also consider other interventions to reduce unnecessary VTE risk factors: limit unnecessary restraints or sedation, remove central venous catheters as soon as they are no longer needed, etc.

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20. Plan – Do – Study – Act (PDSA) Worksheet

The Plan-Do-Study-Act (PDSA) Worksheet is a useful tool for documenting a test of change. The PDSA cycle is shorthand for testing a change by developing a plan to test the change (Plan), carrying out the test (Do), observing and learning from the consequences (Study), and determining what modifications should be made to the tested change (Act).

TASK:

Use the Plan-Do-Study-Act (PDSA) Worksheet to help your team document a test of change. Fill out one PDSA Worksheet for each test you conduct.

> *Your team will test several different changes and each change will go through several PDSA cycles. Keep a file (either electronic or hard copy) of all PDSA Worksheets for all changes your team tests.*

You can download a copy of the IHI model PDSA cycle worksheet from:

http://www.ihi.org/IHI/Topics/Improvement/ImprovementMethods/Tools/Plan-Do-Study-Act%20(PDSA)%20Worksheet

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21. After Your Order Set is Launched: Monitoring and Learning from Variation in the Process

At this point you should have launched your protocol / order set to enhance the prevention of VTE at your center. What you do *after* this point is at least as important as what you did *before* you launched your order set. The team needs to devise a way to track deviation from your protocol and learn why it occurs. Variation in practice away from your protocol may be due to any one of several reasons:

a) the protocol does not adequately address the special needs of a given patient
b) old physician habits / ignorance / unwillingness to change
c) order set / protocol is too hard to use
d) other more familiar, well known, or simple routes to order VTE prophylaxis are available

Your goal should be to modify the protocol continuously to address valid issues on ease of use and individual patient needs. Look and listen for this feedback. Solicit it. You should give your own feedback and apply peer pressure to reduce the undesirable variability based on physician style.

TASK:
Devise methods to track deviation from your protocol. Revise your protocol based on feedback from users and patient needs.

> *As able, expand your protocol to incorporate rules for duration of VTE prophylaxis, when to initiate pharmacologic prophylaxis after trauma or special surgeries, etc.*

Task 21 assignment: _____
Timeline for completing: _____

Repeat in a continuous manner.

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22. Holding the Gains and Spreading Your Improvement

Holding the gains

Once you have redesigned your process of delivering VTE prophylaxis and achieved meaningful results, it may be tempting to move on to other issues and stop monitoring the process of delivering optimal VTE prophylaxis. If you don't want all of your hard work to go to waste, you need to resist this temptation. If you don't hold the gains, they are subject to erosion. While you may be able to reduce the intensity of the monitoring and modification process, some ongoing assessment of how the process is functioning is absolutely necessary. New literature, new therapies, and new patient situations also arise frequently. The team should remain responsible for monitoring these issues, updating your protocols / order sets, and revising the intensity of scrutiny based on the stability in your metrics.

TASK:

a. Schedule regular assessments to trend your metrics. Schedule interval reviews of the literature. Schedule sessions to update the protocol / order set.

Task 22a assignment: _____
Timeline for completing: _____

Spreading the improvement

Creating breakthrough levels of improvement is hard work, but it can be exciting and rewarding as well. Ideally, others will learn from your experience and implement your interventions into their environment at an accelerated pace, while still allowing for customization to account for their own unique environment.

A detailed discussion of a framework to enhance spread of innovations throughout an organization can be found on the IHI web site at:

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TASK:

b. Identify the priority areas to “spread” the improvements you have achieved. Review the framework for spread on the IHI website.

Don’t overlook this significant opportunity.

Task 22b assignment: _____
Timeline for completing: _____

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Appendix A: ***Web Resources to Enhance Working Familiarity with Key QI Tools***

Web:

The Institute for Healthcare Improvement has an excellent web site that reviews a model for improvement, as well as providing tools that you can actually download. While registration is needed to download the tools, this is a quick and free resource.

Information on QI tools can be accessed at:
http://www.ihi.org/IHI/Topics/Improvement/ImprovementMethods/Tools/

The American Society for Quality has an excellent, user-friendly site with overviews of the major quality improvement tools. Explore this section with particular attention to run charts, SPC charts, process flow diagrams, and FMEA.

The sections on tools can easily be accessed at:
http://www.asq.org/learn-about-quality/quality-tools.html.

The Society of Hospital Medicine has a Venous Thromboembolism Quality Improvement Resource Room that can support an entire QI effort, offering a primer on Quality Improvement theory, covering the pertinent VTE literature, providing tools to raise awareness, and hosting an interactive Ask-the-Expert forum as a means of sharing experience with the wider hospital medicine community.

The VTE Resource Room can be accessed at:
http://www.hospitalmedicine.org/AM/Template.cfm?Section=Quality_Improvement_Resource_Rooms&Template=/CM/HTMLDisplay.cfm&ContentID=6312

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Appendix B: *Team Ground Rules*

Team Ground Rules…

- All team members and opinions are equal
- Team members will speak freely and in turn
  - We will listen attentively to others
  - Each must be heard
  - No one may dominate
- *Problems* will be discussed, analyzed, or attacked (not *people*)
- All agreements are kept unless renegotiated
- Once we agree, we will speak with "One Voice" (especially after leaving the meeting)
- Honesty before cohesiveness
- Consensus vs. democracy: each gets his say, not his way
- Silence equals agreement
- Members will attend regularly
- Meetings will start and end on time
- _____
- _____

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Appendix C: ***Sample Process Map***
(Courtesy of Mark V. Williams, MD and Janet Nagamine, MD)

Insulin Drip: Macro and Sub-Processes

1	2	3	4
Prescribe & Transcribe	**Prepare & Dispense**	**Administer Insulin Drip**	**Monitor Insulin Drip**
1A: MD writes order **1B**: Order faxed to pharmacy **1C**: Order entered into pharmacy profile **1D**: MAR is generated	**2A**:RN Checks order **2B**:RN obtains insulin from refrigerator **2C**:RN obtains NS bag **2D**: RN draws insulin, verifies dose with RN2 **2E**: RN places insulin in bag **2F**: RN labels bag **2G**: RN primes tubing	**3A**: RN places tubing in infusion pump **3B**: RN connects tubing to pt **3C**: RN programs pump **3D**: RN verifies pt identification **3E**: RN titrates insulin according to MD order	**4A**:Blood obtained for FS per MD order **4B**: RN documents FS in carevue **4C**: RN titrates insulin drip per MD range **4D**: RN calls MD if glucose outside of parameters

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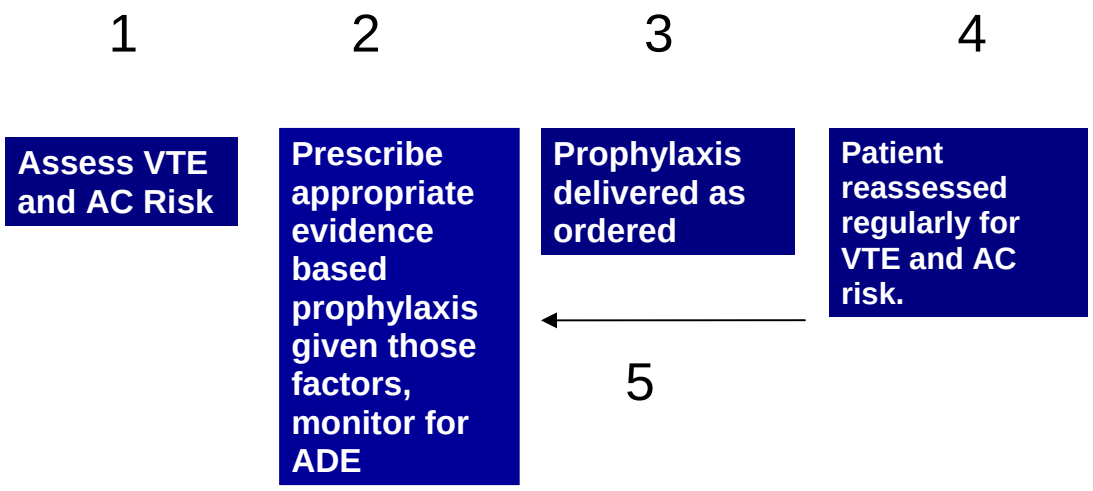
Appendix C, continued: ***VTE Prophylaxis Process***

Write out the sub-processes for each macro-process step. What could go wrong with these steps?

Process of delivering VTE prophylaxis



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Appendix D: *Draft Memo to Administration or Executive*

MEMO Date:

To: [Hospital Administrator/CMO/COO/CEO]
From: Dr. [Hospitalist]

Re: Making the Case for Reducing Rates of Hospital-acquired Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE) in our Hospital

Dear Dr./Mr./Ms [administrator]:

Hospital-acquired blood clots (DVT) are the leading cause of preventable hospital deaths. The condition also raises costs and increases lengths of stay. DVT occurs when blood clots form deep inside the leg (DVT) and bring the risk of death when the clots break off, blocking circulation in the lungs (PE). Though DVT is preventable, simple prevention measures are often overlooked.

Last year [*insert your # here*] DVTs and PEs were diagnosed in our hospital. The literature suggests that approximately half of these are hospital-acquired and nearly a quarter of them occur because we neglect to administer inexpensive yet well proven prophylaxis. In fact, studies show that the majority of hospitalized patients with risk factors for DVT do not receive prophylaxis. A profound opportunity exists to provide better care.

Almost all hospitalized patients are at risk of DVT, especially our surgical, trauma, elderly, and bedridden patients.

The institutional reduction of these events is increasingly being targeted as a component of "merit status" programs and is projected to become its' own JCAHO core measure in 2007.

The strategy for reducing hospital acquired DVT includes:

1) routine and interval assessment of each patient's risk for DVT
2) linking the patient's individual risk to an evidence-based menu of appropriate prophylaxis options
3) administration of the appropriate prophylaxis

We know what needs to be done. We just need appropriate planning and execution to do it. Please let me know when we can meet to discuss further this significant opportunity to provide better hospital care.

On behalf of our patients and our hospital, thank you for your time and interest.

Sincerely,

Joe Hospitalist, MD

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Appendix D, continued: *Executive Summary for QI Initiative*

EXECUTIVE SUMMARY

Describe in 1-2 paragraphs the goals of your program and how it will benefit the institution.

PROJECT OVERVIEW

Background & Institutional Need

Your background should provide a global perspective of the problem and data specific to your institution. End with a clear description of how your institution will benefit from the project. The background should be limited to 2-3 paragraphs. Use benchmark data related to rates of hospital acquired VTE described elsewhere in this workbook. Local institutional data may be available through the quality assurance department, or extractable as described elsewhere in this workbook.

Project Goal / Objectives

Project goals and objectives should be expressed in measurable terms, for example, "reduce by x% the incidence of hospital acquired VTE." Indicate a time frame for achievement. Aim for goals that are reasonable and achievable.

Project Timeline (Table)

Present a clear plan for completing the project. Use a table to show milestones and associated goal dates. Indicate the start date for which the timeline is dependent.

Project Team

Indicate on the timeline the personnel (type and percent or amount of time) required to complete the project. Consider using an Advisory Board to assist with political issues, internal approval processes and communications across departments.

Project Budget (Table)

Present a clear table detailing your budget. Detail costs associated with research personnel, project evaluation and reporting, project management, administrative or clerical support, project equipment and supplies and overhead (if applicable).

RESEARCH PROTOCOL (optional)

Research Questions

Demonstrate a focused project by limiting research questions to those that are "need to know" vs "nice to know." Future projects can address additional research questions. Be sure research questions and project objectives are congruent. Be sure you have budgeted the right resources and planned a timeline to answer your research questions.

Research Methods

Detail data collection methods and timetables. Indicate how researcher biases will be addressed. Consider how data collection methods might affect patient confidentiality regulations.

Human Subjects Approval

Indicate if you are seeking IRB approval for use of human subjects and how the issue will be addressed.

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Appendix E: *Risk Assessment Models*

Model 1 Point-based model (example submitted by Val Akopov MD, Emory University). Models similar to this have been used at Emory and UCSF with mixed results.

Venous Thromboembolism RISK FACTOR ASSESSMENT - Check all identifiable risk factors

RFs with value of 1 point	RFs with value of 2 points	RFs with value of 3 points
❑ Age 41-60 years	❑ Age 61-70 years	❑ Age over 70 years
❑ Prior history of postoperative DVT	❑ History of unprovoked/idiopathic DVT	❑ History of PE
❑ Family history of DVT or PE	❑ Major surgery	❑ Inherited thrombophilia *
❑ Leg swelling, ulcers, stasis, varicose veins	❑ Malignancy	❑ Acquired thrombophilia *
❑ MI/CHF	❑ Multiple trauma	
❑ Stroke with paralysis	❑ Spinal cord injury with paralysis	
❑ Inflammatory bowel disease		
❑ Central line		
❑ Bed confinement / immobilization >12 hours		
❑ General anesthesia time >2 hours		
❑ Pregnancy, or postpartum<1 month		
❑ Probable Obesity (>20% over IBW)		
❑ Hyperviscosity syndromes		
❑ Estrogen therapy		
For Chart Abstract Analysis Only		
TOTAL RISK FACTOR SCORE =	Low =0 Moderate=1-2 High=3-4 Very High=>4	

* Thrombophilia includes Factor V Leiden, and prothrombin variant mutations; anticardiolipin antibody syndrome; antithrombin, protein C or protein S deficiency; hyperhomocysteinemia; myeloproliferative disorders.

Low Risk: Early ambulation
Moderate Risk: UFH 5,000 units q 12 h or UFH 5,000 units q 8 h or IPC
High Risk: UFH 5,000 units q 8 h OR LMWH (Enoxaparin 40 mg subQ q day or equivalent)
Very High Risk: LMWH (Enoxaparin 30 mg subQ q 12 h or equivalent) or Coumadin with Target INR 2-3. IPC also strongly recommended.
Contraindications to pharmacologic prophylaxis: IPC recommended on all patients, also consider TED hose.

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Appendix E: ***Risk Assessment Models***

Model 2 DVT-Free Consensus Panel algorithm. Note: this model is not designed to address VTE prophylaxis in the surgical / post operative patient.

Access via the link below:
http://www.thrombosis-consult.com/ThrombosisPposters/VTEDPathway.pdf

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Appendix E. *Risk Assessment Models*

Model 3 Model based on ACCP 7th Consensus Panel, modified to local circumstances

1. Assign venous thromboembolism risk

LOW risk	MODERATE risk	HIGH risk	VERY HIGH risk
Outpatient Surgery No "RISK FACTORS", minor surgery in patients with age < 40. Ambulatory Medical patient with 0-1 "RISK FACTORS". No "RISK FACTORS", vascular surgery. No "RISK FACTORS", minor laparoscopic procedure.	General moderate/major surgery in patients < 60 yr without additional "RISK FACTORS". Minor surgery in patients with additional "RISK FACTORS". Minor laparoscopic procedures with additional "RISK FACTORS". Major gynecologic surgery for benign disease without other "RISK FACTORS". Extensive open GU procedures (radical prostatectomy, nephrectomy, cystectomy) without additional "RISK FACTORS". Medical patients with additional "RISK FACTORS", but not in "HIGH RISK MEDICAL CONDITIONS".	General moderate/major surgery in patients > 60 years of age, or age > 40 with additional "RISK FACTORS". Vascular surgery with additional "RISK FACTORS". Major gynecologic surgery for malignant disease. Major gynecologic surgery for benign disease with additional "RISK FACTORS". Extensive open GU procedures (radical prostatectomy, nephrectomy, cystectomy) with additional "RISK FACTORS". HIGH RISK MEDICAL CONDITIONS ❑ Ischemic CVA with limited mobility ❑ Acute Q-wave myocardial infarction ❑ Central venous catheter with 2 or more other risk factors ❑ ICU admissions with 2 or more other risk factors.	Elective major lower extremity arthroplasty Hip, pelvic, or severe lower extremity fractures Acute spinal cord injury with paresis Multiple major trauma

RISK FACTORS INCLUDE: Age > 65, Decompensated CHF, Bed Rest, Central line, Hormonal Rx, Myeloproliferative disorder, prior hx of VTE, thrombophilic state, Obestity, pregnancy / post partum, IBD or active inflammation, acute or chronic lung disease, varicose veins or stasis

2. (Does patient have RELATIVE or ABSOLUTE contraindications to pharmacologic prophylaxis?
   Yes No

3. Recommended prophylaxis for each risk category
   (Intermittent pneumatic compression [IPC] is appropriate if answer to #2 is Yes)

LOW risk	MODERATE risk	HIGH risk	VERY HIGH risk
Early ambulation	Heparin 5000 units SC q 12 h OR Heparin 5000 units SC q 8 h OR Heparin 7500 units SC q 12 h OR Dalteparin 2500 units SC daily AND / OR IPC	Heparin 5000 units SC q 8 h OR Heparin 7500 units SC q 12 h OR Dalteparin 5000 units SC daily AND Suggest adding IPC	Dalteparin 5000 units SC daily OR Fondaparinux 2.5 mg SC daily OR Warfarin, INR 2-3. **AND** IPC

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Appendix E. *Risk Assessment Models*

Model 4 UCSD Risk Assessment Model (example submitted by Greg Maynard, MD, MSc)

Venous Thromboembolism (VTE) Risk in the Hospitalized Inpatient		
❑ LOW	❑ MODERATE TO HIGH	❑ VERY HIGH
▪ Ambulatory patient *without* additional VTE Risk Factors (see Table of Risk Factors below) ▪ Same day surgery patients ▪ Minor surgery	▪ All other patients (not in LOW or VERY HIGH category)	▪ Elective major lower extremity arthroplasty ▪ Hip, pelvic, or severe lower extremity fractures ▪ Acute spinal cord injury with paresis ▪ Multiple major trauma ▪ Abdominal / pelvic surgery cancer surgical patients

APPROPRIATE PROPHYLAXIS REGIMENS FOR EACH LEVEL OF VTE RISK

LOW risk	MODERATE to HIGH risk	VERY HIGH risk
Early ambulation	Heparin 5000 units SC q 8 h OR Heparin 7500 units SC q 12 h OR Dalteparin 5000 units SC daily OR Enoxaparin 40 mg SC daily OR Heparin 5000 units SC q 12 hours (only for patients with weight < 50 kg or age > 75 years) **AND Suggest** adding IPC	Dalteparin 5000 units SC daily OR Enoxaparin 30 mg SC q 12 hours OR Fondaparinux 2.5 mg SC daily OR Warfarin, INR 2-3. **AND** IPC (unless not feasible)

(Note: the "appropriate" choices listed are for auditing purposes, you may well want to narrow down the choices you present as preferred choices when you build your order set, see sec 13.)

For all patients with contraindications to pharmacologic prophylaxis: IPC and consider graded compression stockings

Venous Thromboembolism Risk Factors		
Age > 50 years	Prior history of VTE	Acute or chronic lung disease
Myeloproliferative disorder	Impaired mobility	Obesity
Dehydration	Inflammatory bowel disease	Known thrombophilic state
CHF	Active rheumatic disease	Varicose veins /chronic stasis
Active malignancy	Sickle cell disease	Recent post-partum w/ immobility
Hormonal replacement	Estrogen based contraceptives	Nephrotic syndrome
Moderate to Major surgery	Central venous catheter	Myocardial infarction

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Appendix E. *Risk Assessment Models*

Model 5 Carillon Risk Assessment (example submitted by Jim Franko, MD, Carillion Medical Center, Roanoke, VA)

Risk Factors:
Any **two or more** is an indication for VTE prophylaxis

- ► Age over 40 years
- ► Obesity
- ► ICU admission
- ► Presence of a central venous line
- ► Prolonged immobility, more than 24 hours
- ► Past history of Chronic Lung Disease or an inflammatory disorder
- ► Admitted with or a history of heart failure, pneumonia or serious infection, varicose veins, nephrotic syndrome, sickle cell disease, pregnancy or estrogen use

"High" Risk Factors:
Any **One** is an indication for VTE prophylaxis

- ► Major trauma (abdomen, pelvis, hip or leg)
- ► Ischemic (non hemorrhagic) stroke or paralysis
- ► Malignancy
- ► Any prior history of deep vein thrombosis or pulmonary embolism

Anticoagulant prophylaxis exclusion criteria:

- ► Significant renal insufficiency (affects low molecular weight heparin only!)
- ► Uncontrolled hypertension
- ► Presence or history of heparin induced thrombocytopenia
- ► Recent intraocular or intracranial surgery
- ► Spinal tap or epidural anesthesia within the previous 24 hours
- ► Any active bleeding
- ► Coagulopathy or thrombocytopenia

LAB: CBC with diff every 2 days while on Heparin or LMWH (Low Molecular Weight Heparin)
TREATMENTS: (please check appropriate boxes for patient)
For patients with three or more risk factors or any two risk factors with one risk factor being stroke/paralysis, cancer, major surgery, trauma, or prior VTE, consider using Enoxaparin every 12 hours or the higher dose of Dalteparin.

1. ❑ Intermittent Sequential Pneumatic Compression Device (SCD) bilateral for the leg/calf

PHARMACY: (please check appropriate boxes for patient)

2. ❑ Heparin 5000 units subcutaneously every eight hours
3. ❑ Enoxaparin (Lovenox) injection 40 milligrams subcutaneously daily or
   ❑ Enoxaparin (Lovenox) injection 30 milligrams subcutaneously every 12 hours
4. ❑ Dalteparin (Fragmin) injection 2500 units subcutaneously daily or
   ❑ Dalteparin (Fragmin) injection 5000 units subcutaneously daily
5. ❑ No VTE Prophylaxis at this time

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