

Venous Thromboembolism (VTE)

2016 UPDATE

Change Package

PREVENTING HARM FROM VTE-RELATED EVENTS



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Accessible at: www.hret-hen.org

Contact: hen@aha.org

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How to Use this Change Package

This change package is intended for hospitals participating in the Hospital Engagement Network (HEN) 2.0 project led by the Centers for Medicare & Medicaid Services (CMS) Partnership for Patients (PFP); it is meant to be a tool to help you make patient care safer and improve care transitions. This change package is a summary of themes from the successful practices of high performing health organizations across the country. It was developed through clinical practice sharing, organization site visits and subject matter expert contributions. This change package includes a menu of strategies, change concepts and specific actionable items that any hospital can choose to implement based on need or for purposes of improving patient quality of life and care. This change package is intended to be complementary to literature reviews and other evidence-based tools and resources.

PART 1: ADVERSE EVENT AREA (AEA) DEFINITION AND SCOPE

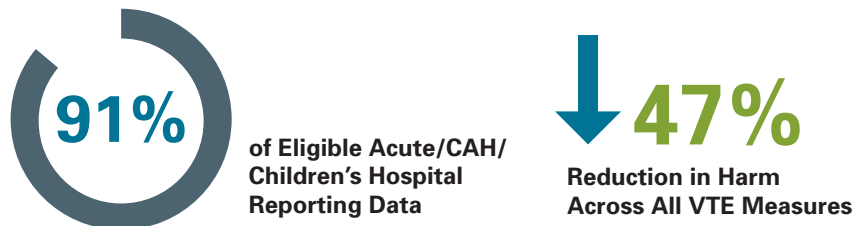
Hospital-associated VTEs (deep venous thrombosis and pulmonary emboli) are one of the most common causes of preventable hospital death.^{1,2,3} The risk for VTE increases among those hospitalized or those recently hospitalized especially among those who are sick or injured.^{4,5} Fortunately, pharmacologic and mechanical methods to prevent VTE are safe, cost-effective and supported by evidence-based research. However, despite the risk factors present in almost all hospitalized medical and surgical patients, large prospective studies continue to demonstrate the significant underutilization of these preventive measures.^{6,7} The American Public Health Association has stated that the “disconnect between evidence and execution as it relates to DVT (deep vein thrombosis) prevention amounts to a public health crisis”.⁸

Magnitude of the Problem

In the U.S., an estimated 350,000 to 600,000 individuals⁹ develop VTE each year and approximately 100,000 die from this condition.¹⁰ Between ages 50 and 80, the mortality rate for pulmonary embolism (PE) more than doubles.¹¹ Alongside severe mortality rates, VTE can also cause chronic morbidities and up to 40 percent of patients may suffer a recurrent event within 10 years after the initial diagnosis.

HEN 1.0 Progress

Through the work of the AHA/HRET HEN, from 2011 through 2014, over 1,400 hospitals worked to prevent and reduce VTE.



What does that Mean?

3,255
VTE HARMS PREVENTED

\$72,391,200
TOTAL PROJECTS ESTIMATED COST SAVING

40% MEETING THE REDUCTION GOAL

17 states

HEN 2.0 Reduction Goals

Reduce the incidence of hospital-acquired VTE by 40 percent, by September 23, 2016.

PART 2: MEASUREMENT

A key component to making patient care safer in your hospital is to track your progress toward improvement. This section outlines the nationally recognized process and outcome measures that you will be collecting and submitting data as part of the AHA/HRET HEN 2.0. Collecting these monthly data points at your hospital will guide your quality improvement efforts as part of the Plan-Do-Study-Act (PDSA) process. Tracking your data in this manner will provide valuable information needed to study your data across time and determine the effect your improvement strategies are having in your hospital at reducing patient harm. Furthermore, collecting these standardized metrics will allow the AHA/HRET HEN to aggregate, analyze and report its progress toward reaching the project's 40/20 goals across all AEAs by September 2016.

Nationally Recognized Measures: Process and Outcome

Please download and reference the encyclopedia of measures (EOM) for additional topics on the AHA/HRET HEN website for additional measure specifications and for any updates after publication at <http://www.hret-hen.org/audience/data-informatics-teams/EOM.pdf>.

HEN 2.0 EVALUATION MEASURE

- Postoperative pulmonary embolism or deep vein thrombosis rate (AHRQ PSI 12)

PROCESS MEASURES

- Percent of patients who got treatment to prevent blood clots on the day of, or day after hospital admission or surgery (NQF 371 - VTE-1)
- Percent of surgery patients who received appropriate venous thromboembolism prophylaxis within 24 hours prior to surgery to 24 hours after surgery (NQF 218 - SCIP-VTE-2)
- Percent of patients diagnosed with confirmed VTE who are discharged (to home, home care, home hospice care or court/law enforcement) on warfarin with written discharge instructions (NQF 0375 - VTE-5)

PART 3: APPROACHING YOUR AEA

Suggested Bundles and Toolkits

- Maynard, G., *Preventing hospital-associated venous thromboembolism: a guide for effective quality improvement*, 2nd ed. Agency for Healthcare Research and Quality; October 2015. AHRQ Publication No. 16-0001-EF. Retrieved at: <http://www.ahrq.gov/sites/default/files/wysiwyg/professionals/quality-patient-safety/patient-safety-resources/resources/vtguide/vteguide.pdf>
- *Patient Information Guide: Deep Vein Thrombosis and Pulmonary Embolism*. Retrieved at: http://files.www.clotconnect.org/DVT_and_PE.pdf
- *Venous Thromboembolism Prophylaxis in Hospitalized Patients: A Clinical Practice Guideline* From the American College of Physicians. Retrieved at: <http://annals.org/article.aspx?articleid=1033137>

- *The Society for Hospital Medicine VTE Prevention Implementation Toolkit*. Retrieved at: http://www.hospitalmedicine.org/Web/Quality_Innovation/Implementation_Toolkits/Venous_Thromboembolism/Web/Quality___Innovation/Implementation_Toolkit/Venous/First_Steps/Implementation_Guide.aspx##
- *Antithrombotic Therapy and Prevent of Thrombosis*, 9th edition: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Retrieved at: <http://journal.publications.chestnet.org/issue.aspx?journalid=99&issueid=23443&direction=P>
- *AAOS Clinical Practice Guidelines for Preventing Venous Thromboembolic Disease in Patients Undergoing Elective Hip and Knee Arthroplasty*. Retrieved at: http://www.aaos.org/research/guidelines/VTE/VTE_guideline.asp
- For key tools and resources related to preventing and reducing VTE, visit www.hret-hen.org

Investigate Your Problem and Implement Best Practices

Driver diagrams: A driver diagram visually demonstrates the causal relationship between your change ideas, secondary drivers, primary drivers and your overall aim. A description of each of these components is outlined in the table below. This change package is organized by reviewing the components of the driver diagram to first, help you and your care team identify potential change ideas to implement at your facility and second, to show how this quality improvement tool can be used by your team to tackle new process problems.

Aim	Primary Driver	Secondary Driver	Change Idea
		Secondary Driver	Change Idea
	Primary Driver	Secondary Driver	Change Idea

AIM: A clearly articulated goal or objective describing the desired outcome. It should be specific, measurable and time-bound.

PRIMARY DRIVER: System components or factors that contribute directly to achieving the aim.

SECONDARY DRIVER: Action, interventions or lower-level components necessary to achieve the primary driver.

CHANGE IDEAS: Specific change ideas which will support/achieve the secondary driver.

Drivers in This Change Package

Prevent VTE	Engage Patients and Families	Educate patients and families on risks and symptoms	Change Idea
	Effectively Stratify by Risk	Risk screen all patients with standard screening tools	Change Idea
		Repeat risk screening when conditions change	Change Idea Change Idea
	Standardize Care Processes	Review current national guidelines	Change Idea
		Develop standard VTE order sets and protocols	Change Idea
		Monitor and assess variation from approved protocols and orders	Change Idea
		Implement ambulation protocols	Change Idea
	Utilize Clinical Decision Support	Design clinical decision support to drive optimal care while limiting workflow interruption	Change Idea
		Engage a pharmacist as part of the care team	Change Idea
		Use pharmacists to identify alternatives when contraindications exist	Change Idea
	Design for Prevention of Failure	Map your process failures and redesign the process to reduce failure	Change Idea
		Perform independent double-checks of all VTE prophylaxis orders	Change Idea
		Eliminate unnecessary central venous catheters (CVC) and peripherally inserted central catheters (PICC)	Change Idea
	Identify and Mitigate Failure	Implement measure-vention strategies	Change Idea
		Use protocols for anti-coagulation	Change Idea
	Use Smart Technology	Link order sets to recent lab values	Change Idea
		Use weight-based dosing for heparin	Change Idea
		Monitor medication administration and mitigate failures in real-time	Change Idea
		Use alerts for weight-based heparin dosing	Change Idea
		Monitor medication administration	Change Idea
		Use smart pumps to minimize dosing errors	Change Idea

OVERALL AIMS: REDUCE VTE

Primary Driver > Patient and Family Engagement

VTE prophylaxis requires engaging patients and family members as part of the VTE prevention plan. Doing so allows better understanding, participation and adherence to recommended prevention activities, whether ambulation, chemoprophylaxis, mechanical prophylaxis or a combination of these interventions. In addition, the patient or family member may be the first to notice the signs of a complication of anticoagulation, side effects of mechanical prophylaxis or the signs and symptoms of VTE. Creating an environment in which the patient and family feel comfortable asking questions and raising issues to clinicians promotes good communication and patient safety.

Secondary Driver > Educate patients and families on risks and symptoms

It is important that patients and families understand the risks associated with prophylaxis and the risks of forgoing prophylaxis.

Change Ideas

- + Alert patients of the recommended prophylaxis measures and the importance of adherence to the measures.
- + Alert patients and families to the early signs and symptoms of VTE.
- + Give clearly written and well explained VTE discharge instructions to patients and families.
- + Use the teach back method to validate that patients and families have a thorough understanding of prophylactic medication administration and dosing, as well as the necessary follow-up instructions regarding physician visits and/or laboratory testing.
- + Involve patients and families in the design of patient education materials that enhance communication with clinical staff and promote patient safety.

Suggested Process Measures for Your Test of Change

- Percent of patients receiving any form of prophylaxis who have a teach back assessment of their understanding of the prophylaxis
- Percent of patients receiving the teach back who successfully demonstrate adequate understanding of the prophylaxis
- Percent of patients who are able to verbalize the warning signs of treatment complications and the next steps for clinical staff notification

Hardwire the Process

Provide every patient and family with educational materials (appropriate health literacy level) regarding the risks of VTE, its complications and the need for adherence to the prevention strategies ordered by the physician. Use a standard mechanism, like teach-back method, to assess patient and family understanding. Don't apply this to chemoprophylaxis only: mechanical devices are often refused by patients, and many do not fully understand what is expected when they are told to ambulate.

Primary Driver > Use Effective Patient Risk Stratification

Effective risk stratification allows for the development of standardized processes that can drive more effective prophylaxis. Many risk stratification models exist: qualitative, quantitative and empirical. Qualitative models include the 3 Bucket Model from the University of California, San Diego (See Appendix II). Quantitative models, such as the Caprini and Padua models, require multi-factor numerical scoring. Empiric models such as the Rogers, Intermountain, IMPROVE and Premier model derive risk factor scoring from observational studies of patients who acquire VTE.¹²

The most used, studied, published and validated model is the qualitative 3 Bucket Model.¹³ Neither the quantitative nor empiric models have broad evidence of efficacy in community settings.¹⁴ Furthermore, the quantitative models can result in physician work-arounds that ignore the scoring altogether. Empiric models have disparate risk factors amongst them that, given the lack of validation, leads one to question their effectiveness.¹⁶ Implementation of simple risk stratification models makes this process easier to accomplish and more likely to be reliably applied in the busy hospital setting. Although easier to implement, this risk-grouping approach does not reduce the effectiveness of the selected therapeutic alternatives for individual patients.¹⁷

In addition to assessing the risk for VTE, patients must also be assessed for risk of bleeding. Bleeding risk is highest in

patients who have experienced a bleeding duodenal ulcer in the three months prior to their hospitalization and in patients with a platelet count of >50,000.¹⁸ Bleeding can change during a hospitalization, especially before and after surgery. Appendix III provides more information on bleeding risk.

Secondary Driver > Risk screen all patients with standard screening tools

Screening tools should address the risks of VTE and the risk of bleeding for each patient at admission, on transfer and on change of status. Adopt a risk-assessment screening tool that is easy to complete and embed it into the workflow. More complex tools demand extra work and create reliability and sustainability challenges while offering limited, if any, advantages in prevention.

Change Ideas

- + Adopt an effective and reliable risk-assessment screening tool that is simple to use.
- + Simplify screening results by grouping patients in low, medium and high-risk categories that dictate specific treatment options.
- + Screen patients upon admission, upon transfer to a new level of care and when there is a change in their condition.

Suggested Process Measures for Your Test of Change

- Percent of patients who receive VTE and bleeding risk screening upon admission
- Percent of patients who receive VTE and bleeding risk screening upon transfer to a higher or lower level of care

Secondary Driver > Repeat risk screening when conditions change

Reevaluating the risks of VTE and the appropriateness of therapy is critical as a patient's condition changes. For example, patients may have had contraindications for anticoagulation because of planned surgery or certain types of injury. As they recover or move to a less intensive level of care, anticoagulant therapy may no longer be contraindicated and may even be beneficial. Conversely, patients whose status worsens might require a readjustment of their thromboprophylaxis orders. A postoperative case with complications may benefit from the addition of mechanical and pharmacological thromboprophylaxis to the treatment plan.

Change Ideas

- + Screen all patients 24 hours post-surgery, including after C-sections, to reassess VTE and bleeding risks.
- + Screen all neurosurgery patients five days after surgery to reassess VTE and bleeding risks.

Suggested Process Measures for Your Test of Change

- Percent of patients who receive VTE risk screening 24 hours post-surgery
- Percent of patients who receive VTE risk screening upon transfer to a higher or lower level of care

Hardwire the Process

To avoid underestimating or overestimating the risk of VTE in hospitalized patients, screening should be tied to a mandatory trigger such as admission orders, transfer orders or medication reconciliation. Examples include:

- + Developing a policy to require physicians to perform risk screening at specified intervals.
- + Adding an independent reassessment by a hospital pharmacist of any patient screened as low risk or who does not receive VTE prophylaxis orders within a designated period of time.
- + Adding an independent reassessment by a hospital pharmacist for any patient with a high-risk diagnosis (e.g. oncology surgery)¹⁹ to verify that the patient is receiving chemoprophylaxis and mechanical prophylaxis, and to verify contraindications should they exist.
- + Adding an independent reassessment by nursing using the organization-wide risk stratification tool to verify current appropriateness of prophylaxis orders.

Primary Driver > Standardize Care Processes

Standardized tools and processes ensure that every patient is evaluated and managed appropriately. To ensure regular and routine use, these tools may be linked to triggers such as admission, transfer or surgery.

Secondary Driver > Review current national guidelines

Uniform agreement on best practices does not currently exist and best practices are still evolving. The recommendations of the American College of Chest Physicians²⁰, the American College of Physicians²¹, the American Academy of Orthopedic Surgeons²² and the Society of Hospital Medicine²³ are not in full agreement, and these recommendations can change significantly at any time. Appendix IV summarizes the major recent guidelines, including those of the American College of Obstetricians and Gynecologists and the American Society of Clinical Oncology.

Change Ideas

- + Develop a process to review published guidelines and stay current with future updates.
- + Designate a subcommittee of the medical staff such as the Pharmacy & Therapeutics Committee to review the current recommendations in the medical literature regarding VTE prevention and treatment. Additional review should be scheduled semi-annually to incorporate updates.

Suggested Process Measure for Your Test of Change

- Was regular review completed of all specialty society guidelines that are relevant to the scope of services provided by your organization? (Yes/No)

Secondary Driver > Develop standard VTE order sets and protocols

Standard work assures that patients receive the agreed upon standard of care, unless a patient is known to have a condition that would require alternative care. Order sets, linked to risk assessment, are the key most effective strategy to produce consistent and appropriate VTE prevention. In order to address patients in special circumstances, order sets should offer a limited array of choices.

Change Ideas

- + Limit literature recommendations to a short list of preferred options.
- + Choose the scope of your prevention efforts (e.g. all surgical patients, all patients).
- + Keep order sets simple and easy for the physician to use within the workflow, while maintaining consistency with national guidelines.
- + Consider special order sets for special populations such as post C-section patients, or orthopedic hip and knee surgery patients.

Suggested Process Measure for Your Test of Change

- Percent of patients who receive prophylaxis orders in accordance with the protocols and order sets

Secondary Driver > Monitor and assess variation from approved protocols and orders

Monitoring and assessing variation from the standard approach can, in certain circumstances, lead to better outcomes. Variation is not by definition bad. In fact, analysis of variation can:

- + Identify where there may be a need to improve the order sets.
- + Lead to educational opportunities for clinicians on best practices.
- + Underscore that certain uncommon or complex conditions may require clinician interventions that go beyond standard work and should remain outside of order sets, so as not to unnecessarily complicate them for rare situations.

Change Ideas

- + Capture a small number of orders that varied from the approved order sets.
- + Talk to the physician to understand why the situation led to the variance.
- + Determine if the variance was required by the patient condition or by physician preference.
- + If the variance was required and validated to be due to the patient condition, consider whether the order set should be changed.

Suggested Process Measures for Your Test of Change

- Percent of prophylaxis orders that vary from the approved protocols and order sets
- Percent of physicians who wrote alternative orders contacted to check reason for variance
- Percent of alternative orders with validated reason for variance
- Percent of alternative orders due to physician preference

Secondary Driver > Implement ambulation protocols

Reduced mobility is a risk factor for the development of VTE. Institute a process that assesses a patient's mobility and generates recommendations for safe mobilization and interventions such as physical therapy as appropriate. Nurse-driven mobility protocols have been shown to be effective in reducing immobility-related complications and hospital lengths-of-stay.^{24,25,26,27}

Change Ideas²⁸

- + Adopt a basic ambulation protocol.
- + Use daily staff assignments to identify which staff, by name and discipline, is responsible for ambulating each patient, each shift and including weekends and holidays.
- + Record mobility goals and actual mobility on flow sheets and on the whiteboard in the patient's room.
- + Use mobility and activity order sets that make progressive mobility the default rather than activity ad lib or bed rest.
- + Reduce the use of narcotics, sedatives, restraints and inappropriate urinary catheters and intravenous lines, making it easier for patients to ambulate safely and reducing their fall risk.
- + Explore the use of nonnarcotic measures for pain control.
- + Use sequential compression devices only when necessary.

Suggested Process Measure for Your Test of Change

- Percent of patients eligible for ambulation who receive protocol-directed ambulation each weekday
- Percent of patients eligible for ambulation who receive protocol-directed ambulation each weekend day

Hardwire the Process

Develop and implement paper or electronic workflows that direct prophylaxis orders based upon risk assessment and direct appropriate changes in prophylaxis order appropriately when the risk for VTE or bleeding changes. Develop and implement progressive ambulation protocols that ensure that every eligible patient is ambulated regularly every day.

Primary Driver > Utilize Clinical Decision Support

Clinical decision support (CDS) can be passive or active. Passive decision support includes links to references or guidelines that the clinician must seek out. It is voluntary and not forced, therefore has not been shown to effectively change clinician practices enough to improve overall patient safety.²⁹

Active decision support occurs when a prompt is given to the caregiver suggesting a best practice, based on both research evidence and system knowledge about the individual patient (including the risk-assessment). For paper medical records, a risk-stratification tool can be embedded in a pre-approved order set on the same page. Electronic records can be designed so that the risk assessments must be completed before the prophylaxis orders. Completion of those assessments will allow only those orders appropriate to be presented. Active decision support has been shown to improve clinical practices and patient care.³⁰

Decision support recommendations included in protocols and order sets may not incorporate all significant patient factors and should only serve as for physicians along with clinical judgment. Peer review and/or escalation strategies can be used to evaluate and discuss appropriate orders for outlier situations.

Secondary Driver > Design clinical decision support to drive optimal care while limiting workflow interruption

Apply the five principles for effective implementation of CDS to prevent VTE:³¹

1. Keep it simple for the end user.
2. Minimize interruptions to workflow and do so only when necessary.
3. Design reliability into the process.
4. Pilot interventions on a small scale.
5. Monitor and measure the use of the protocol.

Change Ideas

- + Standardize embedding of risk assessment into prophylaxis options
- + Schedule and perform daily reviews of appropriateness of prophylaxis orders

Suggested Process Measures for Your Test of Change

- Number of days each week including weekends and holidays that a daily review is performed to determine appropriateness of prophylaxis orders.
- Percent of prophylaxis orders identified on daily review as potentially inappropriate that are changed by the physician after feedback.

Secondary Driver > Engage a pharmacist as part of the care team

When clinical pharmacists are available on units and able to round as part of the care team, the team is more likely to utilize the pharmacist's knowledge and expertise, improving medication-related decision making and reducing errors.

Change Ideas

- + Gather a multidisciplinary team to determine the appropriate roles for pharmacists in VTE prevention.
- + Work with pharmacists to implement processes to support VTE prevention review and oversight, e.g., ensuring appropriate prophylaxis and intervention for all hip fracture surgery and knee and hip arthroplasty patients.
- + Create modalities to facilitate communication between physicians and pharmacists for discussion of optimal prophylaxis on complex patients.

Suggested Process Measures for Your Test of Change

- Number of days per week that a pharmacist rounds on all patients at high risk for VTE, or on all patients on a specific high risk VTE unit
- Number of prophylaxis orders changed after pharmacist consultation

Secondary Driver > Use pharmacists to identify alternatives when contraindications exist

When a patient has a contraindication to standard therapy, decision making can become challenging. Consulting a clinical pharmacist can provide guidance regarding other prophylaxis formulations and regimens available.

Change Ideas

- + Assess the current status of VTE prophylaxis and events for hospital units; use sampling strategies to perform paper or EMR audits for all units.
- + Use validated tools to assess the current knowledge of nursing staff regarding the risks of VTE and anticoagulant therapies.^{32,33}
- + Pilot pharmacist participation on rounds in the ICU or the postoperative orthopedics unit.
- + Where allowed, consider medical staff approval for pharmacist management of VTE prophylaxis orders.

Suggested Process Measures for Your Test of Change

- The number of consultation requests that the clinical pharmacist receives
- Percent of prophylactic anticoagulant orders that were modified as a result of pharmacist consultation

Hardwire the Process

Design workflow so that CDS drives prophylaxis based on risk assessments. Build in requirements for pharmacist consultation when, in the physician's judgment, the CDS is not appropriate for a specific patient due to complexity or contraindications.

Primary Driver > Design for Prevention of Failure

According to principles of reliability theory, processes to prevent failure supported by process to promptly identify and mitigate failure will provide the best mechanism for reliable, effective and safe care to prevent VTE.³⁴

Secondary Driver > Map your process failures and redesign the process to reduce failure

Understanding the steps in your current VTE prevention process that fail most frequently is important.

Change Ideas

- + Get a small group of physicians, nurses and pharmacists together to map the current process that is actually occurring, not the one in your policy manual.

- + Pull a sample of charts from a high risk VTE unit and measure the failure rate for each step in the process. Map those failures.
- + Redesign the process using highly reliable strategies.³⁵
- + Do small tests of change to see if your new strategies are both workable and decrease failure.

Suggested Process Measure for Your Test of Change

- Percent of failure of each step of the VTE prevention process

Secondary Driver > Perform independent double-checks of all VTE prophylaxis orders

Independent double-checks recognize human factors, i.e., humans are not perfect and make mistakes. Assuming that clinicians never make mistakes leads to predictable error. Having one clinician double-check the work of another helps ensure that errors (e.g., appropriateness, drug, dose, frequency and route) do not occur.

Change Ideas

- + Provide pharmacists access to individual patients' risk assessments and medications.
- + Ask pharmacists to double check the appropriateness, correctness and completeness of the VTE orders as guided by evidence-based medical staff protocol.
- + Communicate each patient's VTE risk and prophylaxis recommendations and/or orders to the entire health care team including consulting physicians, nurses and physical therapists (e.g., designate a location where all members of the health care team have access).
- + Build in further redundancy to have the bedside nurse validate physician prophylaxis orders using same risk assessment driven order set.

Suggested Process Measures for Your Test of Change

- Percent and raw number of prophylaxis orders changed after feedback from pharmacist redundant checks
- Percent and raw number of prophylaxis orders changed after feedback from nurse redundant checks

Secondary Driver > Eliminate unnecessary central venous catheters (CVC) and peripherally inserted central catheters (PICC)

Upper extremity deep venous thrombosis (DVT) accounts for approximately 30-40 percent of all hospital acquired VTE. The risk in an individual patient of acquiring symptomatic DVT from a CVC or PICC ranges from two to six percent and up to 11-19 percent for acquiring asymptomatic DVT. The risk of pulmonary embolism can be as high as 12 percent in patients with a CVC or PICC.³⁶

Change Ideas

- + Similar to central line associated bloodstream infections (CLABSI) prevention, use criteria for CVC and PICC lines to guide indications for insertion and removal.
- + For CLABSI, perform daily assessments for necessity of centrally placed lines.

Suggested Process Measures for Your Test of Change

- Percent of CVC and PICC lines that meet insertion criteria.
- Percent of CVC and PICC lines that are removed according to criteria.
- Percent of CVC and PICC lines that require daily evaluation against criteria.

Hardwire the Process

Adapt protocols for appropriate insertion and removal and coordinate the daily review.

Primary Driver > Identify and Mitigate Failure

It is difficult to design a VTE harm prevention system that avoids failure at all times. Early identification and mitigation of failure are important features of highly reliable processes.

Secondary Driver > Implement measure-vention strategies

Develop systems to first, identify patients not receiving appropriate VTE prophylaxis and second, implement appropriate prophylaxis in these patients (measure-vention). Even the best system will fail to identify some patients who should receive prophylaxis. Mechanisms that promptly identify these treatment omissions, coupled with mechanisms that lead to prompt and appropriate prophylaxis, are excellent methods to identify system failures and address them.

Change Ideas

- + At each unit huddle, review each patient's VTE prophylaxis appropriateness.
- + Use the Braden Four Point Degree of Ambulation Scale³⁷ to assess ambulation status and determine if the patient should be receiving more prophylaxis, or if prophylaxis can be reduced.
- + Develop stoplight reports that assess each patient's prophylaxis status (See Appendix V). Link these to the Four Point Braden Degree of Mobility Scale in the nursing notes to facilitate assessment of appropriateness of prophylaxis

Suggested Process Measures for Your Test of Change

- Percent of patients found to have inappropriate VTE prophylaxis orders within 24 hours of admission
- Percent of patients found to have inappropriate VTE prophylaxis orders within 24 hours of admission who have their orders changed to conform with VTE prevention protocols

Secondary Driver > Use protocols for anti-coagulation

One of the causes of delay in treating over or under anticoagulation is the need to locate and consult with the ordering physician. Allowing nurses or pharmacists to respond to an emergency and stop anticoagulation per a pre-approved protocol can reduce delays and risks for patients. Pharmacy driven warfarin management, using medical staff approved protocols, have proven be the most successful method of preventing high INRs.³⁸

Change Ideas

- + Allow nursing staff to hold heparin administration and/or to administer Vitamin K based on designated acute lab test result values via pre-approved protocols.
- + Allow pharmacists to manage unfractionated heparin and warfarin dosage based on current lab values via pre-approved protocols.

Suggested Process Measures for Your Test of Change

- The number of out-of-range lab values in one week for patients receiving prophylactic anticoagulation
- Percent of patients on warfarin managed by a pharmacist driven protocol

Hardwire the Process

Create and approve medical staff policies that allow pharmacists to track and trend daily INRs and to intervene when INRs are rising rapidly before they reach the threshold of excessive anticoagulation.

Primary Driver > Use Smart Technology

Technology can drive improvement. It must be designed and implemented in alignment with human approaches and thoughts on work-flow with the purpose of eliminating or mitigating common causes of human error.

Secondary Driver > Link order sets to recent lab values

As pre-approved in medical staff policies and procedures, laboratory test results can prompt clinicians to alter anticoagulation therapy.

Change Ideas

- + Implement automatic daily INRs on patients on warfarin.³⁹
- + Set up alerts to notify physicians and pharmacists when INRs are out of range.
- + Develop a medical staff policy that allows a pharmacist to alter an anticoagulant dose if a specific lab test result is outside of accepted range.

Suggested Process Measures for Your Test of Change

- Percent of patients on warfarin who receive daily INRs
- Percent of patients with INR out of range alerts who have their warfarin orders changed

Secondary Driver > Use weight-based dosing for heparin

Some protocols require the calculation of heparin dosing by weight of the patient. Weight-based dosing can be safer and more effective, particularly in populations with widely-varying body mass indexes (BMIs). An electronic medical record can easily assist with calculating the recommended dose by using the entered patient weight. The pharmacist can also double check the dose via an integrated EMR system.

Change Ideas

- + Capture accurate weights for all patients on prophylaxis for use by the ordering clinician.
- + Provide the patient's weight to the pharmacist along with the VTE prophylaxis orders

Suggested Process Measure for Your Test of Change

- Percent of weight based heparin orders that are changed as a result of practice alerts or pharmacist intervention

Secondary Driver > Monitor medication administration and mitigate failures in real-time

Electronic monitoring of medication administration allows charge nurses and pharmacists to run real-time reports regarding delayed administration of medications. Delayed administration or missed doses of an anticoagulant could have significant negative consequences for the patient. Catching and mitigating these delays in real-time can improve the efficacy of prophylaxis.

Change Ideas

- + Monitor delays in anticoagulant administration by medication.
- + Analyze delays to find leverage points for process changes that will reduce delays.

Suggested Process Measure for Your Test of Change

- Percent of heparin orders administered outside acceptable dosing window of time

Secondary Driver > Use smart pumps to minimize dosing errors

Smart pumps can alert clinicians to potentially unsafe drug therapy prior to drug administration. The smart pump is designed to fuse traditional infusion-pump technology with pre-determined clinical guidelines and IV drug administration protocols. If program choices entered are outside a designated range, the pump sounds an alarm, indicating a soft stop or hard stop warning. A soft stop allows the infusion to continue without the need for dosing choices to be reentered. With a hard stop, the choices must be reprogrammed to comply with the pre-approved dosing guidelines.³⁸

Change Ideas

- + Consider automatic hold or discontinuation of the anticoagulant order if lab values exceed desired limits, with alerts to physician and pharmacist.
- + Run reports that monitor whether or not the alerts, hard stops and soft stops result in desired decision changes. Since these cause an interruption in work flow, if they do not result in desired decision making they should be altered or abandoned.
- + Run reports to monitor the time that the end user group actually spends looking at the alerts and soft stops (meta-data). If staff is simply passing the alerts by in the time it takes to hit the return key, the alerts are ineffective and should be altered or abandoned.

Suggested Process Measures for Your Test of Change

- Percent of decisions changed due to alerts, hard stops and soft stops.
- Number of alerts, hard stops and soft stops changed due to analysis of end user decision making.

Hardwire the Process

Hardwiring clinical processes into electronic systems promotes safety and reduces the ability of staff to ignore or work-around necessary measures. However, alerts should be designed to be relevant and helpful to the clinician. Overuse of alerts may fatigue clinicians and condition them to ignore warnings and other types of intelligent electronic support provided.

Implement Small Tests of Change

Develop a New Order Set that Links Risk Assessment with Prophylaxis Options

PLAN

Using guidelines from the literature, convene a small multidisciplinary group to develop a simple risk assessment that drives prophylaxis choices for hip and knee arthroplasty.

DO

Test the risk-driven order set with one or two orthopedic surgeons on the same day. This may need to be a paper order set if using an EMR. Note: most small tests of changes in an EMR should be done on paper until the changes are ready for spread; as changing the order set in the EMR changes it for everyone.

STUDY

Hold a brief huddle with the surgeons at the end of the day. What worked? What didn't?

ACT

Using feedback from the huddle, alter the paper order sets and run a new test the next day.

Potential barriers

- Given the varying recommendations from professional societies related to VTE prevention, failure to form a consensus at an institution on best practices may lead to provider resistance. When translating these professional society recommendations into best practices and order sets, start with a limited scope (i.e. orthopedic patients, or ICU patients) to avoid overwhelming others.
- Physicians may be reluctant to do the risk assessments. To overcome this barrier, use physician champions from your organization or from tertiary/academic organizations in your referral network. Segment the data and show the differences between processes and results when physicians do the assessment versus the nurses doing it or when the physician bypasses the risk assessment when writing VTE prophylaxis orders. Keep the assessment simple. Complex quantitative assessments will likely slow adoption and as noted earlier have not been shown to be superior in VTE prevention.
- Physicians may resist pharmacist input regarding anticoagulation. However, study after study has shown that clinicians under-order VTE prophylaxis in at risk patients.^{40,41,42,43} Physicians may be unaware of the expertise and knowledge pharmacists have in the area of VTE prophylaxis. Consider having short, small interdisciplinary meetings of physicians and pharmacists to discuss mutual interest, knowledge and opportunities for collaboration to prevent VTE.
- Use smart technology intelligently. Some clinicians may resist prompts and stops because the process is too complicated and burdensome, making their work harder, not easier. To address this barrier, consider placing a clear outline of the common indications and contraindications (as supported by current evidence) for a specific VTE protocol and order set.

- New strategies may be unfamiliar not only to physicians, but also to many nurses and pharmacists. Nurses and pharmacists may be concerned about making a mistake or about not having adequate training to implement the new policies. They may also fear that the medical staff will not be receptive or cooperative. Education of all parties about the risks of delayed intervention compared to the efficacy of immediate intervention will help mitigate these concerns. Highlighting the fact that nurses and pharmacists are often the first-line responders with VTE and PE could underscore the value of including them in the development and implementation of VTE prevention processes.

Enlist Administrative Leadership as Sponsors to Help Remove or Mitigate Barriers

- Obtaining organizational focus on VTE prevention may be difficult given competing priorities. Educate organizational leadership regarding the emotional costs to the patient and the financial costs of the health.
- Identify an executive sponsor from senior management, who recognizes the value of preventing VTE and its complications and can help brainstorm and implement solutions to promote stakeholder acceptance. The sponsor can remove barriers and provide resources and education across the organization to underscore the benefits of these new processes.
- Implementing changes in practices to reduce VTEs will demand multidisciplinary advocacy from all of the units involved via effective physician, pharmacy and nursing leaders and champions. Their efforts can overcome perceptions that such changes are burdensome, punitive or dangerous.

Change not only “The Practice,” but also “The Culture”

- Changing the culture will likely be necessary, especially for physicians, who will be asked to trade their traditional individualized approach to risk-assessment and prophylaxis for a team-based standardized approach. Providing education about the proven benefits of standard processes applied to VTE prevention can help reassure hesitant physicians that these changes will benefit their patients.
- Order sets may make some physicians uncomfortable. Most physicians learn best from peers and will often value their peers’ recommendations over expert advice. Physician champions and early adopters can provide a positive peer influence that can inspire other physicians to embrace new procedures

PART 4: CONCLUSION

VTE is a common and costly cause of health care-acquired morbidity and mortality. The literature is clear that many if not most cases of hospital acquired VTE can be prevented using well designed processes and protocols that link risk assessment to prophylaxis orders, followed by regular evaluation of the appropriateness of prophylaxis during the hospital stay. Organizations around the country have made dramatic reductions in this kind of harm. To replicate, start by: (1) looking at the key professional society recommendations in this document; (2) begin with a simple protocol; (3) conduct a very small test of change - learning, modifying and repeating as necessary; (4) then spread the protocol; and finally (5) employ measure-vention strategies to find and mitigate process failures.

PART 5: APPENDICES

APPENDIX I: VTE TOP TEN CHECKLIST

Associated Hospital/Organization: AHA/HRET HEN 2.0

Purpose of Tool: A checklist to assess current practices to prevent harm from VTE-associated events

Reference: www.hret-hen.org

2016 VTE Top Ten Checklist				
Process Change	In Place	Not Done	Will Adopt	Notes (Responsible and By When?)
Adopt a VTE risk assessment screening tool.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Assess every patient upon admission for his/her risk for VTE using the VTE risk assessment screening tool.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Adopt a standardized risk-linked menu of choices for VTE prophylaxis.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Develop standard written order sets which link risk assessment results to specific prophylaxis options.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Use protocols for dosing and monitoring all chemoprophylaxis agents.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Enlist pharmacists to provide key real-time decision support for prophylaxis option selection, discuss contraindications and options and assist with protocol development.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Give nurses the same risk assessment and prophylaxis tools that you give physicians and utilize nurses to perform independent periodic checks throughout the course of the hospitalization.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Use measure-vention strategies to find under or over prophylaxis within 24 hours of admission, and if possible, throughout the hospitalization.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Educate patients and families regarding the importance of ambulation, oral medications or injections and sequential compression devices in VTE prevention.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Use success stories of patients or groups of patients at high risk for VTE where VTE was prevented due to proper risk assessment, prophylaxis and measure-vention throughout the hospitalization.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

APPENDIX II: UPDATED 3 BUCKET MODEL FOR VTE PROPHYLAXIS

Associated Hospital/Organization: The University of California, San Diego

Purpose of Tool: Simple qualitative model to risk stratify patients and drive prophylaxis orders

Reference: Agency for Healthcare Research & Quality, excerpt from <http://www.ahrq.gov/sites/default/files/wysiwyg/professionals/quality-patient-safety/patient-safety-resources/resources/vtguide/vtguide.pdf>

Updated “3 Bucket” Model	
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, multiple major trauma, spinal cord injury or major neurosurgery, abdominal-pelvic surgery for cancer.	IPCD AND LMWH or other anticoagulant*

* For those at moderate or high VTE risk and contraindications to anticoagulation, use IPCD alone until bleeding risk subsides.

APPENDIX III: BLEEDING RISK FACTORS AND CONDITIONS TO CONSIDER WITH PHARMACOLOGIC VTE PROPHYLAXIS

Associated Hospital/Organization: Agency for Healthcare Research & Quality

Purpose of Tool: Summary of risk factors to consider in concert with VTE pharmacologic prophylaxis

Reference: Agency for Healthcare Research & Quality, excerpt from <http://www.ahrq.gov/sites/default/files/wysiwyg/professionals/quality-patient-safety/patient-safety-resources/resources/vtguide/vteguide.pdf>

Bleeding Risk Factors and Conditions To Consider	
Active bleeding (last 3 months unless low risk profile on endoscopy)	Intracranial bleeding within last year or until cleared by neurological services
Active gastroduodenal ulcer	Intraocular surgery within 2 weeks
Platelet count <50,000, or <100,000 and downtrending	Untreated inherited bleeding disorders
Therapeutic levels of anticoagulation	Hypertensive urgency/emergency
Advanced liver disease with INR >1.5	Postoperative bleeding concerns*
Heparin induced thrombocytopenia (no heparinoids; consider consultation)	Epidural/spinal anesthesia within previous 4 hours or expected within next 12 hours

* Leeway times:

- 24 hours maximum for most general surgery, orthopedic surgery
- Status posttransplant or multiple major trauma to clear bleeding risk: 48 hours
- Status post spinal cord open surgery: 5 days leeway

APPENDIX IV: MAJOR GUIDELINES ADDRESSING VTE PROPHYLAXIS

Associated Hospital/Organization: Agency for Healthcare Research & Quality

Purpose of Tool: Summary of pertinent guidelines on VTE prevention, presented in reverse chronological order beginning with the latest recommendations

Reference: Agency for Healthcare Research & Quality, excerpt from <http://www.ahrq.gov/sites/default/files/wysiwyg/professionals/quality-patient-safety/patient-safety-resources/resources/vtguide/vtguide.pdf>

Guideline	Acronym and Date	Description
American Society of Clinical Oncology guideline update: Venous Thromboembolism Prophylaxis and Treatment in Patients with Cancer ⁴⁴	ASCO 2012	Update from 2007 guideline. More explicit guidance than 2007 on patients that do not warrant prophylaxis as well as those that do.
Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians (ACCP) Evidence-Based Clinical Practice Guidelines ⁴⁵	AT9 2012	Guidelines for VTE prevention presented as four separate articles by the patient's reason for hospitalization, including: <ul style="list-style-type: none"> + Nonsurgical + Nonorthopedic surgical + Orthopedic + Pregnancy
Venous Thromboembolism Prophylaxis in Hospitalized Patients: A Clinical Practice Guideline From the American College of Physicians (ACP) ⁴⁶	ACPI 2011	Guideline focused on nonsurgical patients: medical and stroke.
American College of Obstetricians and Gynecologists Practice Bulletin No. 123. Thromboembolism in Pregnancy ⁴⁷	ACOG 2011	Expands and updates VTE prevention in pregnancy and cesarean deliveries.
Preventing Venous Thromboembolic Disease in Patients Undergoing Elective Hip and Knee Arthroplasty. Evidence-Based Guideline and Evidence Report From the American Academy of Orthopedic Surgeons. Second Edition. ^{48,49}	AAOS2 2011	Second edition and AT9 now aligned on most issues. Many areas with limited guidance.

APPENDIX V: AUTOMATED MEASURE-VENTION SCREENING TOOL

Associated Hospital/Organization: Agency for Healthcare Research & Quality

Purpose of Tool: Assist organization in real time recognition of VTE prophylaxis process failure (measure-vention)

Reference: Agency for Healthcare Research & Quality, excerpt from <http://www.ahrq.gov/sites/default/files/wysiwyg/professionals/quality-patient-safety/patient-safety-resources/resources/vtguide/vtguide.pdf> Last accessed December 29, 2015.⁵⁰

BED_LABEL	VTE Risk Category	Medication	Dose	SCD order	SCD On	AC Contraindication	Braden Activity
601A	Low	No Anticoag Med	No Anticoag Dose	N	No SCD	N	Walks Frequently
601B	Moderate	No Anticoag Med	No Anticoag Dose	Y	On	Y	Chairfast
608B	Moderate	enoxaparin (LOVEN	40 mg DAILY Subcutaneous	N	No SCD	N	Walks Frequently
609A	Low	No Anticoag Med	No Anticoag Dose	N	No SCD	N	Walks Frequently
609B	Moderate	heparin injection 5,	5000 Units EVERY 12 HOURS	N	No SCD	N	Walks Occasionally
611A	High	enoxaparin (LOVEN	40 mg DAILY Subcutaneous	Y	Off	N	Chairfast
611B	Moderate	enoxaparin (LOVEN	40 mg DAILY Subcutaneous	N	Patient Refus	N	Walks Occasionally
612A	Moderate	No Anticoag Med	No Anticoag Dose	Y	Patient Refus	N	Bedfast
612B	Low - Anticoagulat	enoxaparin (LOVEN	1 mg/kg EVERY 12 HOURS Su	N	No SCD	N	Chairfast
615A	Moderate	No Anticoag Med	No Anticoag Dose	Y	On	N	Chairfast

This example illustrates how automated reports can pull together much of the information required to screen for potential prophylaxis deficiencies, allowing for rapid assessment and intervention when appropriate.

RED

Patients on no chemo or mechanical prophylaxis (potential under prophylaxis), but who are low risk and ambulating well. Prophylaxis appropriate.

ORANGE

Patients at moderate risk, with an SCD and a contraindication to an anticoagulant. Care appropriate.

YELLOW

Patients at moderate risk without a contraindication to an anticoagulant. The patient in 612A refused the SCD and is bedfast. Care inappropriate. Patient should be on an anti-coagulant. The patient in 615A, while on an SCD, is chair fast and might benefit from an anticoagulant alone or in combination with the SCD.

GREEN

These patients are on anticoagulants and care appears appropriate, with the exception of the patient in 611A who is at high risk, is chairfast and refuses an SCD. This patient would likely benefit from combination chemo and mechanical prophylaxis.

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