Preventing Hospital-Associated Venous Thromboembolism: Practical Strategies That Work

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CQO, UC Davis Medical Center
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CDC Webinar
Conflict of Interest

Executive Committee -
Mariner VTE Prevention trial of extended duration prophylaxis in medical patients

AHRQ DVT Prevention Guide author
Abbreviations – Terms

- VTE – venous thromboembolism
- VTE-P – VTE Prevention / prophylaxis
- HA VTE – hospital-associated VTE
- CDS – Clinical decision support
- IPCD – intermittent pneumatic compression devices
- SCD – sequential compression devices
- GCS – graduated compression stockings
- Extended duration prophylaxis – beyond hospital stay
- LMWH – low-molecular weight heparin
- UFH – unfractionated heparin
- LDUH – low dose unfractionated heparin
- PAH – Pulmonary artery hypertension
- AT8 – ACCP Anticoagulation / DVT Prevention guidelines (2008)
- AT9 – ACCP Anticoagulation / DVT Prevention guidelines (2102)
A Major Source of Mortality and Morbidity

- 350,000 to 650,000 with VTE per year
- 100,000 to > 200,000 deaths per year
- About half are hospital related.
- VTE is primary cause of fatality in half-
  - More than HIV, MVAs, Breast CA combined
  - Equals 1 jumbo jet crash / day
- 10% of hospital deaths
  - PE among top sources of preventable hospital related death
- Huge costs and morbidity (recurrence, post-thrombotic syndrome, chronic PAH, anticoag)
QI Framework and Strategies that Work

- UC San Diego and Univ. of California VTEP Collaborative
- SHM / AHRQ improvement guides and Collaborative
- Experience, mentoring other hospitals via UCSD CIIS
- Johns Hopkins experience
- Systematic reviews


Strategies to Reduce HA VTE

- Centralized steering group for institution wide approach
- Review and distill the evidence / best practices
- Standardize – Create a VTE Prevention Protocol
- Embed protocol guidance into order sets, hard stops for use on admission, transfer, and post op – Provide seamless CDS
- Go beyond core measures / SCIP - better measures
- Active day-to-day surveillance, in addition to monthly / quarterly
- Multiple mutually reinforcing interventions to reinforce protocol
- Active vs passive interventions
- Address adherence / administration of prophylaxis
- Address other failure modes / contributing factors to HA VTE
Review Evidence, identify best practice

Guidelines
AT9, ATS, ACPJ, AAOS, ASCO, ACOG, NICE

Regulatory
TJC/NQF/SCIP/CMSS

Local standards
Other guidance
Literature, meta-analyses

Summarize Translate

Define Local Best Practice Standards and Expectations

Policies
Protocols VTE and bleeding risk assessment linked to risk appropriate prophylaxis options

Design Multi-faceted Interventions

Order sets
Embedded VTE prevention protocol

Education
Increase delivery of ordered prophylaxis

Checklists
Alerts
Reduced use of central venous catheters

Enhance mobility and activity
Audit and feedback
Care pathways

Ensure reliable delivery of best practice - implement, monitor, revise, and refine,

Engage
Explain why important

Educate
Share evidence, include “just in time” education

Execute
Implement intervention toolkit with standardization, good CDS, high reliability techniques

Evaluate
Regularly assess, revise and refine as needed.

Analyze Care Delivery

Survey Previous / Ongoing Efforts
Environment, baseline, failure modes, barriers to implementation

Continue analysis of care delivery
Local barriers, impact of interventions

Track Metrics

Key Metrics:
Prevalence of appropriate VTE Prophylaxis
Incidence of Hospital-Associated VTE

Establish Foundation:
Institutional Support and Centralized, Empowered VTE Prevention Steering Team
The Essential First Intervention

1) a standardized VTE risk assessment, linked to...
2) a menu of appropriate prophylaxis options, plus...
3) a list of contraindications to pharmacologic VTE prophylaxis

Challenges:

*Make it easy to use ("automatic")*
*Make sure it captures almost all patients*
*Trade-off between guidance and ease of use / efficiency*
Characteristics of the hypothetical ideal protocol

Trade-offs and prioritization of characteristics often needed

- Accurately detects all patients at risk for DVT.
- Reliably excludes patients who would be unlikely to develop DVT, minimizing inappropriate over-prophylaxis in those of lower risk.
- Provides actionable recommendations for permutations of VTE and bleeding risk.
- Simple to use in routine clinical practice
- Identifies patients that should have a combination of mechanical and anticoagulant prophylaxis.
- Lends itself to automation or dynamic ongoing re-evaluations.
- Integration results in convincing decreases in hospital-associated VTE without any increase in bleeding.
<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Predicted Prophylaxis rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No protocol* (“State of Nature”)</td>
<td>40%</td>
</tr>
<tr>
<td>2</td>
<td>Decision support exists but not linked to order writing, or prompts within orders but no decision support</td>
<td>50%</td>
</tr>
<tr>
<td>3</td>
<td><strong>Protocol well-integrated</strong> (into orders at point-of-care)</td>
<td>65-85%</td>
</tr>
<tr>
<td>4</td>
<td>Protocol enhanced (by other QI / high reliability strategies)</td>
<td>90%</td>
</tr>
<tr>
<td>5</td>
<td><strong>Oversights identified and addressed in real time</strong></td>
<td>95+%</td>
</tr>
</tbody>
</table>
Protocol

- Local Standards of best practice
- Written out
- Algorithmic decision trees can be useful
- Include operational definitions*
- Must have enough detail to be measurable and make judgments re:
  
  *Is this case meeting our standard of care?*

- Examples requiring operational definitions*
  - High INR
  - Low platelet counts
  - Impaired mobility
  - “Low Risk”
DVT PROPHYLAXIS ORDERS
- Anti thromboembolism Stockings
- Sequential Compression Devices
- UFH 5000 units SubQ q 12 hours
- UFH 5000 units SubQ q 8 hours
- LMWH (Enoxaparin) 40 mg SubQ q day
- LMWH (Enoxaparin) 30 mg SubQ q 12 hours
- No Prophylaxis, Ambulate
Over 20 different VTE risk assessment models

- No consensus on what is best in clinical practice

- Individualized point-based scoring (quantitative) models
  - Generally more rigorously validated in determining risk, but not in clinical practice
  
  Examples:
  - Caprini
  - Padua
  - IMPROVE

- Grouping or “bucket” models
  - Generally not as well validated in predicting risk, but easier to implement, more published / unpublished success stories in reducing HA VTE

  Examples:
  - NICE / NHS guidelines, Australia / New Zealand working group model
  - Classic “3 bucket” model
  - Updated “3 bucket” grouping model
Caprini Model

- Validated in predicting risk
- Can be difficult to use reliably
- Only 1 published success in clinical practice published after 30 years of use.
- Works best in centers with advanced CDS to make it easier / more automated

### Caprini Score

<table>
<thead>
<tr>
<th>Caprini Score</th>
<th>Risk</th>
<th>VTE Incidence</th>
<th>Recommended Prophylaxis</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2</td>
<td>very low - low</td>
<td>&lt; 1.5%(^1)</td>
<td>Early ambulation, IPC</td>
</tr>
<tr>
<td>3 - 4</td>
<td>moderate</td>
<td>3%(^1)</td>
<td>LMWH; UFH; or IPC. If high bleeding risk, IPC until bleeding risk diminishes.</td>
</tr>
<tr>
<td>5 - 8</td>
<td>high</td>
<td>6%(^1)</td>
<td>LMWH + IPC; or UFH + IPC. If high bleeding risk, IPC until bleeding risk diminishes.</td>
</tr>
<tr>
<td>&gt; 8</td>
<td>very high</td>
<td>6.5 - 18.3%</td>
<td>LMWH + IPC; or UFH + IPC. If high bleeding risk, IPC until bleeding risk diminishes. Consider extended duration prophylaxis.</td>
</tr>
</tbody>
</table>

\(^1\) Abdominal or pelvic surgery for cancer should receive extended VTE prophylaxis with LMWH x 30 days.

IPC = intermittent pneumatic compression  
LMWH = low molecular weight heparin  
UFH = unfractionated heparin

- Classic “3 bucket” model derived from AT8

<table>
<thead>
<tr>
<th>Low Risk: Minor surgery in mobile patients. Medical patients who are fully mobile. Observation patients with expected hospital stay &lt; 48 hours.</th>
<th>No prophylaxis, reassess periodically, ambulate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate Risk: Most general, thoracic, open gynecologic or urologic surgery patients. Medical patients, impaired mobility from baseline or acutely ill.</td>
<td>UFH or LMWH prophylaxis*</td>
</tr>
<tr>
<td>High Risk: Hip or knee arthroplasty, hip fracture surgery. multiple major trauma, spinal cord injury or major spinal surgery, Abdominal-pelvic surgery for cancer.</td>
<td>IPCD <strong>AND</strong> LMWH or other anticoagulant*</td>
</tr>
</tbody>
</table>

*For those at moderate or high risk and contraindications to anticoagulation, use IPCD.
Percent of Randomly Sampled Inpatients with Adequate VTE Prophylaxis

Baseline
Consensus building
Order Set Implementation & Adjustment
Real time ID & intervention

N = 2,944  mean 82 audits / month

<table>
<thead>
<tr>
<th>Year</th>
<th>Patients at Risk</th>
<th>Cases with any VTE</th>
<th>Risk for HA VTE</th>
<th>Odds Ratio</th>
<th>(95% CI)</th>
<th>Cases with PE</th>
<th>Risk for PE</th>
<th>Odds Ratio</th>
<th>(95% CI)</th>
<th>Cases with DVT (and no PE)</th>
<th>Risk for DVT</th>
<th>Odds Ratio</th>
<th>(95% CI)</th>
<th>Cases w/ Preventable VTE</th>
<th>Risk for Preventable VTE</th>
<th>Odds Ratio</th>
<th>(95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>9,720</td>
<td>131</td>
<td>1 in 76</td>
<td>1.0</td>
<td>(0.81, 1.32)</td>
<td>21</td>
<td>1 in 463</td>
<td>1.0</td>
<td>(0.54, 1.96)</td>
<td>110</td>
<td>1 in 88</td>
<td>1.0</td>
<td>(0.79, 1.96)</td>
<td>44</td>
<td>1 in 221</td>
<td>1.0</td>
<td>(0.26, 0.80)</td>
</tr>
<tr>
<td>2006</td>
<td>9,923</td>
<td>138</td>
<td>1 in 73</td>
<td>1.03</td>
<td>(0.46, 0.80)</td>
<td>22</td>
<td>1 in 451</td>
<td>1.02</td>
<td>(0.30, 1.26)</td>
<td>116</td>
<td>1 in 85</td>
<td>1.0</td>
<td>(0.45, 0.82)</td>
<td>21</td>
<td>1 in 473</td>
<td>0.47#</td>
<td>(0.05, 0.31)</td>
</tr>
<tr>
<td>2007</td>
<td>11,207</td>
<td>92</td>
<td>1 in 122</td>
<td>0.61#</td>
<td>(0.46, 0.80)</td>
<td>15</td>
<td>1 in 747</td>
<td>0.62</td>
<td></td>
<td>77</td>
<td>1 in 146</td>
<td>0.61*</td>
<td>(0.45, 0.82)</td>
<td>7</td>
<td>1 in 1,601</td>
<td>0.14*</td>
<td>(0.05, 0.31)</td>
</tr>
</tbody>
</table>

* p < 0.001

## Updated Model – More c/w AT9 guidelines

Updated “3 bucket” model, now in use at authors’ site (UC San Diego)

<table>
<thead>
<tr>
<th>Low Risk: Observation status, expected LOS &lt; 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.</th>
<th>No prophylaxis, reassess periodically, ambulate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>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 &gt; 48 hours. Medical patient with decrease in usual ambulation <strong>AND</strong> VTE risk factors (MI, Stroke, CHF, PNA, active inflammation / infection, dehydration, age &gt; 65)</td>
<td>UFH or LMWH prophylaxis*</td>
</tr>
<tr>
<td>High Risk: Hip or knee arthroplasty, hip fracture surgery, multiple major trauma, spinal cord injury or major neurosurgery, abdominal-pelvic surgery for cancer</td>
<td>IPCD <strong>AND</strong> LMWH or other anticoagulant*</td>
</tr>
</tbody>
</table>

*For those at moderate or high VTE risk and contraindications to anticoagulation, use IPCD alone until bleeding risk subsides.
UC Davis Medical Center
3 bucket model algorithm assoc. w/ reduction in HA VTE

VTE Risk Assessment Tool—for patients ADMITTED (not OBS or same day surgery) to UCDMC and who are expected to be hospitalized for more than two days.

HIGH Risk Factors for VTE
- Major Lower Extremity or Pelvic Orthopedic Surgery
- Neurosurgery Procedure
- Major Spine Surgery
- Acute Spinal Cord Injury
- On Ventilator
- Active Cancer
- Acute stroke with hemiparesis

Does the patient have 1 or more HIGH Risk Factor?

- NO

Is the patient MOBILE**?

- NO

HIGH RISK
- Pharmacologic Prophylaxis AND Mechanical Prophylaxis
  (Unless either or both contraindicated)

- YES

MODERATE RISK
- Pharmacologic Prophylaxis ONLY
  (When pharmacologic prophylaxis contraindicated—use Mechanical Prophylaxis)

Does the patient have 1 or more MOD Risk Factor?

- NO

LOW RISK
- No Prophylaxis required

- YES

Moderate Risks for VTE
- Prior DVT/PE
- Inflammatory Disorder (SLE, RA, Crohn’s Ulcerative Colitis)
- Immobility*
- Major Surgery within prior 7 days
- Infection requiring IV Antibiotics

**Minimum Criteria for MOBILITY = Walks occasionally for short distances, with or without assistance. May spend most of the day in bed.
Effective Implementation / CDS Principles

1. Keep it simple for the end user
   a. Some adjustments can be done behind the scenes (pharmacy adjustment of dose or periop timing, for example)
   b. Minimize calculations / clicks, automate process for them
   c. Streamline options, offer only preferred choices

2. Don’t interrupt the work flow
   a. Integrate risk assessment in admit / transfer / post op process
   b. Keep VTE risk assessment, bleeding risk assessment, and ordering of risk-appropriate prophylaxis together as a unified process.

3. Design reliability into the process
   a. **Forcing functions** / hard stop for VTEP
   b. Present **preferred risk appropriate prophylaxis as the default** option once risk level chosen
   c. **Scheduling** and **redundant** checks for highest risk patients
   d. **Standardization** for services / groups of patients (discourage over-customization at provider level)
Effective Implementation / CDS Principles

4. Pilot interventions on a small scale
   a. Engage medical staff groups, look for barriers and special needs
   b. Use case histories or real patient scenarios to simulate use of the order set

5. Monitor use of the protocol. Build measurement and monitoring into order set and documentation tools
   a. Capture VTE risk, declaration of contraindications, what is ordered
   b. Ambulation, IPCD adherence
   c. Audits – order sets being used? Completed properly?
   d. Learn for variation from protocol
Key Strategies

Implementing Caprini Model

Scope: ALL adult inpatients
Standardized VTE Protocol – Caprini model
Mandatory risk assessment with CPOE hard-stop
Clinical decision support to drive clinical practice
Required documentation of contraindications
Data feedback to services regarding performance
VTE prophylaxis included as peer review (OPPE) indicator for many services
Review of EVERY VTE event that occurs in the health system for preventability
Reorganization / grouping of Caprini VTE risk factors make it more user friendly

Point total calculated for user, prophylaxis recommendation based on risk score
VTE Risk Level, contraindications (if present) and ordered prophylaxis capture for analysis.
Classic 3 bucket model implementation

Courtesy Dr. Lori Porter, Good Samaritan Regional Medical Center
Risk-appropriate prophylaxis options appear after risk level chosen. High Risk requires dual prophylaxis.
Contraindications captured if pharmacologic prophylaxis not ordered for a patient at risk of DVT.
Any Attempt to uncheck the order will give this message.

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Johns Hopkins Medicine DVT Prevention Order Set Example
Courtesy Dr. Michael Streiff

- Embedded in Medicine Admission Orders
- Hard Stop to use (vs delete entire order set)
Patient age, weight, renal function and relevant labs imported from database.
Mandatory Selections
- Risk Factors
- Contraindications

SECTION A: Does the patient have any major VTE risk factors?

- Previous VTE
- Age greater than 60 years
- Cancer - Metastatic or under treatment
- Stroke with paralysis less than 3 months
- Known hypercoagulable state
- NYHA class III/IV heart failure
- Mechanical ventilation
- Sepsis
- Pregnancy to six weeks post partum
- No major risk factors known

SECTION B: Does the patient have any contraindications to pharmacologic prophylaxis?

- Current use of systemic anticoagulation
- Active bleeding
- High risk of bleeding
- INR greater than or equal to 1.5
- APTT greater than or equal to 1.3
- Platelet count less than 50,000 cells/µL
- No contraindications known

Recommended Prophylaxis:

<table>
<thead>
<tr>
<th>Order</th>
<th>Dose</th>
<th>UOM</th>
<th>Route</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heparin Inj</td>
<td>5000</td>
<td>unit</td>
<td>SubQ</td>
<td>q8h</td>
</tr>
<tr>
<td>Heparin Inj</td>
<td>5000</td>
<td>unit</td>
<td>SubQ</td>
<td>q12h</td>
</tr>
<tr>
<td>TED Stockings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compression Device, Sequential</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foot Pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Was VTE Prophylaxis Ordered as Recommended?

- Yes
- No - Pork Aversion
- No - Bleeding Risk Greater than VTE Risk
- No - Prescriber Preference
Prophylaxis Recommendation

SECTION A: Does the patient have any major VTE risk factors?
- Previous VTE
- Age greater than 60 years
- Cancer - Metastatic or under treatment
- Stroke within past 3 months
- Known hypercoagulable state
- NYHA class III/IV heart failure
- Mechanical ventilation
- Severe
- Pregnancy within 6 weeks post partum
- No major risk factors known

Recommended Prophylaxis:
- Choose Heparin 5000 units q8h (High Risk Prophylaxis)

SECTION B: Does the patient have any contraindications to pharmacologic prophylaxis?
- Current use of systemic anticoagulation
- Active bleeding
- High risk of bleeding
- INR greater than or equal to 1.5
- APTT greater than or equal to 1.3
- Platelet count less than 50,000 units
- No contraindications known

VTE Risk Assessment was Completed
<table>
<thead>
<tr>
<th>Order</th>
<th>Dose</th>
<th>UOM</th>
<th>Route</th>
<th>Frequency</th>
<th>Start Date</th>
<th>Start Time</th>
<th>Pharmacy Instructions</th>
<th>Side of Body</th>
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</thead>
<tbody>
<tr>
<td>Enoxaparin Inj</td>
<td>40</td>
<td>mg</td>
<td>SubQ</td>
<td>q24h</td>
<td></td>
<td></td>
<td>Time Critical</td>
<td></td>
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<tr>
<td>Heparin Inj</td>
<td>5000</td>
<td>unit</td>
<td>SubQ</td>
<td>q8h</td>
<td>08/13/2007</td>
<td>18:00</td>
<td>First dose 2 hours Pre-Op and...</td>
<td></td>
</tr>
<tr>
<td>Heparin Inj</td>
<td>5000</td>
<td>unit</td>
<td>SubQ</td>
<td>q12h</td>
<td>08/13/2007</td>
<td>18:00</td>
<td>Give first dose 2 hours Pre-...</td>
<td></td>
</tr>
<tr>
<td>Ambulate with Assistance</td>
<td></td>
<td></td>
<td></td>
<td>tid</td>
<td></td>
<td>Routine</td>
<td>Routine</td>
<td></td>
</tr>
<tr>
<td>Ambulate without Assistance</td>
<td></td>
<td></td>
<td></td>
<td>tid</td>
<td></td>
<td>Routine</td>
<td>Routine</td>
<td></td>
</tr>
<tr>
<td>TED Stockings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Routine</td>
<td>Routine</td>
<td>Bilateral</td>
</tr>
<tr>
<td>Compression Device, Sequential</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Routine</td>
<td>Routine</td>
<td></td>
</tr>
<tr>
<td>Foot Pump</td>
<td></td>
<td></td>
<td></td>
<td>T</td>
<td></td>
<td>Routine</td>
<td>Routine</td>
<td></td>
</tr>
</tbody>
</table>

Was VTE Prophylaxis Ordered as Recommended?

- Yes [✓]
- No - Religious Reasons [ ]
- No - Bleeding Risk Greater than VTE Risk [ ]
- No - VTE Risk Greater than Bleeding Risk [ ]
- No - Heparin Allergy/Adverse Reaction [ ]

VTE Risk Assessment was Completed - LABPOE, CHARLES

- Order: VTE Risk Assessment was Completed
- Requested By: Durette, Annette
- Messages: [Recommended Prophylaxis was...]

Documentation of Risk Assessment
TJC and SCIP Measures

- Relatively low bar
- Do not drive rapid cycle QI
- Looks only at set points in hospitalization
  - Does not address patients who “fall off” protocol
- TJC measures: any prophylaxis = adequate prophylaxis

Go Beyond Core Measures to achieve better results
- Judge adequacy of prophylaxis by adherence to your protocol
- HA VTE = readmitted cases with new VTE + those not present on admission
- Monitor for lapses in care on a day-to-day basis
Outcomes measure for HA VTE and Preventable VTE

- Real time capture using imaging system, and concurrent review of cases to see if they are HA or community acquired, preventable / not preventable. Not practical for most, but may be gold standard.

- Improved methodology using administrative data
  - Captures readmitted patients as well as those with POA = No
  - Captures UE DVT, but tracks them separately
  - Higher bar for ‘preventable’
  - Audits to validate coding

- Administrative coding Caveats
Need to address all common failures in process

- No protocol / standardized order sets
- Order sets / prompts for VTE P in place, but no guidance
- Order sets with guidance in place but bypassed
- Order sets with guidance in place and used, but used incorrectly
- Patient gets placed on right prophylaxis, but VTE / bleeding risk changes and adjustment not made.
- Prophylaxis gets missed / changed on transfer / peri-op setting
- Correct prophylaxis ordered, but not administered, or patient refuses.
- Patient not mobilized optimally
- Preventable risk factors (central line) not optimally managed
- Patient had indication for extended duration prophylaxis, but did not get it
Strategies for VTE Prevention
Beyond order sets

- *Good protocol driven order set is well integrated*
- Assessing administration / adherence
  - (not just orders)
- Alert Systems
  - Electronic alerts (E-alerts)
  - Human alerts
- Raising situational awareness (eg checklists)
- Audit and feedback
- Measure-vention
- Increase activity
- Optimize central lines
- Focus on extended duration for select populations
What is a blood clot?
- Clumps of thickened blood that blocks blood flow
- Blood clots most often form in your legs, arms, and groin but could move to your lungs, heart or brain
- Blood clots can be dangerous and deadly

Why am I at risk in the hospital?
- You are not moving around well *
- You recently had surgery or an injury
- Your disease may increase your chance of getting a clot

To prevent a blood clot from happening during your hospital stay, your doctor may ask you to take a medication or wear a leg device.

If your doctor asks you to take a medication....
- The medication is a blood thinner
- This medication is a small injection into fatty tissue just below the skin
- It may be given more than once a day
- You will likely not need the medication once you leave the hospital

*If you are able to walk, this may decrease your risk. Please ask your nurse for help before getting out of bed.

If your doctor asks you to wear a leg device...
- Sleeves will be placed on your legs that will squeeze your legs off and on during the day
- This light squeeze will increase the flow of blood in your legs to prevent clots from forming
- These sleeves should be removed before you are out of bed and walking because they can cause you to trip and fall
- Be sure you to ask for the sleeves to be put back on when you are back in bed
MEASURE-VENTION

Daily measurement drives concurrent intervention (i.e., same as Level 5 in Hierarchy)

Identify suboptimal prophylaxis in real time

- Ongoing assessment
- Use for real-time intervention
28 Patients – Measure-vention

<table>
<thead>
<tr>
<th>BED_LABEL</th>
<th>Service</th>
<th>VTE Risk Category</th>
<th>Medication</th>
<th>Dose</th>
<th>SCD</th>
<th>Lab Contra</th>
<th>Orders state contra</th>
<th>Orders state LOW VTE Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>2250A</td>
<td>Medicine Thornton</td>
<td>LOW</td>
<td>warfarin (COUMADIN) tablet 3 mg</td>
<td>3 mg EVERY EVENING Oral</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>2250B</td>
<td>Medicine Thornton</td>
<td>MODERATE</td>
<td>enoxaparin (LOVENOX) injection 30 mg</td>
<td>30 mg DAILY Subcutaneous</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
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<td>warfarin (COUMADIN) tablet 10 mg</td>
<td>10 mg EVERY EVENING Oral</td>
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<td>N</td>
<td>N</td>
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<td>2272</td>
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<td>Fondaparinux (ARIIXTRA) injection 7.5 mg</td>
<td>7.5 mg DAILY Subcutaneous</td>
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<td>Y</td>
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Effect of Situational Awareness on Prevalence of VTE Prophylaxis by Nursing Unit

**Hospital A, 1\textsuperscript{st} Nursing Unit**

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Post-Intervention</th>
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<tbody>
<tr>
<td>UCL</td>
<td>93%</td>
<td>104%</td>
</tr>
<tr>
<td>Mean</td>
<td>73%</td>
<td>99% (p &lt; 0.01)</td>
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<tr>
<td>LCL</td>
<td>53%</td>
<td>93%</td>
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**Hospital A, 2\textsuperscript{nd} Nursing Unit**

<table>
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<tr>
<th></th>
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<tbody>
<tr>
<td>UCL</td>
<td>90%</td>
<td>102%</td>
</tr>
<tr>
<td>Mean</td>
<td>68%</td>
<td>87% (p &lt; 0.01)</td>
</tr>
<tr>
<td>LCL</td>
<td>46%</td>
<td>72%</td>
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</table>

**Hospital B, 1\textsuperscript{st} Nursing Unit**

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Post-Intervention</th>
</tr>
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<tbody>
<tr>
<td>UCL</td>
<td>89%</td>
<td>108%</td>
</tr>
<tr>
<td>Mean</td>
<td>71%</td>
<td>98% (p &lt; 0.01)</td>
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<tr>
<td>LCL</td>
<td>53%</td>
<td>88%</td>
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UCL = Upper Control Limit
LCL = Lower Control Limit
Patient Enemy #1: Bed

Complications Associated with Hospital Beds:

- Aspiration pneumonia
- Deep Vein Thrombosis
- Delirium
- Pulmonary Emboli
- Pressure Ulcers
- Ileus, Bowel Paralysis
PICC Lines

- Increasing use
- Symptomatic VTE associated with PICC during hospitalization 3.0 - 7.8%
- Significant CLABSI burden
- Occlusion complications / lytics
Practices to Reduce PICC complications

- Minimize exposure to PICCs
  - Maximize midline / PIV
  - Remove asap
- Size matters – smaller PICCs = fewer DVT
- Smallest number of lumens
- Proper flushing
- Following all infection control practices
- Fewer attempts to place PICC
- Appropriately sized catheter in proper position
- Appropriate DVT prophylaxis probably helps some, but not as much as for leg DVT
- Special catheters?

Questions / Answers / Comments?

- Coming Spring 2015 - Major Revision / Update AHRQ DVT Prevention Guide

- Questions on this webinar series? Contact Cynthia Sayers at 404-498-0020.