



Preventing Hospital-Associated Venous Thromboembolism: Practical Strategies That Work

Greg Maynard M.D., M.Sc, SFHM
Clinical Professor of Medicine
CQO, UC Davis Medical Center
March 19, 2015
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

Kahn SR, Morrison DR, Cohen JM, Emed J, Tagalakakis V, Roussin A, Geerts W. Interventions for implementation of thromboprophylaxis in hospitalized medical and surgical patients at risk for venous thromboembolism (Review). *Cochrane Database of Systematic Reviews* 2013, Issue 7. Art. No.: CD008201. DOI: 10.1002/14651858.CD008201.pub2.

Streiff MB, Carolan HT, Hobson DB, Kraus PS, Holzmüller CG, Demski R, et al. Lessons from the Johns Hopkins Multi-Disciplinary Venous Thromboembolism (VTE) Prevention Collaborative. *BMJ* 2012; Jun 19;344:e3935.

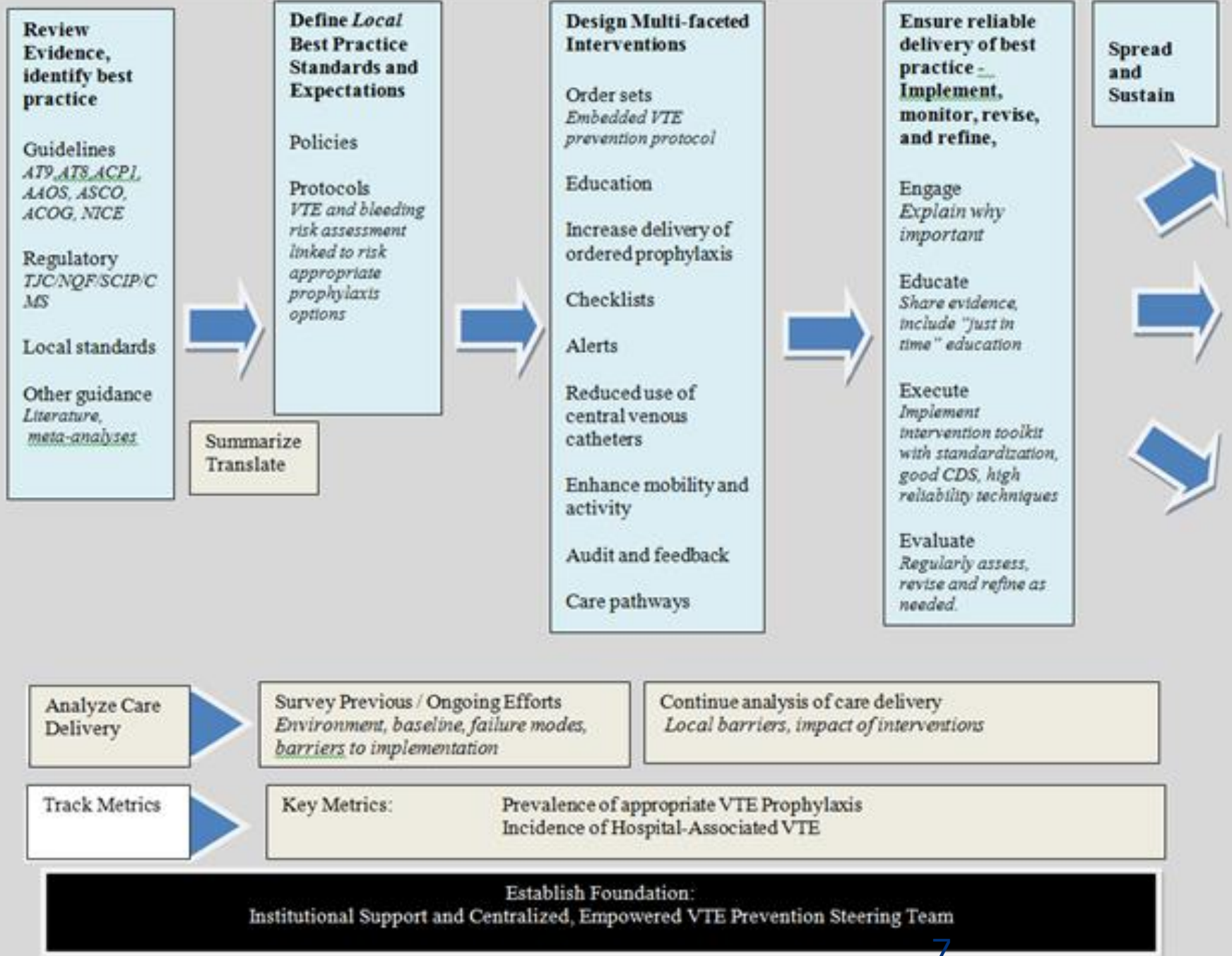
Kakkar AK, Davidson BL, Haas SK. Compliance with recommended prophylaxis for venous thromboembolism: improving the use and rate of uptake of clinical practice guidelines. *J Thromb Haemost.* 2004;2:221–227.

Toohar R, Middleton P, Pham C, et al. A systematic review of strategies to improve prophylaxis for venous thromboembolism in hospitals. *Ann Surg* 2005; 241:397–415.

Maynard G, Stein J. Designing and Implementing Effective VTE Prevention Protocols: Lessons from Collaboratives. *J Thromb Thrombolysis* 2010 Feb;29(2):159-166.

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



The Essential First Intervention

VTE Protocol

- 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.

Hierarchy of Reliability

Level

Predicted
Prophylaxis
rate

- | | | |
|---|---|--------|
| 1 | No protocol* (“State of Nature”) | 40% |
| 2 | Decision support exists but not linked to order writing, or prompts within orders but no decision support | 50% |
| 3 | Protocol well-integrated
(into orders at point-of-care) | 65-85% |
| 4 | Protocol enhanced
(by other QI / high reliability strategies) | 90% |
| 5 | Oversights identified and addressed in real time | 95+% |

UC San Diego
HEALTH SCIENCES

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”

Prompt - Not a protocol - No CDS offered

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

Each Risk Factor Represents 1 Point	
<input type="checkbox"/> Age 41-60 years	<input type="checkbox"/> Acute myocardial infarction
<input type="checkbox"/> Swollen legs (current)	<input type="checkbox"/> Congestive heart failure (<1 month)
<input type="checkbox"/> Varicose veins	<input type="checkbox"/> Medical patient currently at bed rest
<input type="checkbox"/> Obesity (BMI >25)	<input type="checkbox"/> History of inflammatory bowel disease
<input type="checkbox"/> Minor surgery planned	<input type="checkbox"/> History of prior major surgery (<1 month)
<input type="checkbox"/> Sepsis (<1 month)	<input type="checkbox"/> Abnormal pulmonary function (COPD)
<input type="checkbox"/> Serious lung disease including pneumonia (<1 month)	
<input type="checkbox"/> Oral contraceptives or hormone replacement therapy	
<input type="checkbox"/> Pregnancy or postpartum (<1 month)	
<input type="checkbox"/> History of unexplained stillborn infant, recurrent spontaneous abortion (≥ 3), premature birth with toxemia or growth-restricted infant	
<input type="checkbox"/> Other risk factors _____	Subtotal:

Each Risk Factor Represents 5 Points	
<input type="checkbox"/> Stroke (<1 month)	<input type="checkbox"/> Multiple trauma (<1 month)
<input type="checkbox"/> Elective major lower extremity arthroplasty	
<input type="checkbox"/> Hip, pelvis or leg fracture (<1 month)	Subtotal:
<input type="checkbox"/> Acute spinal cord injury (paralysis) (<1 month)	

Each Risk Factor Represents 2 Points	
<input type="checkbox"/> Age 61-74 years	<input type="checkbox"/> Central venous access
<input type="checkbox"/> Arthroscopic surgery	<input type="checkbox"/> Major surgery (>45 minutes)
<input type="checkbox"/> Malignancy (present or previous)	
<input type="checkbox"/> Laparoscopic surgery (>45 minutes)	Subtotal:
<input type="checkbox"/> Patient confined to bed (>72 hours)	
<input type="checkbox"/> Immobilizing plaster cast (<1 month)	

Each Risk Factor Represents 3 Points	
<input type="checkbox"/> Age 75 years or older	<input type="checkbox"/> Family history of thrombosis*
<input type="checkbox"/> History of DVT/PE	<input type="checkbox"/> Positive Prothrombin 20210A
<input type="checkbox"/> Positive Factor V Leiden	<input type="checkbox"/> Positive Lupus anticoagulant
<input type="checkbox"/> Elevated serum homocysteine	
<input type="checkbox"/> Heparin-induced thrombocytopenia (HIT)	
(Do not use heparin or any low molecular weight heparin)	
<input type="checkbox"/> Elevated anticardiolipin antibodies	
<input type="checkbox"/> Other congenital or acquired thrombophilia	Subtotal:
If yes: Type _____	
* most frequently missed risk factor	

TOTAL RISK FACTOR SCORE:

Caprini Score	Risk	VTE Incidence	Recommended Prophylaxis
0 - 2	very low - low	< 1.5% ¹	Early ambulation, IPC
3 - 4	moderate	3% ¹	LMWH; UFH; or IPC. <i>If high bleeding risk, IPC until bleeding risk diminishes.</i>
5 - 8	high	6% ¹	LMWH + IPC; or UFH + IPC. <i>If high bleeding risk, IPC until bleeding risk diminishes.</i>
> 8	very high	6.5 - 18.3%	LMWH + IPC; or UFH + IPC. <i>If high bleeding risk, IPC until bleeding risk diminishes.</i> <i>Consider extended duration prophylaxis.</i>

* Abdominal or pelvic surgery for cancer should receive extended VTE prophylaxis with LMWH x 30 days.¹

IPC = intermittent pneumatic compression

LMWH = low molecular weight heparin

UFH = unfractionated heparin

- Classic “3 bucket” model derived from AT8

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

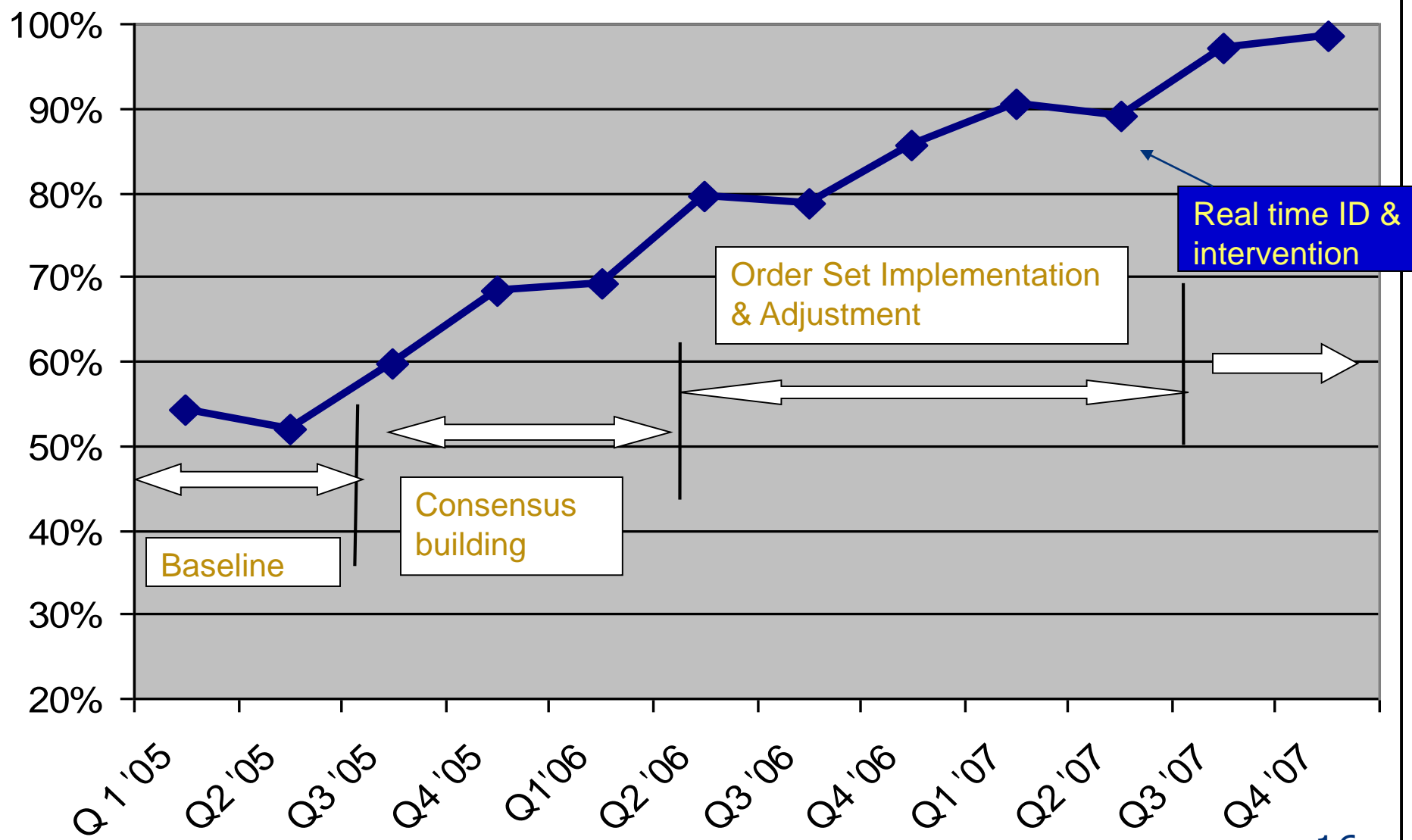
*For those at moderate or high risk and contraindications to anticoagulation, use IPCD.

Percent of Randomly Sampled Inpatients with Adequate VTE Prophylaxis

J Hosp Med 2010 Jan;5(1):10-18.

N = 2,944

mean 82 audits / month



Hospital Acquired VTE by Year

	2005	2006	2007	2008
Patients at Risk	9,720	9,923	11,207	
Cases w/ any VTE	131	138	92	80
Risk for HA VTE	1 in 76	1 in 73	1 in 122	
Odds Ratio (95% CI)	1.0	1.03 (0.81, 1.32)	0.61# (0.46, 0.80)	
Cases with PE	21	22	15	12
Risk for PE	1 in 463	1 in 451	1 in 747	
Odds Ratio (95% CI)	1.0	1.02 (0.54, 1.96)	0.62 (0.30, 1.26)	
Cases with DVT (and no PE)	110	116	77	68
Risk for DVT	1 in 88	1 in 85	1 in 146	
Odds Ratio (95% CI)	1.0	1.03 (0.79, 1.96)	0.61* (0.45, 0.82)	
Cases w/ Preventable VTE	44	21	7	6
Risk for Preventable VTE	1 in 221	1 in 473	1 in 1,601	
Odds Ratio (95% CI)	1.0	0.47# (0.26, 0.80)	0.14* (0.05, 0.31)	

p < 0.01 *p < 0.001

Updated Model – More c/w AT9 guidelines

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

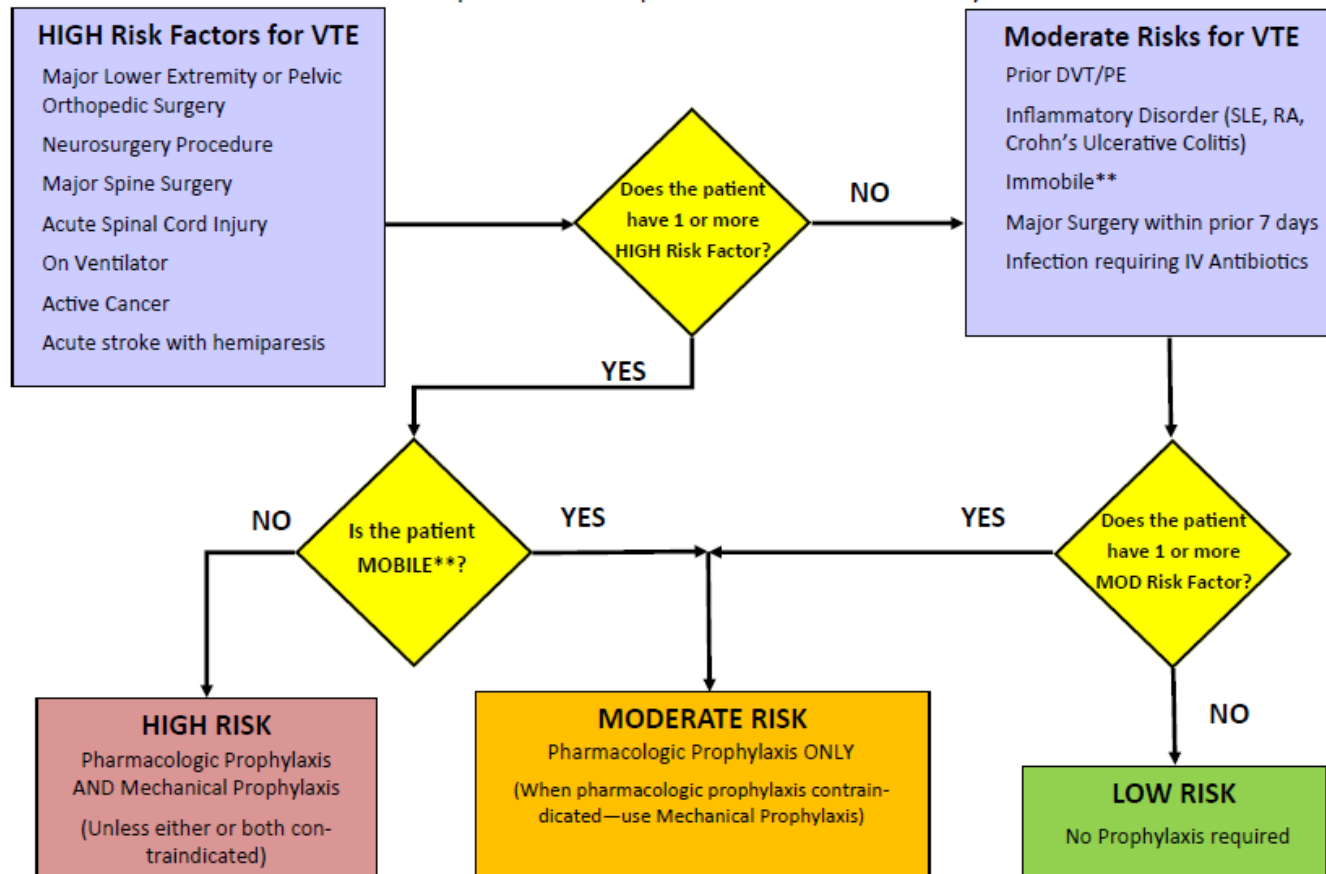
Low Risk: Observation status, expected LOS < 48 hours. Minor ambulatory surgery unless multiple strong risk factors. Medical patients ambulatory in hall and not Moderate or High Risk. Ambulatory cancer patients admitted for short chemotherapy infusion.	No prophylaxis, reassess periodically, ambulate.
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 patient with decrease in usual ambulation AND VTE risk factors (MI, Stroke, CHF, PNA, 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.

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.



**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

Courtesy Marc Moote, PA-C

- 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

Choose ALL that apply from each section (based on Age, Gender and BMI; appropriate checkboxes have been defaulted and/or restricted)

SECTION I: Age Related Risk Factors:

- Age 41-60 years (1 pt.) ☒
Age 61 - 74 years (2 pts.) ☐
Age 75 years or older (3 pts.) ☐

SECTION II: Disease Related Risk Factors:

- Abnormal PFT / COPD (1 pt.) ☒
Acute MI (1 pt.) ☐
CHF, Hx or active within 1 mo. (1 pt.) ☐
Inflammatory bowel disease (1 pt.) ☐

Obesity [BMI > 25] (1 pt.) ☒
Pneumonia < 1 mo. (1 pt.) ☐
Prior major surgery < 1 mo. (1 pt.) ☐
Sepsis, Hx or active < 1 mo. (1 pt.) ☐
Swollen legs, current (1 pt.) ☐
Varicose veins (1 pt.) ☐
Central venous access (2 pts.) ☐
Malignancy, present or previous (2 pts.) ☒
Acute spinal cord inj. < 1 mo. (5 pts.) ☐
Paralysis < 1 mo. (5 pts.) ☐
Stroke < 1 mo. (5 pts.) ☐

SECTION III: Hematology Related Risk Factors:

- Hx of DVT/PE (3 pts.) ☐
Family Hx of thrombosis (3 pts.) ☐
Elevated serum homocysteine (3 pts.) ☐
Positive Factor V Leiden (3 pts.) ☐
Heparin induced thromb. (HIT)* (3 pts.) ☐
Other clotting disorder** (3 pts.) ☐

*Avoid heparin and LMWH if HIT
**e.g. Positive prothrombin 20210A, Antiphospholipid Antibody Syndrome, protein C or S deficiency, positive lupus anticoagulant, elevated anticardiolipin antibodies

TOTAL RISK FACTOR SCORE:

5 Highest Risk (40-80% incidence of DVT)

Recommended Prophylaxis Regimen Based on Total Risk Factor Score:

Heparin 5000 units three times daily or enoxaparin (combined with Sequential compression device (SCD) in surgical patients)

Enoxaparin regimens are as follows: 40 mg subcutaneous daily (weight < 150 kg, CrCl > 30 mL/min); 30 mg subcutaneous daily (weight < 150 kg, CrCl = 10-29 mL/min); 30 mg subcutaneous twice daily (weight > 150 kg, CrCl > 30 mL/min)

SECTION IV: Mobility Related Risk Factors:

- Patient currently at bed rest (1 pt.) ☐
Pt. confined to bed > 72 hrs. (2 pts.) ☐
Immobilizing plaster cast < 1 mo. (2 pts.) ☐

SECTION V: Gender Specific Risk Factors:

- Pregnancy or postpartum < 6 weeks (1 pt.) ☐
Oral contraceptives or HRT (1 pt.) ☐
Hx of pregnancy complications* (1 pt.) ☐

*Hx of unexplained stillborn, recurrent spontaneous abortion (>= 3), premature birth with toxemia or growth restriction (</=) 3rd percentile, Severe early onset Pre-Eclampsia < 34 weeks

SECTION VI: Surgery Related Risk Factors:

- Cesarean section (1 pt.) ☐
Minor surg. planned / performed (1 pt.) ☐
Major surgery > 45 min. (2 pts.) ☐
Laparoscopic surgery > 45 min. (2 pts.) ☐
Arthroscopic surgery (2 pts.) ☐
Elective major LE arthroplasty (5 pts.) ☐

SECTION VII: Trauma Related Risk Factors:

- Acute spinal cord inj. < 1 mo. (5 pts.) ☐
Multiple trauma within 1 mo. (5 pts.) ☐
Paralysis < 1 mo. (5 pts.) ☐
Hip, pelvis, leg fracture < 1 mo. (5 pts.) ☐

Reorganization / grouping of Caprini VTE risk factors make it more user friendly

Point total calculated for user, prophylaxis recommendation based on risk score



Measurements: Height (cm) Actual Weight (kg) BSA Creatinine Clearance: (Actual) Creatinine (mg/dl) Creat Clear (actual) ☒ Actual ☐ Estimated

VTE Risk Level, contraindications (if present) and ordered prophylaxis capture for analysis

STEP 1: Perform Risk Assessment

	Order	Risk Score	Risk Level
<input checked="" type="checkbox"/>	VTE Risk Factor Assessment	5	Highest Risk (40-80% incidence of DVT)

STEP 2: Press button on right to determine prophylaxis modality based on risk score above ----->

Pharmacologic prophylaxis:

	Order	Dose:	Units:	Ordering Info:	Route:	Frequency:	Priority:
<input type="checkbox"/>	heparin injection	5,000	unit		subcutaneous	two times a day	Routine
<input type="checkbox"/>	heparin injection	5,000	unit		subcutaneous	three times a day	Routine
<input checked="" type="checkbox"/>	Enoxaparin (Non-Pregnant) - 3 item(s)						
<input type="checkbox"/>	enoxaparin injection UH - prophylaxis	40	mg	weight <= 150 kg, CrCl >= 30 mL/min	subcutaneous	daily	Routine
<input type="checkbox"/>	enoxaparin injection UH - prophylaxis	30	mg	weight <= 150 kg, CrCl = 10-29...	subcutaneous	daily	Routine
<input type="checkbox"/>	enoxaparin injection UH - prophylaxis	30	mg	weight > 150 kg, CrCl >= 30 mL/min	subcutaneous	every 12 hours	Routine
<input checked="" type="checkbox"/>	Enoxaparin (Pregnancy) - 4 item(s)						
<input type="checkbox"/>	enoxaparin injection UH - prophylaxis	30	mg	weight < 75 kg, <= 20 weeks	subcutaneous	daily	Routine
<input type="checkbox"/>	enoxaparin injection UH - prophylaxis	30	mg	weight < 75 kg, > 20 weeks	subcutaneous	two times a day	Routine
<input type="checkbox"/>	enoxaparin injection UH - prophylaxis	40	mg	weight >= 75 kg, <= 20 weeks	subcutaneous	daily	Routine
<input type="checkbox"/>	enoxaparin injection UH - prophylaxis	40	mg	weight >= 75 kg, > 20 weeks	subcutaneous	two times a day	Routine

Order Recommended prophylaxis unless contraindicated

Systemic anticoagulation with INR > 2.0
 Systemic anticoagulation - non warfarin
 Active bleeding (major): more than 2 units transfused in 24 hours
 History of HIT (cannot use heparin or low molecular weight heparin)
 Glycoprotein IIB/IIIA inhibitors
 Chronic, clinically significant measurable bleeding > 48 hours
 Thrombocytopenia (platelets < 50,000)
Recent CNS bleed, intracranial or spinal lesion at high risk of bleeding
 Hemophilia or significant bleeding disorder
 N/A for outpatient surgery

Drug Info


OK

Cancel

Classic 3 bucket model implementation

Courtesy Dr. Lori Porter, Good Samaritan Regional Medical Center

Discern: zzzdiscern, advisor vte

 **Banner Health** Help

Patient Name: zzzdiscern, advisor vte **Sex:** Male **MRN:** 999999
Location: 05 A4E - VA4E **Age/DOB:** 31 Years / June 04, 1980 **FIN:** 222222

VTE Risk Assessment - Discern Advisor®

The VTE Risk Assessment Advisor is **optional** for your documented patient relationship. You may click the Done button to close the Advisor or complete the documentation and orders.

Please Determine and Document appropriately the Risk Profile of this patient based on your clinical assessment and the criteria listed for development of Venous thromboembolism. Place the appropriate prophylactic treatment measure suggested OR document any contraindications that preclude the same.


Patient Weight: 65.000 Kg Patient Creatinine Clearance: 131.20 mL/min

	Risk Level	Risk Factors
<input type="radio"/>	High Risk	<ul style="list-style-type: none">• Elective hip or knee arthroplasty• Hip, pelvic, or severe lower extremity fractures• Acute spinal cord injury with paresis• Multiple major trauma• Morbid obesity (> 150 kg)
<input type="radio"/>	Moderate Risk	<ul style="list-style-type: none">• Inpatient with an Acute Medical Illness <p>Including but not limited to: h/o PE or DVT, acute CHF, malignancy, age > 40, pneumonia, cellulitis, BMI > 30, limited mobility, active tobacco use, CVL or PICC line in place, sepsis, ischemic CVA or previous CVA with paresis, recent major surgery (< 3 months), myocardial infarction (< 3 months), varicose veins, acute or chronic lung disease, severe dehydration, IBD, sickle cell disease, nephrotic syndrome, on estrogen based therapy, post partum < 1 month, collagen vascular disease, etc...</p>
<input type="radio"/>	Low Risk	<p>Less than 5% of inpatients are low risk:</p> <ul style="list-style-type: none">• Observation patients• Same-day or minor surgery (less than 30 minutes)• Expected length of stay less than 48 hours• Zero risk factors• Already on therapeutic anticoagulation

Please select the VTE Risk for this patient. Reset Done

Risk-appropriate prophylaxis options appear after risk level chosen. High Risk requires dual prophylaxis

Discern: zzzdiscern, advisor vte

 **Banner Health** [Help](#)

Patient Name: zzzdiscern, advisor vte **Sex:** Male **MRN:** 999999
Location: 05 A4E - VA4E **Age/DOB:** 31 Years / June 04, 1980 **FIN:** 222222

☐ Same-day or minor surgery (less than 30 minutes) ☐ Already on therapeutic anticoagulation
☐ Expected length of stay less than 48 hours

☐ Surgical Patient

Orders for High Risk Patients
Prophylaxis for High Risk Patient: Choose one pharmacologic option and one mechanical option.

Pharmacologic:

<input type="radio"/> enoxaparin	30 mg SubQ, Injection, Q12H (int)	(CrCl > 30 mL/min, weight ≤ 150 Kg)
<input type="radio"/> enoxaparin	30 mg SubQ, Injection, Q24H	(CrCl 15 to 30 mL/min)
<input type="radio"/> enoxaparin	40 mg SubQ, Injection, Q12H (int)	(CrCl > 30 mL/min, weight > 150 Kg)
<input type="radio"/> heparin	5,000 unit(s) SubQ, Soln, Q8H (int)	(In hip and knee replacement, spinal cord injury, and trauma patients use heparin ONLY if CrCl < 15 mL/min or on renal replacement therapy)
<input type="radio"/> warfarin PT (Protime)	5 mg PO, Tab, Q1700 T+1;0400, AM Routine, RT, DAILY 3 day(s)	(Hip and knee arthroplasty only)
<input type="radio"/> Reason Pharmacologic Prophylaxis Not Given		

Mechanical:

<input type="radio"/> Intermittent Pneumatic Compression Knee	Remove only for walking or bathing.
<input type="radio"/> Reason Mechanical Prophylaxis Not Given	

Please select a Pharmacologic and Mechanical Prophylaxis order.

Contraindications captured if pharmacologic prophylaxis not ordered for a patient at risk of DVT.

Discern: zzzdiscern, advisor vte

Reasons Pharmacologic Prophylaxis not Given

Check all that apply:

<input type="checkbox"/> No documented reason	<input type="checkbox"/> Post-operative bleeding concerns
<input type="checkbox"/> Continuous IV heparin therapy day of or day after admission	<input type="checkbox"/> Thrombocytopenia: Platelets <50,000 or 100,000 and down trending
<input type="checkbox"/> Patient low risk for VTE	<input type="checkbox"/> Coagulopathy (INR >2 or PT > 18)
<input type="checkbox"/> Patient/Family refused	<input type="checkbox"/> Active hemorrhage
<input type="checkbox"/> Warfarin therapy prior to admission; on hold due to high INR	<input type="checkbox"/> Heparin induced thrombocytopenia
<input type="checkbox"/> Other	<input type="checkbox"/> Recent TPA (within last 24 hours)
	<input type="checkbox"/> Hemorrhage from severe trauma to head or spinal cord (within one month)
	<input type="checkbox"/> Recent intracranial surgery (within 2 weeks)
	<input type="checkbox"/> Active intracranial lesions/ neoplasms
	<input type="checkbox"/> Recent spine surgery (within 7 days)
	<input type="checkbox"/> Recent transplant surgery (within 48 hours)
	<input type="checkbox"/> Epidural catheter insertion (see note)
	<input type="checkbox"/> Epidural catheter removal (within 2 hours)
	<input type="checkbox"/> GI hemorrhage (within one month)
	<input type="checkbox"/> GU hemorrhage (within one month)
	<input type="checkbox"/> Intraocular surgery (within 2 weeks)
	<input type="checkbox"/> Hypertensive urgency or emergency

You must select at least one reason why Pharmacologic Prophylaxis will not be given.

Close

The screenshot shows the 'Sunrise Clinical Manager' interface. On the left, a list of orders is displayed with checkboxes. The 'VTE Prophylaxis: Internal Medicine' order is checked. A red arrow points from this order to a dialog box on the right. The dialog box has a blue header and contains a question mark icon and the following text: 'This order item is mandatory in the set DOM Admission Order Set. If you delete it, you will also delete the entire set. Do you want to delete the set?'. Below the text, there are 'OK' and 'Cancel' buttons. A red box highlights the text 'Any Attempt to uncheck the order will give this message'.

Order Item	Order Update	Status	Frequency
IV Therapy			
.Peripheral IV Catheter, Insert VAT -	Order Update: Ordered		
Second IV (Conditional Order)			
Peripheral IV Catheter, Insert 2nd VAT -	Order Update: Ordered	T	Routine
Nurse will activate order to support medication/fluid administration <Avail. Activations=1>			
Maintain IV			
.Peripheral IV Catheter, Maintain NUR - VAD Protocol MUST be implemented and followed! <Continuous>		T	Routine
Pharmacy			
Normal Saline Flush Inj - 2 ml IV q5min; PRN for VAD protocol. Flush each IV after each use or at least q8h when not in continuous use. (Peripheral IV)			Routine

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)

VTE Prophylaxis: Internal Medicine [1 orders of 6 are selected] - POETEST, PDS

Patient Age:
48y

Combined Measurements
Height (inches) Height (cm) Weight (lb) Weight (kg) BSA BMI
67 170.2 147 66.7 1.77 23

Relevant Results

Creatinine Clearance (Estimated (Cockcroft-Gault))
Creatinine (mg/dl) Creat Clear (est)

1 84.7
Entered - 07/04/2007 16:41

Actual
Estimated

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 paresis 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 cu/mm ☐
No contraindications known ☐

Patient age, weight, renal function and relevant labs imported from database

Recommended Prophylaxis:

Prophylaxis Orders

	Order	Dose	UOM	Route	Frequency	Start Date	Start Time	Priority	Side of Body	Type	Instructions/Comments
<input type="checkbox"/>	Heparin Inj	5000	unit	SubQ	q8h			Routine			
<input type="checkbox"/>	Heparin Inj	5000	unit	SubQ	q12h			Routine			
<input type="checkbox"/>	TED Stockings				<Continuous>	T		Routine	Bilateral	Knee	Review patient status daily...
<input type="checkbox"/>	Compression Device, Sequential				<Continuous>	T		Routine			Review patient status daily...
<input type="checkbox"/>	Foot Pump				<Continuous>	T		Routine			

Was VTE Prophylaxis Ordered as Recommended?

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

OK Cancel

VTE Prophylaxis: Internal Medicine [1 orders of 6 are selected] - POETEST, PDS

Patient Age:

48y

Relevant Results

Combined Measurements

Height (inches)	Height (cm)	Weight (lb)	Weight (kg)	BSA	BMI
67	170.2	147	66.7	1.77	23

 Creatinine Clearance (Estimated (Cockcroft-Gault))
 Creatinine (mg/dl)

1

Creat Clear (est)

84.7

Actual

Estimated

Entered - 07/04/2007 16:41

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

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

- Previous VTE ☐
 Age greater than 60 years ☐
 Cancer - Metastatic or under treatment ☐
 Stroke with paresis 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 ☐

- 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 cu mm ☐
 No contraindications known ☐

▪Mandatory Selections
 ▪Risk Factors
 ▪Contraindications

Recommended Prophylaxis:

Prophylaxis Orders

	Order	Dose	UOM	Route	Frequency						
<input checked="" type="checkbox"/>	Heparin Inj	5000	unit	SubQ	q8h						
<input type="checkbox"/>	Heparin Inj	5000	unit	SubQ	q12h						
<input type="checkbox"/>	TED Stockings				<Continuous>	T		Routine	Bilateral	Knee	Review patient status daily...
<input type="checkbox"/>	Compression Device, Sequential				<Continuous>	T		Routine			Review patient status daily...
<input type="checkbox"/>	Foot Pump				<Continuous>	T		Routine			

Orders and Order Sets with Warnings or Errors

Order Set: VTE Prophylaxis: Internal Medicine

The following Order Set and/or Orders either have warnings or contain errors. Correct any errors by editing the order. You must review any Informational Messages before you can save the order.

Order Items:

VTE Prophylaxis: Internal Medicine -

The SECTION Labeled A and B may not be left blank. Please enter a value into the field

Was VTE Prophylaxis Ordered as Recommended?

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

OK

Cancel

30

Patient Age:
90y

Relevant Results
Creatinine, Serum.: 1.6(Mar01); INR, Prothrombin Time: 2.2(Mar01); Platelet Count.: 78(Mar01); Ratio,APTT: 1.8(Mar01);

Combined Measurements
Height (inches) Height (cm) Weight (lb) Weight (kg) BSA BMI
190 86

Creatinine Clearance (Estimated (Cockcroft-Gault))
Creatinine (mg/dl) Creat Clear (est) Actual Estimated
1.6 36.9
Resulted - 03/01/2010 05:07

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 paresis 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 cu mm ☐
No contraindications known ☒

**Prophylaxis
Recommendation**

Recommended Prophylaxis:

Choose Heparin 5000 units q8h (High Risk Prophylaxis)

Prophylaxis Orders

Order	Dose	UOM	Route	Frequency	Start Date	Start Time Priority	Side of Body	Type	Instructions/Comments
<input type="checkbox"/> Heparin Inj	5000	unit	SubQ	q8h		Routine			
<input type="checkbox"/> Heparin Inj	5000	unit	SubQ	q12h		Routine			
<input type="checkbox"/> TED Stockings				<Continuous>	T	Routine	Bilateral	Knee	Review patient status daily...
<input type="checkbox"/> Compression Device, Sequential				<Continuous>	T	Routine			Review patient status daily...
<input type="checkbox"/> Foot Pump				<Continuous>	T	Routine	Bilateral		

☒ VTE Risk Assessment was Completed

Drug Info

OK

Cancel

Submit Order(s) for KROLL, IRVING

Hide Worksheet

Cancel

Help

No contraindications known ☒

Recommended Prophylaxis:

Choose Heparin 5000 units Q8H plus Mechanical Orders. (VERY HIGH Risk WITH Renal Impairment)

Prophylaxis Orders

	Order	Dose	UOM	Route	Frequency	Start Date	Start Time Priority	Pharmacy Instructions	Side of Body
<input type="checkbox"/>	Enoxaparin Inj	40	mg	SubQ	q24h		Time Critical	First dose 2 hours Pre-Op and...	
<input checked="" type="checkbox"/>	Heparin Inj	5000	unit	SubQ	q8h		18:00	Give first dose 2 hours Pre...	
<input type="checkbox"/>	Heparin Inj	5000	unit	SubQ	q12h		Time Critical	Give first dose 2 hours Pre...	
<input type="checkbox"/>	Ambulate with Assistance				tid	T	Routine		
<input type="checkbox"/>	Ambulate without Assistance				tid	T	Routine		
<input checked="" type="checkbox"/>	TED Stockings				<Continuous>	08/13/2007	Routine		Bilateral
<input checked="" type="checkbox"/>	Compression Device, Sequential				<Continuous>	08/13/2007	Routine		
<input type="checkbox"/>	Foot Pump				<Continuous>	T	Routine		

Was VTE Prophylaxis Ordered as Recommended?

Yes ☒No - Religious Reasons ☐No - Bleeding Risk Greater than VTE Risk ☐No - Prescriber Preference ☐No - VTE Risk Greater than Bleeding Risk ☐No - Other ☐No - Heparin Allergy/Adverse Reaction ☐☒ VTE Risk Assessment was Completed

VTE_Risk Assess Completed - LABPOE, CHARLES

VTE Risk Assessment was Completed - LABPOE, CHARLES

Order: VTE Risk Assessment was Completed Order ID: 001BTB829

Requested By: Durette, Annette Template Name:

Messages:

Recommended Prophylaxis was:
Very High Risk WITH Renal Impairment

Repeat View Document OK Cancel

OK

Cancel

32

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

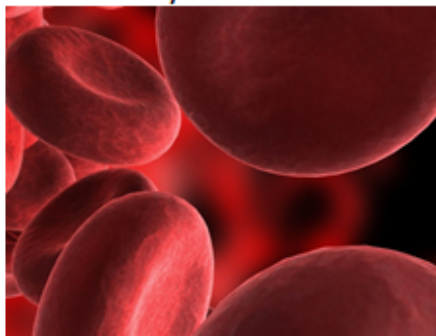
- *No protocol / standardized order sets*
- *Order sets / prompts for VTE P in place, but no guidance*
- *Order sets with guidance in place but bypassed*
- *Order sets with guidance in place and used, but used incorrectly*
- Patient gets placed on right prophylaxis, but VTE / bleeding risk changes and 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



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



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

*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

20 on anticoagulation

4 on mechanical prophylaxis with lab contraindication

3 on Nothing

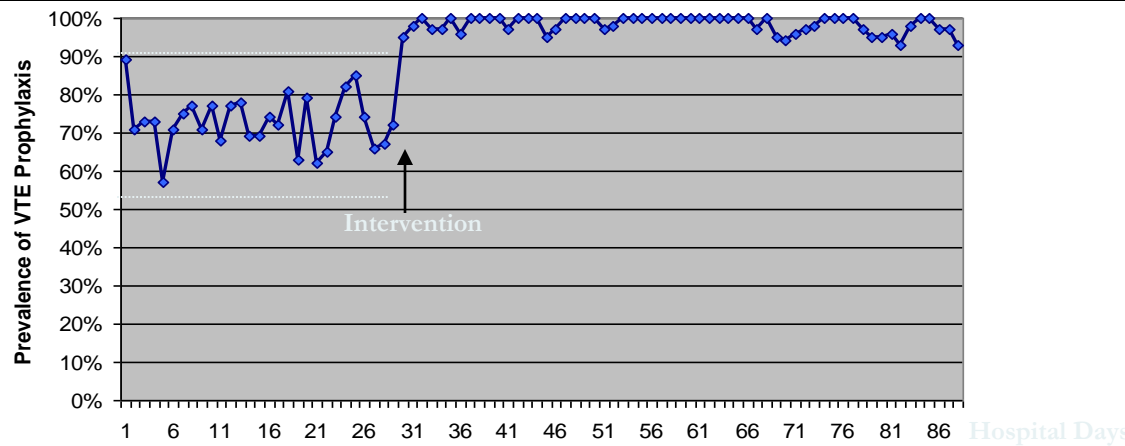
1 mechanical

BED_LABEL	Service	VTE Risk Category	Medication	Dose	SCD	Lab Contra	Orders state contra	Orders state LOW VTE Risk
2250A	Medicine Thornton	LOW	warfarin (COUMADIN) tablet 3 mg	3 mg EVERY EVENING Oral	Y	N	N	Y
2250B	Medicine Thornton	MODERATE	enoxaparin (LOVENOX) injection 30 mg	30 mg DAILY Subcutaneous	Y	N	N	N
2251	Medicine Thornton	MODERATE	heparin injection 5,000 Units	5000 Units EVERY 12 HOURS Su	Y	N	N	N
2252	Cardiothoracic Surgery	MODERATE/HIGH	No Anticoag Med	No Anticoag Dose	Y	Y	N	Y
2253	Medicine Thornton	MODERATE	enoxaparin (LOVENOX) injection 40 mg	40 mg DAILY Subcutaneous	Y	Y	N	N
2254	Medicine Thornton	MODERATE	heparin injection 5,000 Units	5000 Units EVERY 8 HOURS Sub	Y	N	N	N
2255	Medicine Thornton	MODERATE	heparin injection 5,000 Units	5000 Units EVERY 12 HOURS Su	Y	N	N	N
2256A	Medicine Thornton	MODERATE	enoxaparin (LOVENOX) injection 40 mg	40 mg DAILY Subcutaneous	Y	N	N	N
2256B	Pulmonary Vascular Medicine	MODERATE/HIGH	enoxaparin (LOVENOX) injection 50 mg	50 mg EVERY 12 HOURS Subcut	Y	Y	N	N
2257A	Medicine Thornton	MODERATE	enoxaparin (LOVENOX) injection 40 mg	40 mg DAILY Subcutaneous	Y	N	N	N
2257B	Gynecology	MODERATE/HIGH	No Anticoag Med	No Anticoag Dose	Y	Y	N	N
2258	Medicine Thornton	MODERATE	enoxaparin (LOVENOX) injection 30 mg	30 mg DAILY Subcutaneous	Y	N	N	Y
2259	Medicine Thornton	MODERATE	No Anticoag Med	No Anticoag Dose	Y	N	N	N
2260	Pulmonary/Critical Care	LOW	No Anticoag Med	No Anticoag Dose	N	N	N	Y
2261	Medicine Thornton	MODERATE/HIGH	No Anticoag Med	No Anticoag Dose	Y	Y	N	N
2262A	Medicine Thornton	LOW	enoxaparin (LOVENOX) injection 40 mg	40 mg DAILY Subcutaneous	Y	N	N	Y
2262B	Medicine Thornton	MODERATE	enoxaparin (LOVENOX) injection 40 mg	40 mg DAILY Subcutaneous	Y	N	N	N
2263	Medicine Thornton	MODERATE/HIGH	No Anticoag Med	No Anticoag Dose	Y	Y	N	N
2264	Pulmonary Vascular Medicine	MODERATE	warfarin (COUMADIN) tablet 5 mg	5 mg EVERY EVENING Oral	Y	Y	N	Y
2265	Pulmonary Vascular Medicine	LOW	heparin injection 5,000 Units	5000 Units EVERY 8 HOURS Sub	Y	N	N	Y
2265	Pulmonary Vascular Medicine	LOW	warfarin (COUMADIN) tablet 10 mg	10 mg EVERY EVENING Oral	Y	N	N	Y
2266	Medicine Thornton	MODERATE	heparin injection 5,000 Units	5000 Units EVERY 8 HOURS Sub	Y	N	N	N
2267	Pulmonary Vascular Medicine	HIGH	enoxaparin (LOVENOX) injection 100 mg	100 mg EVERY 12 HOURS Subcu	Y	Y	N	Y
2268	Cardiothoracic Surgery	LOW	enoxaparin (LOVENOX) injection 40 mg	40 mg DAILY Subcutaneous	Y	N	N	Y
2269	Cardiothoracic Surgery	No Risk Category	No Anticoag Med	No Anticoag Dose	N	N	N	N
2270	Cardiothoracic Surgery	No Risk Category	No Anticoag Med	No Anticoag Dose	N	N	N	N
2271	Medicine Thornton	MODERATE	heparin injection 5,000 Units	5000 Units EVERY 12 HOURS Su	Y	N	N	N
2272	Pulmonary Vascular Medicine	HIGH	fondaparinux (ARIXTRA) injection 7.5 mg	7.5 mg DAILY Subcutaneous	Y	Y	N	Y

Effect of Situational Awareness on Prevalence of VTE Prophylaxis by Nursing Unit

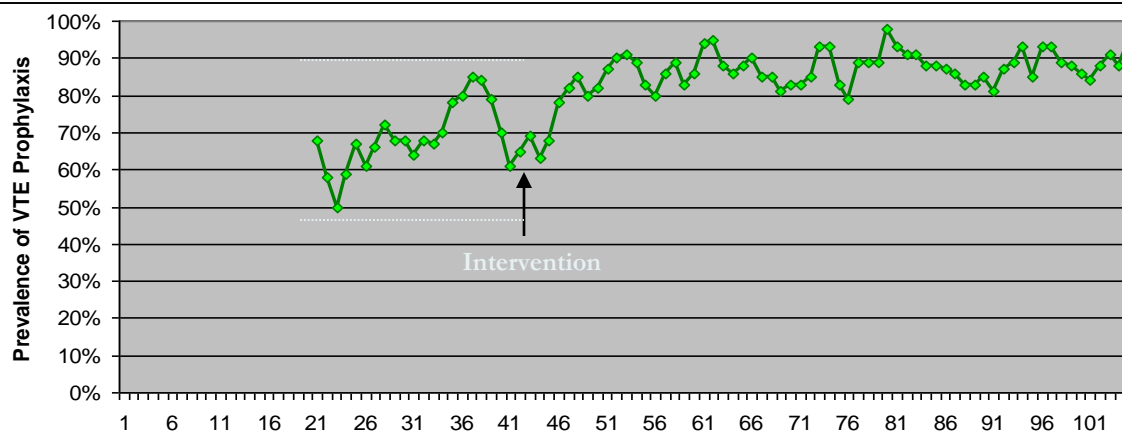
Hospital A, 1st Nursing Unit

	Baseline	Post-Intervention
UCL:	93%	104%
Mean:	73%	99% ($p < 0.01$)
LCL:	53%	93%



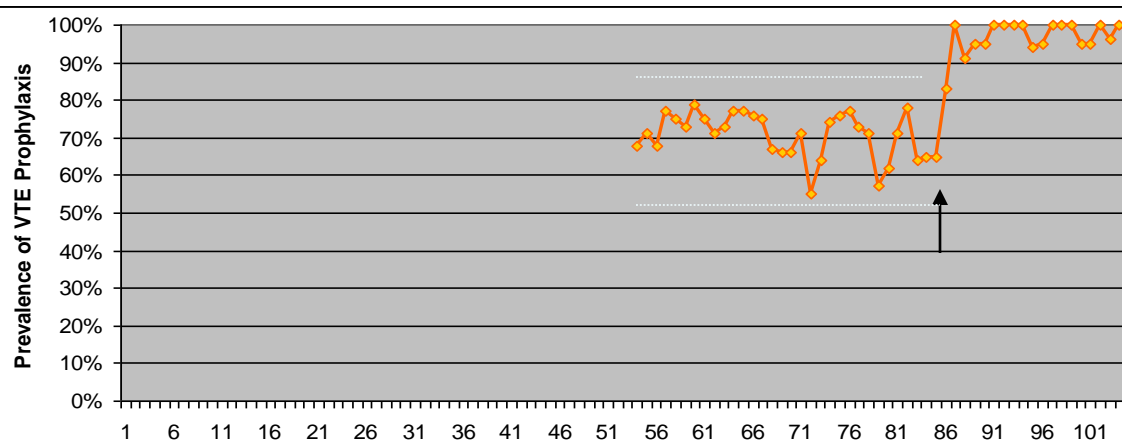
Hospital A, 2nd Nursing Unit

	Baseline	Post-Intervention
UCL:	90%	102%
Mean:	68%	87% ($p < 0.01$)
LCL:	46%	72%



Hospital B, 1st Nursing Unit

	Baseline	Post-Intervention
UCL:	89%	108%
Mean:	71%	98% ($p < 0.01$)
LCL:	53%	88%



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.