Preventing Hospital-associated Venous Thromboembolism: Practical Strategies That Work

Greg Maynard, M.D., M.Sc., MHM
Clinical Professor of Medicine
CQO, UC Davis Medical Center

Sept. 20, 2017

Disclosures

The presenter has no conflicts of interest to disclose.

Dr. Maynard is the author of: *AHRQ DVT Prevention Guide*

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

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
  - Pulmonary embolism (PE) among top sources of preventable hospital-related deaths
- Huge costs and morbidity (recurrence, post-thrombotic syndrome, chronic PAH, anticoagulation)

Source: Surgeon General's Call to Action to Prevent DVT and PE 2008 DHHS

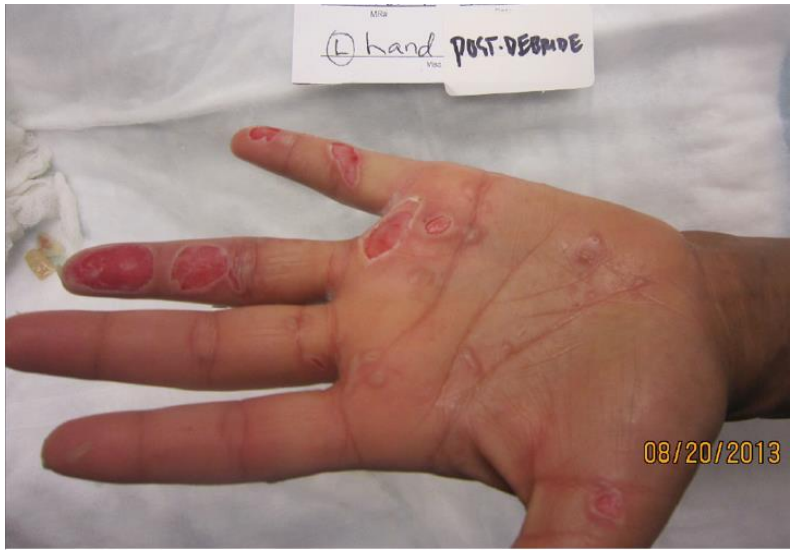
Suboptimal VTE Prophylaxis Is Common

- ENDORSE: 70,000 cases, 358 hospitals
  - Appropriate prophylaxis: about 50%
  - 60% surgical, 40% medical
- JHM Review: 390,000 cases, 429 hospitals
  - Any dose: 78% surgical, 66% medical
  - Appropriate: 16% and 13%
- Many Others

Sources: Cohen et al. ENDORSE: Lancet 2008; 371: 387–94
Amin. J Hosp Med 2009; 4:E15

Flip Side of Under Prophylaxis

- A 35-year-old ambulatory woman was admitted with minor burns, but more for mild alcohol withdrawal:



- VTE prophylaxis: Enoxaparin 30 mg q 12 hours
- $, pain, small risks of HIT, bleeding, RN time

Slide courtesy of Dr. Ian Jenkins, UCSD

Sources

QI Framework and Strategies That Work

- UC San Diego and University of California VTEP Collaborative
- Dignity Health 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, Tagalakis 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, Holzmueller 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.
- Tooher 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, Morris T, Jenkins I, Stone S, Lee J, Renvall M, Fink E, Schoenhaus R. Optimizing prevention of hospital acquired venous thromboembolism: prospective validation of a VTE risk assessment model. *J Hosp Med* 2010 Jan:5(1):10-18.
- Maynard G, Stein J. Designing and Implementing Effective VTE Prevention Protocols: Lessons from Collaboratives. *J Thromb Thrombolysis* 2010 Feb:29(2):159-166.
- Jenkins IH, White RH et al. Reducing the Incidence of Hospital-Associated Venous Thromboembolism Within A Network of Academic Hospitals: Findings from Five University of California Medical Centers. *J Hosp Med.* 2016;Vol 11, S2, S22-28.

Practical “How-to” and More

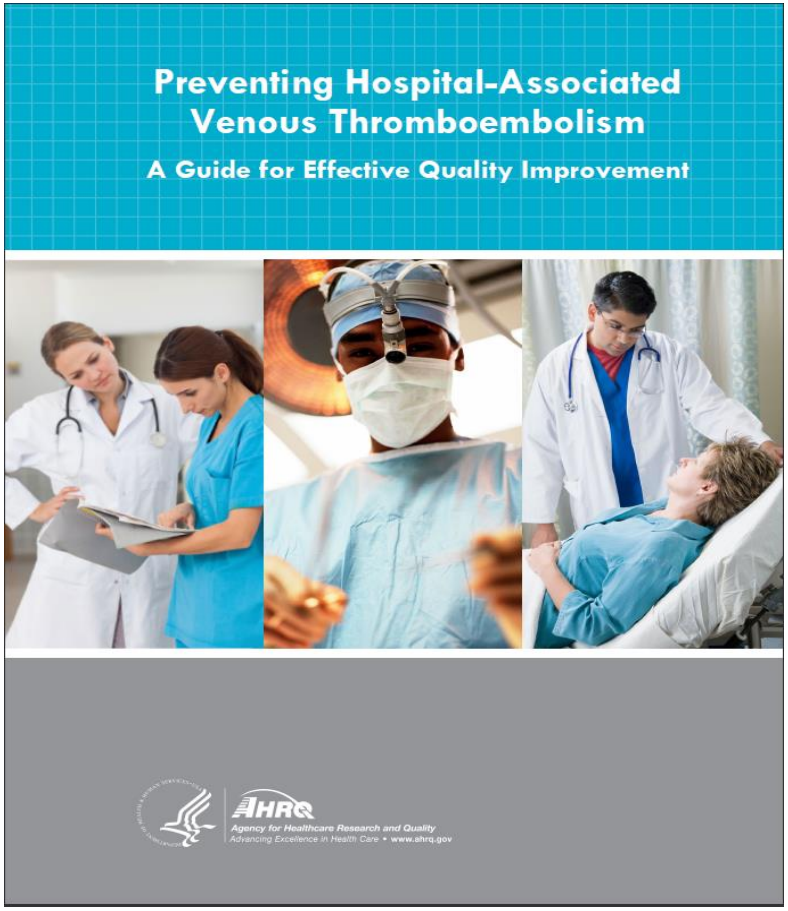


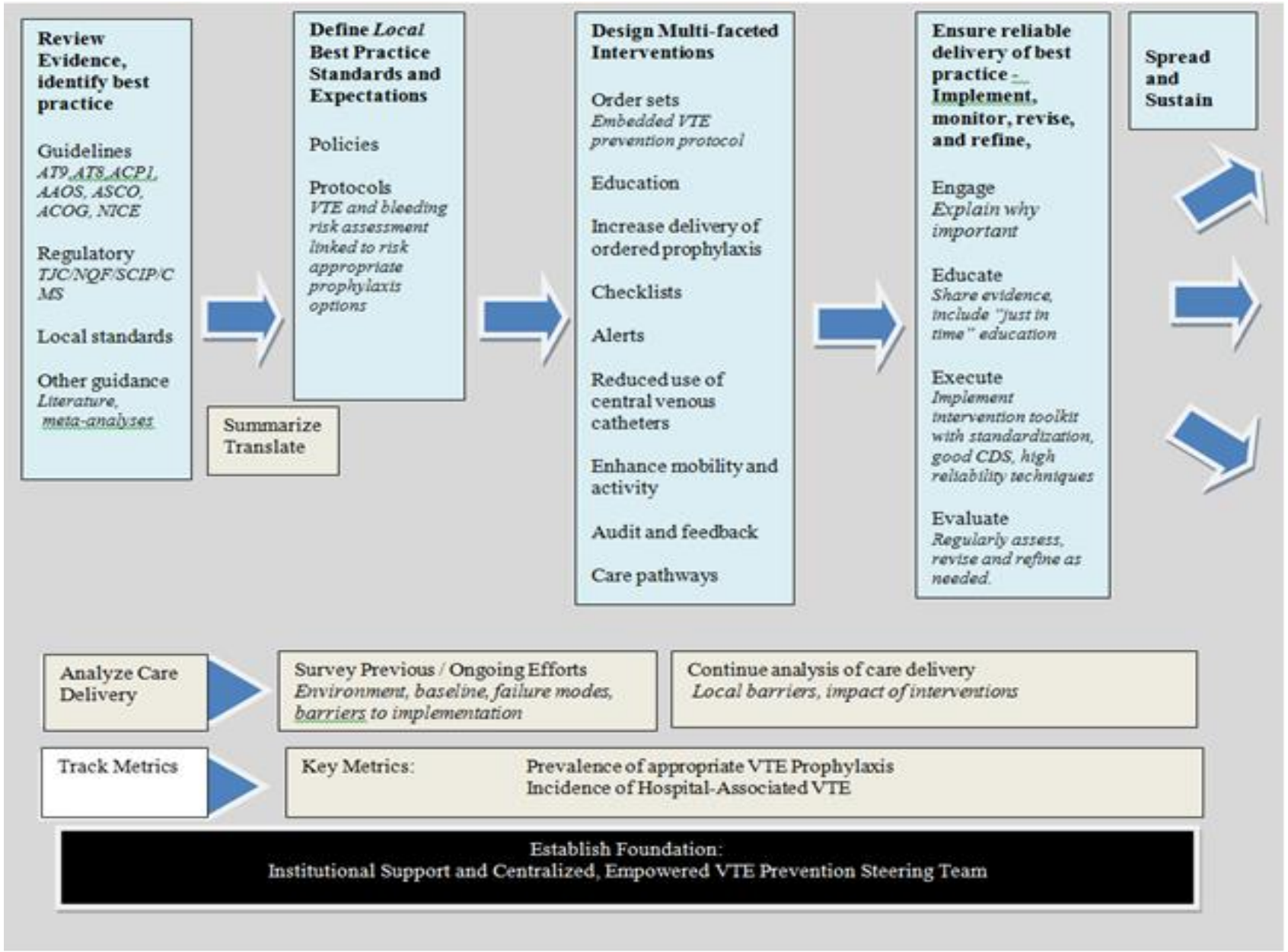
Table of Contents

Suggested Citation

Maynard G. Preventing hospital-associated venous thromboembolism: a guide for effective quality improvement, 2nd ed. Rockville, MD: Agency for Healthcare Research and Quality; August 2016. AHRQ Publication No. 16-0001-EF.

Strategies to Reduce HA VTE

- Centralized steering group for institution (or system) wide approach. Local teams vital. Collaborative structure
- 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 – better measures
- Active day-to-day surveillance, in addition to monthly/quarterly: Common protocol for nurse and doctor
- 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
  - Mobility, central lines, bypassing order sets, etc.


Review Evidence, identify best practice
Guidelines
AT9,AT8,ACP1, AAOS, ASCO, ACOG, NICE
Regulatory
TJC/NQF/SCIP/CMS
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.
Spread and Sustain
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

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

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

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

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

Each Risk Factor Represents 1 Point

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

Subtotal:

Each Risk Factor Represents 2 Points

- ❑ Age 61-74 years
- ❑ Arthroscopic surgery
- ❑ Malignancy (present or previous)
- ❑ Laparoscopic surgery (>45 minutes)
- ❑ Patient confined to bed (>72 hours)
- ❑ Immobilizing plaster cast (<1 month)
- ❑ Central venous access
- ❑ Major surgery (>45 minutes)

Subtotal:

Each Risk Factor Represents 3 Points

- ❑ Age 75 years or older
- ❑ History of DVT/PE
- ❑ Positive Factor V Leiden
- ❑ Elevated serum homocysteine
- ❑ Heparin-induced thrombocytopenia (HIT) (Do not use heparin or any low molecular weight heparin)
- ❑ Elevated anticardiolipin antibodies
- ❑ Other congenital or acquired thrombophilia

If yes: Type_____

- ❑ **Family history of thrombosis***
- ❑ Positive Prothrombin 20210A
- ❑ Positive Lupus anticoagulant

Subtotal:

*** most frequently missed risk factor**

Each Risk Factor Represents 5 Points

- ❑ Stroke (<1 month)
- ❑ Elective major lower extremity arthroplasty
- ❑ Hip, pelvis or leg fracture (<1 month)
- ❑ Acute spinal cord injury (paralysis) (<1 month)
- ❑ Multiple trauma (<1 month)

Subtotal:

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. *If high bleeding risk, IPC until bleeding risk diminishes.*
5 - 8	high	6%[1]	LMWH + IPC; or UFH + IPC. *If high bleeding risk, IPC until bleeding risk diminishes.*
> 8	very high	6.5 - 18.3%	LMWH + IPC; or UFH + IPC. *If high bleeding risk, IPC until bleeding risk diminishes.* *Consider extended duration prophylaxis.*

* 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

1. Gould MK, Garcia DA, Wren SM, et.al. Prevention of VTE in nonorthopedic surgical patients: antithrombotic therapy and prevention of thrombosis, 9th ed: Americal College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest.* 2012; 141(2)(Suppl): e227S-e277S.

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

Risk Assessment

- **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 **AND** LMWH or other anticoagulant*

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

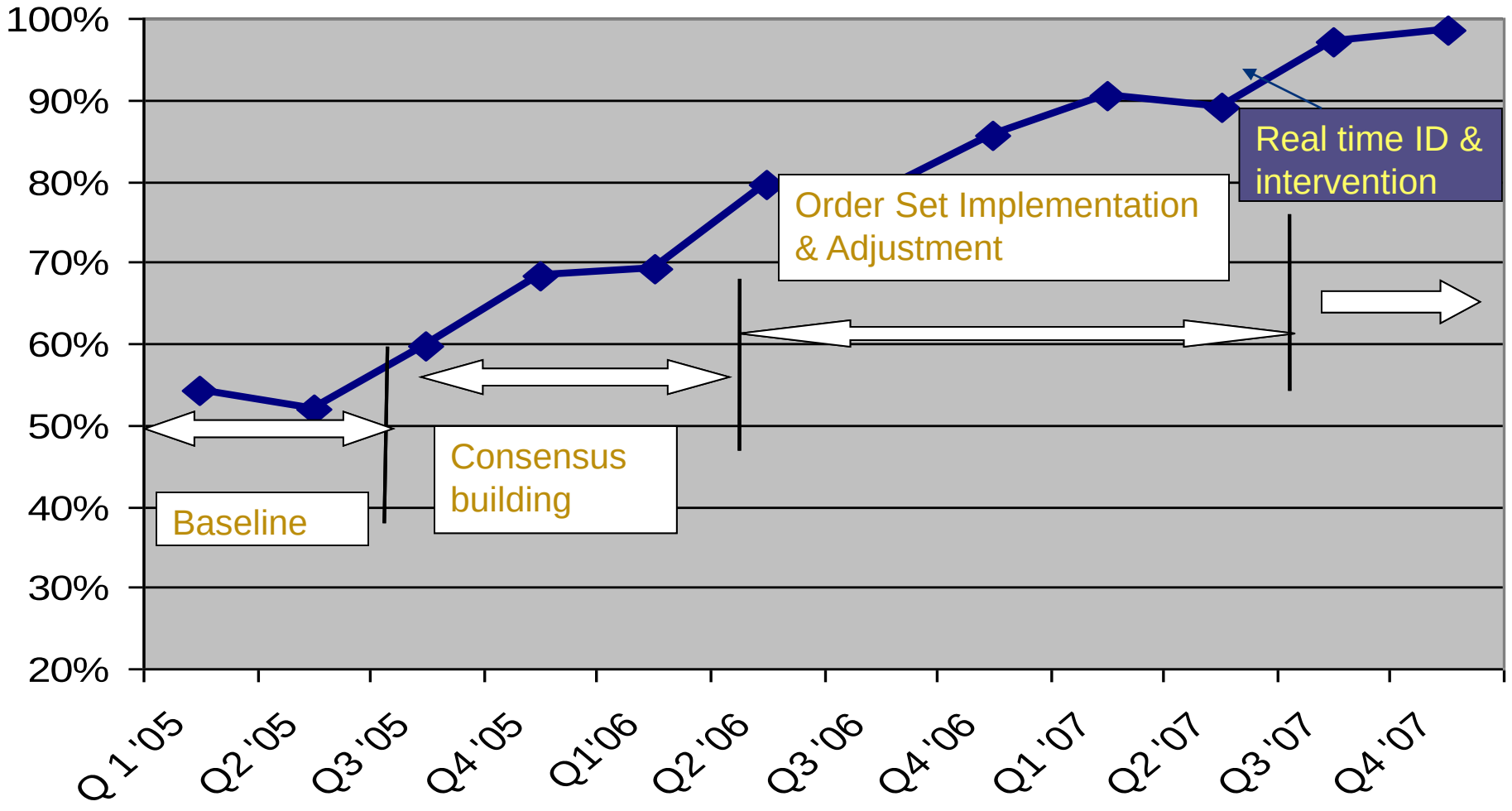
Updated Model – More c/w AT9 Guidelines

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.

Percent of Randomly Sampled Inpatients with Adequate VTE Prophylaxis



UCSD Results

Hospital Acquired VTE by Year	2005	2006	2007	2008
Patients at Risk	9,720	9,923	11,207	11,621
Cases w/ any VTE	131	138	92	80
Risk for HA VTE	1 in 76	1 in 73	1 in 122	
Odds Ratio	1.0	1.03	0.61#	
(95% CI)		(0.81, 1.32)	(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	1.0	1.02	0.62	
(95% CI)		(0.54, 1.96)	(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	1.0	1.03	0.61*	
(95% CI)		(0.79, 1.96)	(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	1.0	0.47#	0.14*	
(95% CI)		(0.26, 0.80)	(0.05, 0.31)	

# $p < 0.01$ *$p < 0.001$

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

Effective Implementation/CDS Principles

1. Keep it simple for the end user
   a. Some adjustments can be made behind the scenes (pharmacy adjustment of dose or peri-op timing, for example)
   b. Minimize calculations/clicks, automate process for them
   c. Streamline options, offer only preferred choices
2. Don't interrupt the workflow
   a. Integrate risk assessment in admit/transfer/post-op processes
   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)

continued…

Effective Implementation/CDS Principles, *continued*

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

Strategies for VTE Prevention
Beyond order sets

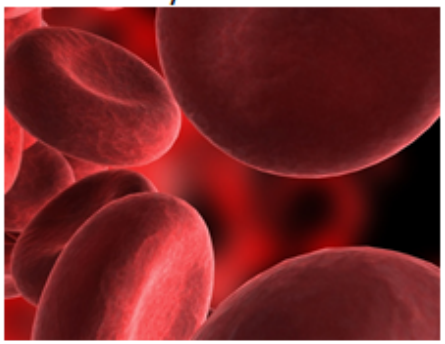
- *A good protocol-driven order set is well integrated*
- Assessing administration/adherence
  - (not just orders)
- Alert systems
  - Electronic alerts (E-alerts)
  - Human alerts
- Raising situational awareness (e.g., checklists)
- Audit and feedback
- Measure-vention
- Increase activity
- Optimize central lines
- Focus on extended duration for select populations

Challenges with Mechanical Prophylaxis2

- Ordering
  - M.D. over-ordering, including for low-risk patients
  - Clinical decision support needs (IF high risk *and* no contraindication) *then* SCDs and LMWH
- Compliance
  - Comfort, fall risks, convenience, priorities
  - Bulky devices and tethering vs. battery powered
  - Nurse driven protocol?
- Documentation
  - Adherence: priorities; challenges (what's adequate? documentation of use at that moment?)
  - Timing: fallouts when not documented instantly, even when (+) test was protocoled surveillance

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?

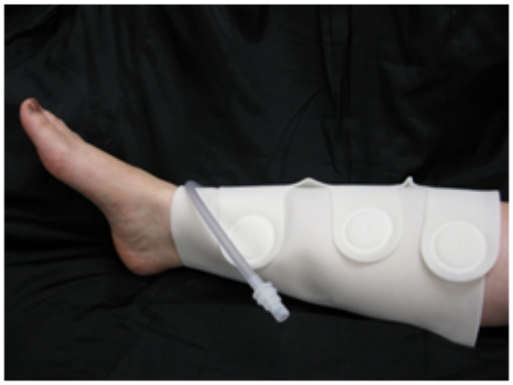
- You are not moving around well *
- You recently had surgery or an injury
- Your disease may increase your chance of getting a clot

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

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 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

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

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

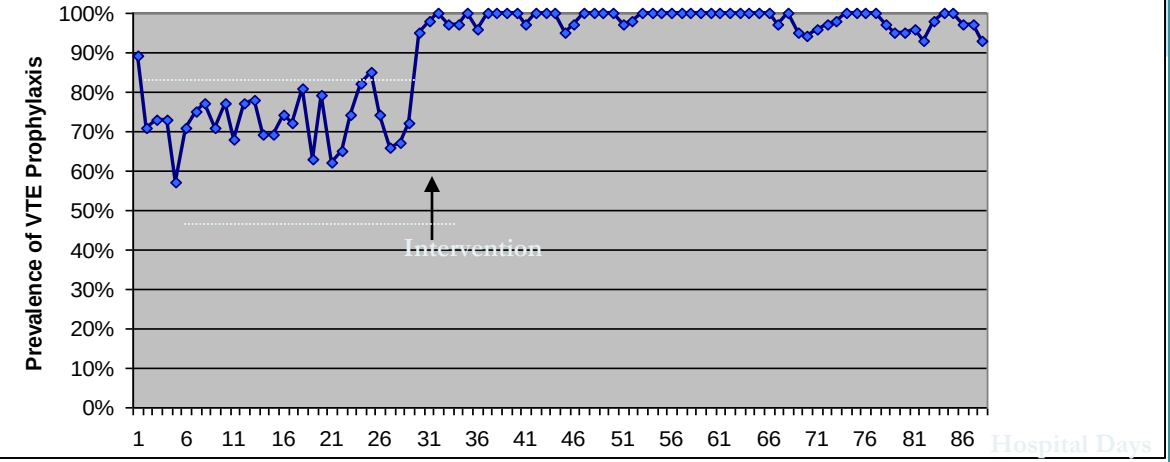
20 on anticoagulation

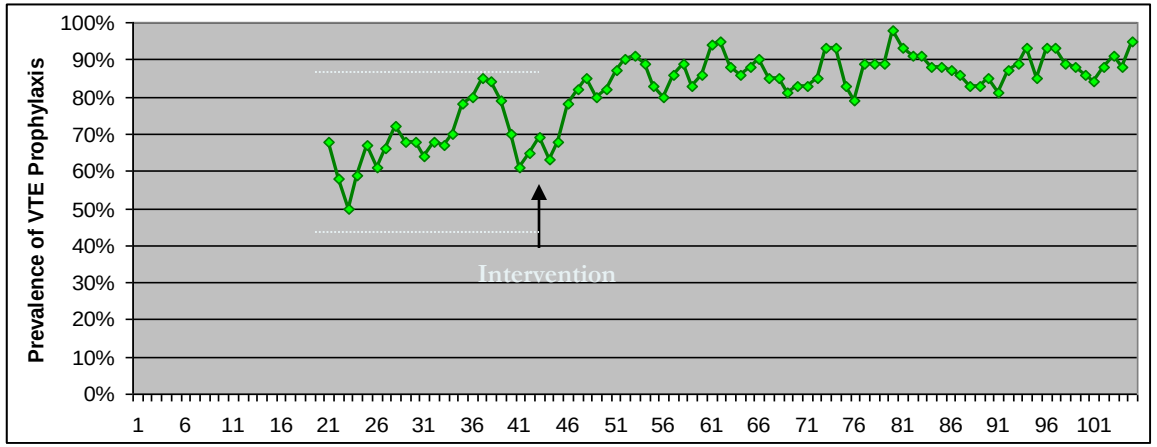
4 on mechanical prophylaxis with lab contraindication

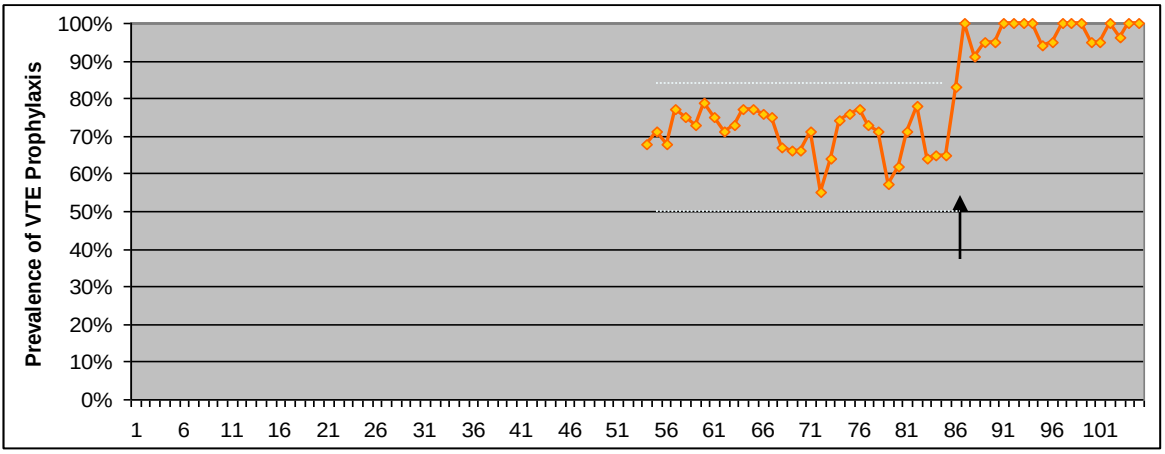
3 on Nothing

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/thrombolytics

Practices to Reduce PICC complications

- Minimize exposure to PICCs
  - Maximize midline/PIV
  - Remove asap
- Size matters – smaller PICCs = less 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?

Sources: Evans RS, Sharp JH, Linford LH, Lloyd JF et al. Reduction of Peripherally Inserted Central Catheter-Associated DVT. *Chest* 2013; 143(3):626-633.
Mai C, Hunt D. Upper-extremity Deep Vein Thrombosis: A Review. *Am J Med* 2011; 124:402-407.

Reducing the Incidence of Hospital-Associated Venous Thromboembolism Within a Network of Academic Hospitals: Findings From Five University of California Medical Centers

Ian H. Jenkins, MD, SFHM[1], Richard H. White, MD[2], Alpesh N. Amin, MD, MBA, MACP, SFHM, FACC[3], Nasim Afsarmanesh, MD, SFHM[4], Andrew D. Auerbach, MD, MPH[5], Raman Khanna, MD[5], Gregory A. Maynard, MD, MS, MHM[6*]

Baseline:

- 700 HA VTE/year
- No standardized approach to VTE risk assessment
- Different EHRs and different versions of Epic
- Poor adherence to mechanical prophylaxis, suboptimal metrics

Objective: Reduce HA VTE by > 20% in all adult medical/surgical patients

Methods:

- Collaborative infrastructure – webinars, e-mail, minutes, project management, task lists, DropBox, REDCap, tool sharing, AHRQ toolkit
- Common metrics –
  - Adequate (not just any) prophylaxis by protocol, audits across entire stay (not just first 24 hours)
  - Incidence of HA VTE: Those that developed de-novo in the hospital, and readmitted within 30 days of prior stay with new VTE. Also looked at adherence to orders

Source: *J Hosp Med.* 2016;Vol 11, S2, S22-28.

Recognized as 2015 CDC HA-VTE Prevention Challenge – VTEP Champions

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.

Reducing the Incidence of Hospital-Associated Venous Thromboembolism Within a Network of Academic Hospitals: Findings From Five University of California Medical Centers

Ian H. Jenkins, MD, SFHM[1], Richard H. White, MD[2], Alpesh N. Amin, MD, MBA, MACP, SFHM, FACC[3], Nasim Afsarmanesh, MD, SFHM[4], Andrew D. Auerbach, MD, MPH[5], Raman Khanna, MD[5], Gregory A. Maynard, MD, MS, MHM[6*]

Intervention bundle:

- Hardwire simple VTE risk assessment – admit, transfer, post-op
- Education – staff and patient
- Increase mobility and adherence to prophylaxis
- Improve diagnostic coding
- Mini-RCAs of HA VTE for lessons learned, new interventions
- Audit and feedback on VTEP and HA VTE
- Active surveillance (a.k.a. measure-vention)
- Customize special populations (e.g., Orthopedics, OB-GYN, Neurosurgery, CABG)

- Analysis:
  - Medical vs. surgical, cancer vs. non-cancer

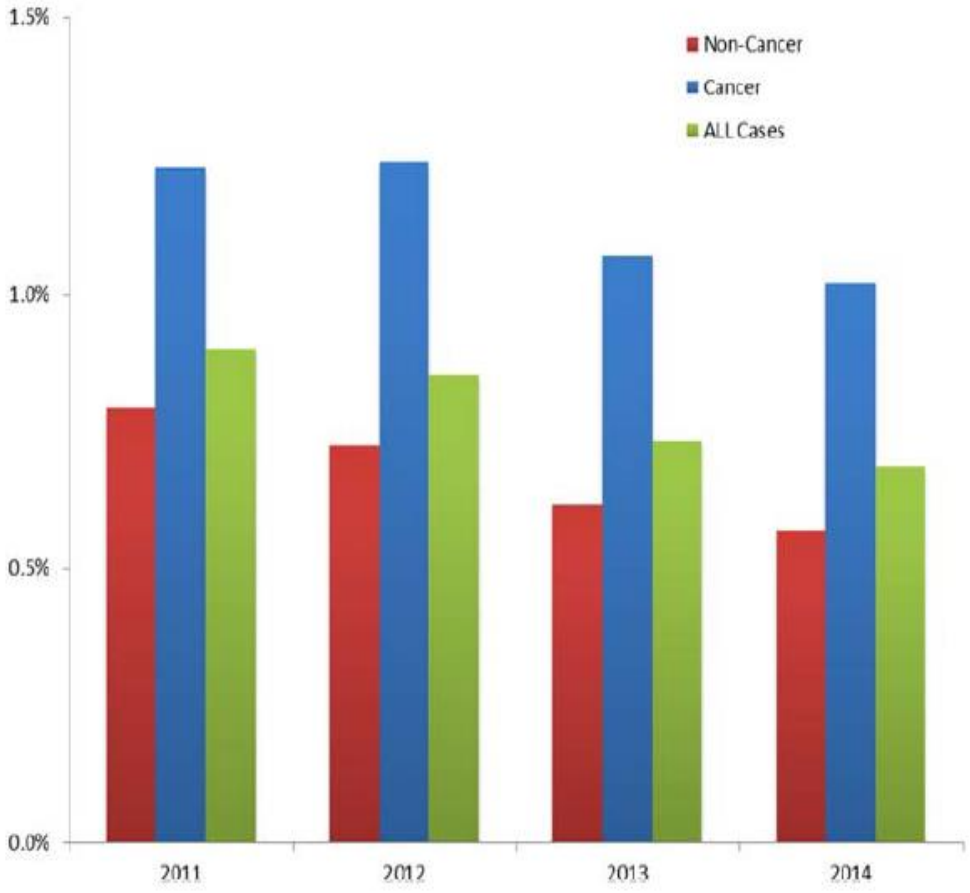
Source: *J Hosp Med.* 2016;Vol 11, S2, S22-28.

Recognized as 2015 CDC HA-VTE Prevention Challenge – VTEP Champions

Reducing the Incidence of Hospital-Associated Venous Thromboembolism Within a Network of Academic Hospitals: Findings From Five University of California Medical Centers

Ian H. Jenkins, MD, SFHM[1], Richard H. White, MD[2], Alpesh N. Amin, MD, MBA, MACP, SFHM, FACC[3], Nasim Afsarmanesh, MD, SFHM[4], Andrew D. Auerbach, MD, MPH[5], Raman Khanna, MD[5], Gregory A. Maynard, MD, MS, MHM[6*]

- Adequate VTEP increased from < 82% to > 96% at all sites
- 2,431 HA VTE in 306,906 encounters
- HA VTE reduced by 24%
  - 28% reduction – surgical
  - 10% reduction – medical
- 170 averted HA VTE2014 vs. 2011
- Est. $1.9 million in cost savings/year
- Cancer patients and surgical patients have higher risk than medical patients
- No increase in bleeding or HIT



Source: *J Hosp Med.* 2016;Vol 11, S2, S22-28.

Recognized as 2015 CDC HA-VTE Prevention Challenge – VTEP Champions

UC San Diego Health
Hospital Medicine

UCDAVIS HEALTH
UNIVERSITY of CALIFORNIA

A Multi-Center, Mentored Quality Collaborative Reduced Hospital-Associated VTE

Ian Jenkins, MD, SFHM [1]; Tamra O'Bryan, MHA, RHIA, CPHQ[2]; Janet Holdych, PharmD, CPHQ[3]; Gregory A. Maynard MD, MSc, MHM[4]

[1]Division of Hospital Medicine, UCSD, ihjenkins@ucsd.edu; [2] Dignity Health, Director of Quality Improvement; [3]Dignity Health, VP of Quality, [4] UC Davis Medical Center, CQO

Dignity Health

VTE
Assess. Prevent.

Selected for plenary, SHM meeting. Submitted to JHM

METHODS

Setting, patients and timeframe:

- 35 community hospitals (varied sizes, teach status, and paper vs. electronic ordering systems)
- Compared 2011 (the baseline) to 2014 (the final state)
- Excluded were: Rehab, hospice, psychiatry, OB and pediatric patients
- Nine "pilot" sites developed a RAM/VTEP protocol and implementation plan which was disseminated to 26 "spread" hospitals
- All sites formed QI teams and received monthly collaborative webinars, data management support and site visits

UC San Diego Health
Hospital Medicine

UCDAVIS HEALTH
UNIVERSITY of CALIFORNIA

A Multi-Center, Mentored Quality Collaborative Reduced Hospital-Associated VTE

Ian Jenkins, MD, SFHM [1]; Tamra O'Bryan, MHA, RHIA, CPHQ[2]; Janet Holdych, PharmD, CPHQ[3]; Gregory A. Maynard MD, MSc, MHM[4]

[1]Division of Hospital Medicine, UCSD, ihjenkins@ucsd.edu; [2] Dignity Health, Director of Quality Improvement; [3]Dignity Health, VP of Quality, [4] UC Davis Medical Center, CQO

Dignity Health

VTE
Assess. Prevent.

Selected for plenary, SHM meeting. Submitted to JHM

METHODS

Interventions:

- QI mentorship at 9 pilot sites
- Education: site leads, staff, patients
- RAM/protocol: patients at low, medium or high risk with paired prophylaxis options
- Measure-vention: pilot sites were grant funded for real-time measurement/intervention
- Spread sites received partial support via Hospital Engagement Network (HEN) funds
- Same bundle components as UC collaborative

UC San Diego Health
Hospital Medicine

UCDAVIS HEALTH
UNIVERSITY of CALIFORNIA

A Multi-Center, Mentored Quality Collaborative Reduced Hospital-Associated VTE

Ian Jenkins, MD, SFHM [1]; Tamra O'Bryan, MHA, RHIA, CPHQ[2]; Janet Holdych, PharmD, CPHQ[3]; Gregory A. Maynard MD, MSc, MHM[4]

[1]Division of Hospital Medicine, UCSD, ihjenkins@ucsd.edu; [2] Dignity Health, Director of Quality Improvement; [3]Dignity Health, VP of Quality, [4] UC Davis Medical Center, CQO

Dignity Health

VTE
Assess. Prevent.

Selected for plenary, SHM meeting. Submitted to JHM

METHODS

Metrics (similar to UC collaborative):

- TJC VTEP measures (VTE-1 and 2)
- Adequate VTEP (per protocol) rates at pilot sites (per month of measure-vention)
- HA-VTE rates (coding data) including service and whether occurring during index stay (NPOA) or POA within 30 days of hospitalization (readmit)
- Rates for HIT and adverse effects of anticoagulation (coding data)

UC San Diego Health
Hospital Medicine

UCDAVIS HEALTH
UNIVERSITY of CALIFORNIA

A Multi-Center, Mentored Quality Collaborative Reduced Hospital-Associated VTE

Ian Jenkins, MD, SFHM [1]; Tamra O'Bryan, MHA, RHIA, CPHQ[2]; Janet Holdych, PharmD, CPHQ[3]; Gregory A. Maynard MD, MSc, MHM[4]

[1]Division of Hospital Medicine, UCSD, ihjenkins@ucsd.edu; [2] Dignity Health, Director of Quality Improvement; [3]Dignity Health, VP of Quality, [4] UC Davis Medical Center, CQO

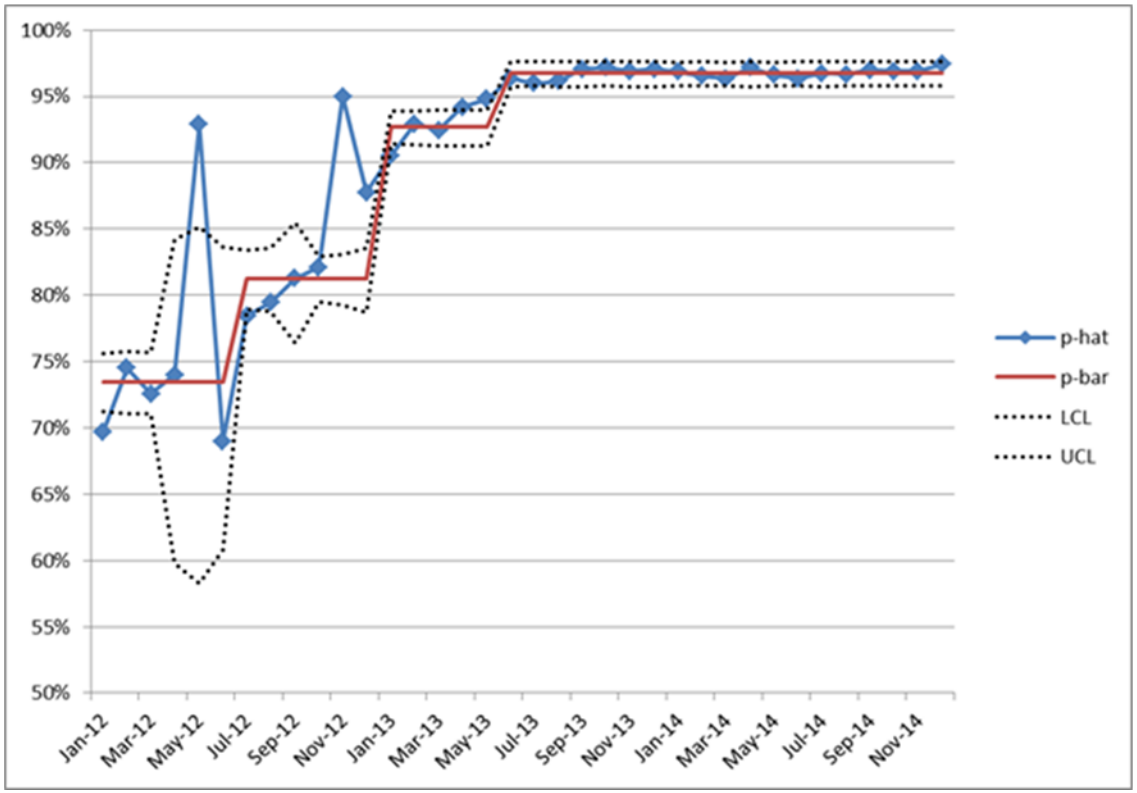
Dignity Health

VTE
Assess. Prevent.

Selected for plenary, SHM meeting. Submitted to JHM

Results – VTE Prophylaxis Rates

- 1.15 million admissions > 36,000 audits for adequate VTEP per protocol
- Adequate VTEP Improved from < 80% to > 97% at pilot sites
- >46,000 TJC audits showed improvement to > 95%



UC San Diego Health
Hospital Medicine

UC DAVIS HEALTH
UNIVERSITY of CALIFORNIA

A Multi-Center, Mentored Quality Collaborative Reduced Hospital-Associated VTE

Ian Jenkins, MD, SFHM [1]; Tamra O'Bryan, MHA, RHIA, CPHQ[2]; Janet Holdych, PharmD, CPHQ[3]; Gregory A. Maynard MD, MSc, MHM[4]

[1]Division of Hospital Medicine, UCSD, ihjenkins@ucsd.edu; [2] Dignity Health, Director of Quality Improvement; [3]Dignity Health, VP of Quality, [4] UC Davis Medical Center, CQO

Dignity Health

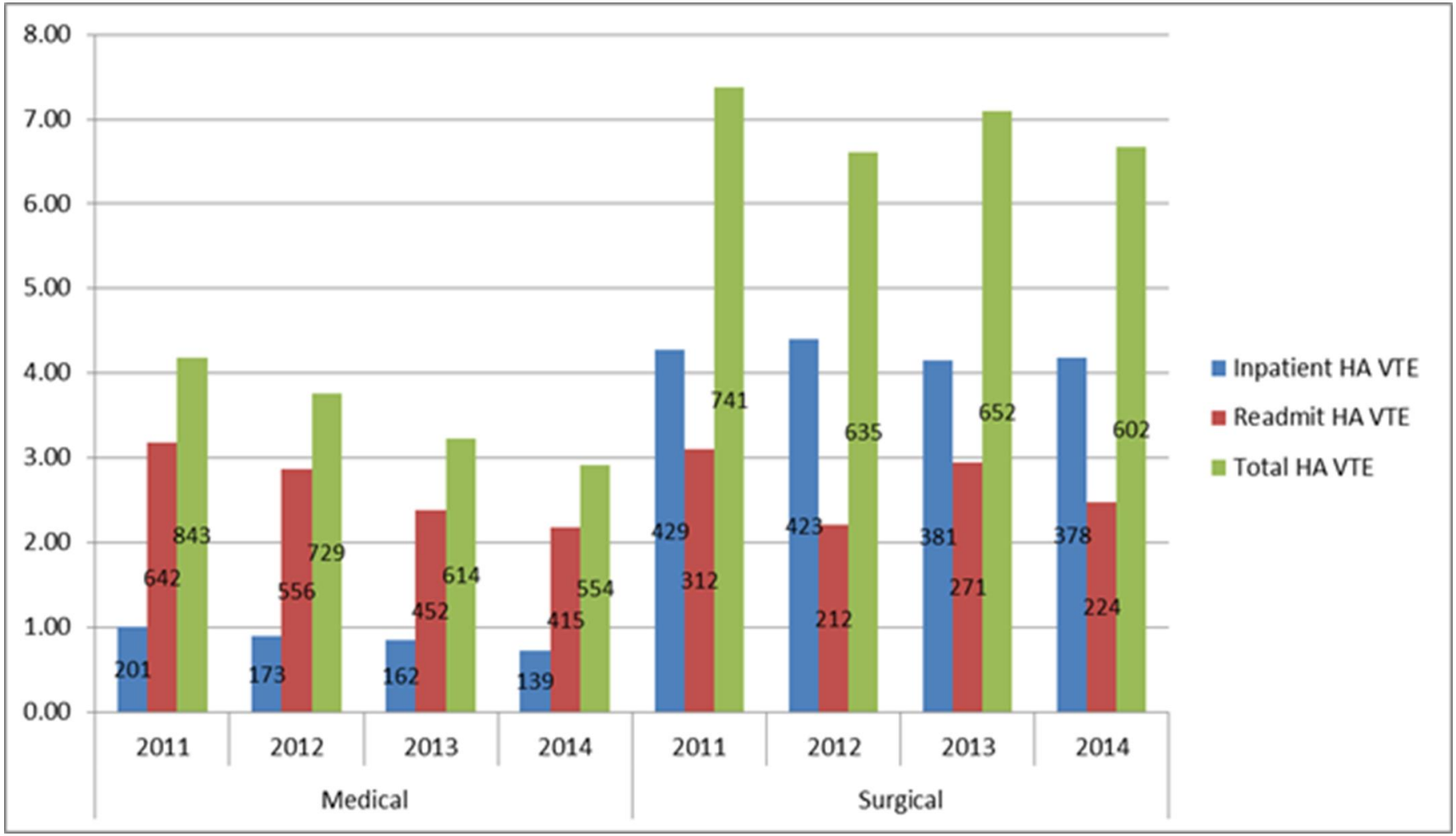
VTE
Assess. Prevent.

Selected for plenary, SHM meeting. Submitted to JHM

Results – HA VTE

- There were 5,370 HA-VTE during the study (51% medical, 49% surgical)
- The HA-VTE rate was higher in surgical than medical patients
- Most (75%) medical HA VTE occurred after discharge (readmit)
- Most (61%) surgical HA VTE occurred during index admission
- HA VTE fell 22% – 428 *fewer HA VTE per year*
  - Readmit VTE fell 28%, NPOA VTE fell 12%
  - In medical patients, HA VTE fell 31% with improvements in both NPOA and readmit cases
  - In surgical cases, RR 0.90 [95% CI 0.81 – 1.01]

Medical vs. Surgical HA VTE Rates
NPOA vs. Readmit



UC San Diego Health
Hospital Medicine

UCDAVIS HEALTH
UNIVERSITY of CALIFORNIA

A Multi-Center, Mentored Quality Collaborative Reduced Hospital-Associated VTE

Ian Jenkins, MD, SFHM [1]; Tamra O'Bryan, MHA, RHIA, CPHQ[2]; Janet Holdych, PharmD, CPHQ[3]; Gregory A. Maynard MD, MSc, MHM[4]

[1]Division of Hospital Medicine, UCSD, ihjenkins@ucsd.edu; [2] Dignity Health, Director of Quality Improvement; [3]Dignity Health, VP of Quality, [4] UC Davis Medical Center, CQO

Dignity Health

VTE
Assess. Prevent.

Selected for plenary, SHM meeting. Submitted to JHM

	2011	2012	2013	2014	2014 vs 2011 RR [95% CI]
Admissions	301,968	290,160	282,216	280,725	
NPOA HA-VTE	630 (2.09)	596 (2.05)	543 (1.92)	517 (1.84)	0.88 [0.79 – 0.99]*
Readmit HA-VTE	954 (3.16)	768 (2.65)	723 (2.56)	639 (2.28)	0.72 [0.65 – 0.80]*
Total HA-VTE	1,584 (5.25)	1,364 (4.70)	1,266 (4.49)	1,156 (4.12)	0.78 [0.73 – 0.85]*
HIT events	178 (0.59)	157 (0.54)	140 (0.50)	109 (0.39)	0.66 [0.52 – 0.84]*
Adverse effects	348 (1.15)	348 (1.20)	361 (1.28)	328 (1.17)	1.01 [0.87 – 1.18]NS

Summary

- Practical approach, proven effective in academic and community hospital setting. Free AHRQ toolkit
- Multi-pronged interventions, including standardized, protocol-driven order sets and active surveillance
- Metrics for outcomes that capture readmitted VTE cases, as well as new NPOA VTE
- Metrics for VTE prophylaxis that measure whether *appropriate* (not just any) *prophylaxis delivered* (not just ordered) *across entire stay* (not just day 1)

Thank you…

Questions?