Preventing Avoidable Venous Thromboembolism: Every Patient, Every Time

The Johns Hopkins VTE Collaborative
Elliott R. Haut MD PhD, Deborah Hobson RN BSN, Peggy Kraus PharmD CACP, Brandyn Lau MPH CPH, Dauryne Shaffer MSN RN CCRN, Michael Streiff MD

@elliotthaut

Armstrong Institute for Patient Safety and Quality Webinar
March 8, 2016
Polling Question: Who is on the call?

- Quality improvement professional
- Healthcare administrator
- Project manager
- Researcher
- Physician
- Nurse
- Pharmacist
- Other healthcare professional
- Patient or family member
- Representative of healthcare organizations
- Student
- Other
Your Presenters

Elliott Haut, MD, PhD
Michael Streiff, MD
Deborah Hobson, RN, BSN
Peggy Kraus, PharmD
Brandyn Lau, MPH, CPH
Dauryne Shaffer, MSN, RN, CCRN
Topics to Cover Today

- Epidemiology & Public Reporting
- VTE Prevention
  - Systems Approaches
  - Impact of Missed Doses
  - Role of Nurses
  - Patient Engagement
What is Venous Thromboembolism (VTE) ?

- Deep Vein Thrombosis (DVT)
- Pulmonary Embolism (PE)
What Causes Venous Thromboembolism (VTE)?

Stasis

Vessel Wall Injury

Hypercoaguability

Rudolf Virchow (1821-1902)
Why Focus on VTE?

• VTE is common
  – 350,000 to 600,000 Americans suffer DVT and/or PE each year

Why Focus on VTE?

• VTE is Deadly
  – >100,000 deaths per year
• More deaths than combined from
  – Breast Cancer
  – Motor Vehicle Collisions
  – AIDS

Risk Factors for VTE

- Age
- Cancer
- Chemotherapy
- Previous DVT/PE
- Trauma
- Major surgery
- Hospitalization
- Thrombophilia
- Pregnancy
- Hormone therapy
- Family history of VTE
- Recent Stroke
- Cardiac disease
- Respiratory disease
- Infection
- Immobility > 3 days
- Varicose veins
- Obesity
Why Focus on VTE?

- Increases cost
  - Increased per patient, per event cost estimates vary
    - $11,930 (Spyropoulos)
    - $15,941 (Lefebvre)
  - Annual direct costs > $250 million annually for venous stasis/ulcer alone

Why Focus on VTE?

- VTE is (mostly) preventable
VTE Should NOT be Considered a “Never Event”

• Not **ALL** events are preventable

• VTE occurs even in patients receiving best practice prophylaxis

• 8 RCTs of VTE Prophylaxis in Joint Replacement Surgery (4 TKA, 4 THR)
  – 0.3%-2.5% Symptomatic VTE

Streiff & Haut, JAMA 2009
The CMS Ruling on Venous Thromboembolism After Total Knee or Hip Arthroplasty
Weighing Risks and Benefits

Michael B. Streiff, MD
Elliott R. Haut, MD

These data highlight an important clinical reality: VTE prophylaxis is not perfect. The most effective currently available prophylactic regimens do not prevent all thrombotic events following TKA or THA. Yet the current CMS rule appears to be based on the false premise that VTE prophylaxis prevents all thrombotic events and is risk free. Therefore, under the current CMS rule, institutions will be financially penalized for at least 1% to 2.5% of patients undergoing elective TKA or THA, despite administering evidence-based prophylaxis.
Evidence Based VTE Prophylaxis Guidelines

- American College of Chest Physicians (ACCP)
- Eastern Association for the Surgery of Trauma (EAST)
- American Academy of Orthopedic Surgeons (AAOS)
- American College of Obstetricians and Gynecologists (ACOG)
- American College of Physicians (ACP)
DVT Prophylaxis is Vastly Underutilized!

A Prospective Registry of 5,451 Patients With Ultrasound-Confirmed Deep Vein Thrombosis

Samuel Z. Goldhaber, MD, and Victor F. Tapson, MD, for the DVT FREE Steering Committee*

We enrolled 5,451 patients with ultrasound-confirmed deep vein thrombosis (DVT), including 2,892 women and 2,559 men, from 183 United States sites in our prospective registry. The 5 most frequent co-morbidities were hypertension (50%), surgery within 3 months (38%), immobility within 30 days (34%), cancer (32%), and obesity (27%). Of the 2,726 patients who had their DVT diagnosed while in the hospital, only 1,147 (42%) received prophylaxis within 30 days before diagnosis. ©2004 by Excerpta Medica, Inc.

(Am J Cardiol 2004;93:259–262)
Venous thromboembolism risk and prophylaxis in the acute hospital care setting (ENDORSE study): a multinational cross-sectional study

Alexander T Cohen, Victor F Tapson, Jean-Francois Bergmann, Samuel Z Goldhaber, Ajay K Kakkar, Bruno Deslandes, Wei Huang, Maksim Zayaruzny, Leigh Emery, Frederick A Anderson Jr, for the ENDORSE Investigators*

- 68,183 patients
- 358 hospitals in 32 countries
- Prophylaxis
  - 58.5 % compliance - surgical patients
  - 39.5 % compliance - medical patients

Cohen, Lancet 2008
“The disconnect between evidence and execution as it relates to DVT prevention amounts to a public health crisis.”

Samuel Z. Goldhaber, M.D., Associate Professor of Medicine, Harvard Medical School

DVT: Advancing Awareness to Protect Patient Lives

American Public Health Association (APHA) White Paper 2003
Deep vein thrombosis (DVT)-related pulmonary embolism (PE) is the most common cause of preventable hospital death²

DVT prophylaxis of at-risk patients is the #1 strategy to improve patient safety in hospitals²

www.ahrq.gov
### Table C. Strongly encouraged patient safety practices

- Preoperative checklists and anesthesia checklists to prevent operative and post-operative events
- Bundles that include checklists to prevent central line-associated bloodstream infections
- Interventions to reduce urinary catheter use, including catheter reminders, stop orders, or nurse-initiated removal protocols
- Bundles that include head-of-bed elevation, sedation vacations, oral care with chlorhexidine, and subglottic-suctioning endotracheal tubes to prevent ventilator-associated pneumonia
- Hand hygiene
- “Do Not Use” list for hazardous abbreviations
- Multicomponent interventions to reduce pressure ulcers
- Barrier precautions to prevent healthcare-associated infections
- Use of real-time ultrasound for central line placement
- **Interventions to improve prophylaxis for venous thromboembolisms**
Chapter 28. Prevention of Venous Thromboembolism: Brief Update Review

Elliott R. Haut, M.D., FACS; Brandyn D. Lau, M.P.H.

• “Strategies to increase appropriate prophylaxis for VTE” included on list of top 10 “Strongly Encouraged Patient Safety Practices”

Surveillance Bias and Public Reporting of VTE
Conflict Regarding Duplex Screening for Asymptomatic DVT

- Conflicting data on efficacy and cost-effectiveness of duplex screening of asymptomatic trauma patients

  - Pro: Identify DVT early allowing treatment before fatal PE
  - Con: Large expense, not cost effective, harm from anticoagulation
Should We Screen High-Risk Trauma Patients for DVT?

Conflicting Guidelines

Rogers, J Trauma 2002
Gould, CHEST 2012
„Serial duplex ultrasound imaging of high-risk asymptomatic trauma patients to screen for DVT may be cost-effective and decrease the incidence of PE.”

http://www.EAST.org/resources/treatment-guidelines
Rogers, J Trauma 2002
American College of Chest Physicians (ACCP) Guidelines

- “For major trauma patients, we suggest that periodic surveillance with venous compression ultrasonography should not be performed (Grade 2C).”

Gould, CHEST 2012
Single Center (JHH)- Duplex & DVT rates Before v. After Screening Guideline

Haut, J Trauma 2007


- Duplex Rate per 1000 Trauma Admissions:
  - Before: 21 (0.7)
  - After: 82 (7)

- DVT/PE Rate per 1000 Trauma Admissions:
  - Before: 0
  - After: 7

Statistical significance:
- *p < 0.0001
- **p = 0.0024
Multi-Center (NTDB) - Hospital Level
Duplex & DVT rates

• Trauma centers with higher rates of duplex ultrasound report higher DVT rates to the National Trauma Data Bank

Surveillance Bias and Deep Vein Thrombosis in the National Trauma Data Bank: The More We Look, The More We Find

Charles A. Pierce, MPH, Elliott R. Haut, MD, Shahrzad Kardooni, MPH, David C. Chang, MBA, MPH, PhD, David T. Efron, MD, Adil Haider, MD, MPH, Peter J. Pronovost, MD, PhD, and Edward E. Cornwell III, MD

Pierce, J Trauma 2008
The More We Look, The More We Find

7-fold higher DVT rate at hospitals in top quartile of duplex ultrasounds

Pierce, J Trauma 2008
Hospital Screening Status is an Independent Risk Factor for DVT Reporting

Haut, J Trauma 2009

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Odds Ratio</th>
<th>95% Confidence Interval</th>
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<td>Treatment at “Screening” vs. “Non-Screening” Trauma Center</td>
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<td>1.07-4.34</td>
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<tr>
<td>Age ≥ 40 years</td>
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<td>1.74-2.30</td>
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<tr>
<td>Extremity Injury (AIS≥3)</td>
<td>1.96</td>
<td>1.68-2.30</td>
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<tr>
<td>Head Injury (AIS≥3)</td>
<td>1.53</td>
<td>1.22-1.92</td>
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<tr>
<td>Ventilator Days ≥ 3</td>
<td>5.14</td>
<td>3.66-7.22</td>
</tr>
<tr>
<td>Venous Injury</td>
<td>2.85</td>
<td>1.97-4.13</td>
</tr>
<tr>
<td>Major Surgery</td>
<td>4.79</td>
<td>4.08-5.62</td>
</tr>
</tbody>
</table>
Variability in Trauma Surgeons Opinions of DVT Screening

- AAST/EAST member survey
- 317 individual trauma surgeons

“High risk asymptomatic patients should be screened for DVT”

Haut, J Trauma 2011
A Classic Example of Surveillance Bias

- Providers who screen more aggressively by performing more duplex ultrasounds may identify more cases of DVT and appear to provide worse quality of care than those providers who order fewer tests.

Haut & Pronovost, JAMA 2011
Implications

Surveillance Bias in Outcomes Reporting

Elliott R. Haut, MD
Peter J. Pronovost, MD, PhD

DVT, some clinicians use duplex ultrasound to screen high-risk asymptomatic trauma patients for DVT. Other clinicians argue this approach is neither clinically necessary nor
“We’ll just use the test results anyway because it’s the only data we have”

Defining Preventable Harm
The VTE Example

• We suggested that “performance measures could link a process of care with adverse outcomes when defining incidences of preventable harm”

Preventable Harm = VTE + No Prophylaxis

Haut & Pronovost, JAMA 2011
We Talked

• Centers for Medicare & Medicaid Services listened
“Meaningful Use” of Electronic Health Record (EHR) Technology

– VTE1 Prophylaxis within 24 hours of arrival
– VTE2 ICU VTE Prophylaxis
– VTE3 Anticoagulation Overlap Therapy
– VTE4 Platelet Monitoring on UFH
– VTE5 VTE Discharge Instructions
– VTE6 Incidence of Potentially Preventable VTE

https://www.cms.gov/EHRIncentivePrograms/30_Meaningful_Use.asp
“Meaningful Use” Definition of Potentially Preventable VTE

• VTE-6 Incidence of Potentially Preventable VTE

“This measure assesses the number of patients diagnosed with confirmed VTE during hospitalization (not present or suspected at admission) who did not receive VTE prophylaxis between hospital admission and the day before the VTE diagnostic testing order date.”
Surveillance Bias in VTE Reporting in Surgery

Original Investigation

Evaluation of Surveillance Bias and the Validity of the Venous Thromboembolism Quality Measure

Karl Y. Bilimoria, MD, MS; Jeanette Chung, PhD; Mila H. Ju, MD; Elliott R. Haut, MD; David J. Bentrem, MD, MS; Clifford Y. Ko, MD, MS; David W. Baker, MD, MPH

Published online October 7, 2013.

Bilimoria, JAMA 2013
Surveillance Bias in VTE Reporting in Surgery

- 2,786 hospitals
- 954,526 Medicare patients ≥65 years
- 11 major operations
  - AAA, CABG, craniotomy, colectomy, cystectomy, esophagectomy, gastric bypass, lung resection, pancreatic resection, proctectomy, total knee arthroplasty

Bilimoria, JAMA 2013
Surveillance Bias in VTE Reporting in Surgery

Figure 3. Mean Risk-Adjusted Event Rates by Imaging Use Rate Quartile

Bilimoria, JAMA 2013
No Association Between Hospital-Reported Perioperative VTE Prophylaxis and Outcome Rates in Publicly Reported Data

- 3040 hospitals
- Median prophylaxis performance = 94.5%
- The median risk-adjusted VTE rate was 4.13 per 1000 surgical discharges

Linear regression (3040 hospitals) of VTE rate on percentage of surgical patients receiving timely VTE prophylaxis did not show a significant association (95% CI, -1.65% to 13.35%; P = .13). The horizontal red line represents the simple linear regression line. AHRQ indicates Agency for Healthcare Research
No Association Between Hospital-Reported Perioperative VTE Prophylaxis and Outcome Rates in Publicly Reported Data

Hospitals reporting 100% perfect VTE prophylaxis performance (n = 141) vs. Hospitals in the bottom quintile of prophylaxis performance (n = 618)

Nearly identical median VTE outcome rates
(4.18 vs. 4.17; P = .98)

JohnBull, JAMA-Surg 2014
The Jury is Still Out

• What is the optimal approach to public reporting of VTE??

Concerns About Using the Patient Safety Indicator-90 Composite in Pay-for-Performance Programs

Facilitating Quality Improvement
Pushing the Pendulum Back Toward Process Measures

Bilimoria KY. JAMA 2015 x2 commentaries
The Jury is Still Out

• What is the optimal approach to public reporting of VTE??

• Process v. Outcome ?????

• VTE-1 (prophylaxis measure) is no longer being reported (RETIRED)
Can a Systems Approach Improve VTE Prevention and Outcomes?
What Approaches Can Improve VTE Prophylaxis?

• “Passive dissemination of guidelines is unlikely to improve VTE prophylaxis practice.”

• “A number of active strategies used together, which incorporate some method for reminding clinicians to assess patients for DVT risk and assisting the selection of appropriate prophylaxis, are likely to result in the achievement of optimal outcomes.”

Improving VTE Prophylaxis at The Johns Hopkins Hospital

Lessons from the Johns Hopkins Multi-Disciplinary Venous Thromboembolism (VTE) Prevention Collaborative

BMJ 2012;344:e3935

Michael B Streiff associate professor of medicine, Howard T Carolan quality and innovations project administrator, Deborah B Hobson patient safety clinical specialist, surgical intensive care nurse and coordinator, Peggy S Kraus clinical specialist for anticoagulation, Christine G Holzmueller senior research coordinator II, medical writer and editor, Renee Demski senior director, quality and safety, Brandyn D Lau medical informatician, Paula Biscup-Horn clinical pharmacy specialist, anticoagulation management, Peter J Pronovost professor, director, senior vice president for patient safety and quality, Elliott R Haut associate professor of surgery.

Streiff, BMJ 2012
Improving VTE Prophylaxis at The Johns Hopkins Hospital

Streiff, BMJ 2012

Pilot Worksheet

**Allergies:**

- **Serious Risk Factors**
  - Current, active cancer
  - Previous DVT and/ or PE
  - Stroke within past 4 months (non-hemorrhagic)
  - Trauma (major or lower extremity)
  - Heart or respiratory failure undergoing acute treatment
  - Pregnancy and post-partum (< 1 month)
  - Inherited or acquired thrombophilia

- **Other Risk Factors**
  - Immobility (bedrest/sitting ≥ 3 days) or paralysis
  - Central venous catheterization
  - Acute medical illness or sepsis
  - Myeloproliferative disorder
  - Inflammatory bowel disease
  - Neoplastic syndrome
  - Varicose veins

**Weight:** ___ Kg  
**Serum Creatinine:** ___

**INDICATE RISK FACTORS**

- **Low Risk**
  - Minor surgery (< 30 min), age < 40 years, with NO additional risk factors
  - OR
  - Vascular surgery with NO additional risk factors
  - OR
  - Laparoscopic procedures with NO additional risk factors
  - OR
  - Low risk urologic procedures (TURP, etc.)

- **Moderate Risk**
  - Minor surgery (< 30 min), age ≥ 40 years, WITH any additional risk factors (one or more)
  - OR
  - Major surgery (> 30 min), age ≥ 40 years, WITH any additional risk factors (one or more)
  - OR
  - Major surgery (> 30 min), age < 40 years, WITH any additional risk factors (one or more)
  - OR
  - Laparoscopic surgery WITH any additional risk factors (one or more)

- **High Risk**
  - Any surgery age ≥ 60 years WITHOUT any additional risk factors
  - OR
  - Minor surgery (< 30 min), age 40-60 years WITH any additional risk factors (one or more)
  - OR
  - Major surgery (> 30 min), age ≥ 60 years WITH any additional risk factors (one or more)
  - OR
  - Major vascular surgery (> 30 min) WITH any additional risk factors (one or more)

**ORDER**

- **Low Risk**
  - No pharmacologic prophylaxis indicated; Early and partial mobilization recommended; Please specify ambulation plan

- **Moderate Risk**
  - Heparin, 5,000 Units SC Q12 hours
  - **With the option to add**
    - TED
  - SCD

- **High Risk**
  - Heparin, 5,000 Units SC Q8 hours
  - **With the option to add**

**CONTRAINDICATIONS**

- Active, uncontrolled bleeding or high risk of bleeding
- Systemic anticoagulation
- Active atheroma (carotid or saccular dissecting)
- Bacterial endocarditis or pericarditis
- Active peptic ulcer disease, ulcerative GI lesions
- Malignant hypertension
- Severe head trauma
- INR or aPTT ratio > 1.5 (unless antithrombotic antibody)
- Threatened abortion
- Severe thrombocytopenia (platelet count < 30,000)
- Recent TURP
- Eye, brain, or spinal cord injury within the past 48 hrs.
- For Heparin or Enoxaparin: history of HIT
- For Enoxaparin: Epidural catheter removal or spinal tap < 2 hours prior to dose, weight < 45 kg, hemodilysis²
- For SCD: open wounds or extremity with known DVT

If contraindication present: (Check one or more)
- Discontinue orders above
- Early and partial mobilization
- Please specify ambulation plan
- TED/SCD

---

1. For patients with contraindications to pharmacologic prophylaxis, use mechanical prophylaxis with properly fitted TED and/ or SCD until the bleeding risk decreases.
2. Patients undergoing major cancer surgery who are ≥ 60 years or patients with previous DVT/PE, post-discharge prophylaxis for 2 to 4 weeks is recommended.
3. Mobilization of epidural catheter should be undertaken at the murmur's (nurse's) discretion. If necessary, remove the catheter at least 10 to 12 hours after dosing and wait 2 hours to recover. If catheter is to remain in place, heparin is strongly recommended, with repeat 1 hour after removal. If blood is present with catheter manipulation, the procedure should be stopped and SCD ordered.
4. For patients with diabetes (BMI ≥ 40 kg/m²), following major surgery, enoxaparin at 1.25 mg SC Q12 hours was more effective than 0.5 mg SC Q12 hours in an open trial.
5. TED and SCD are most effective when applied to the patient and are ordered for ≤ 23 hours per day.
Improving VTE Prophylaxis at The Johns Hopkins Hospital

• Mandatory VTE risk stratification tool into the computerized provider order entry (CPOE) system
• Advanced computerized clinical decision support (CDS)

Streiff, BMJ 2012
**VTE Prophylaxis: General Surgery [3 orders of 9 are selected]**

**Combined Measurements**
- Height (inches): 72
- Height (cm): 182.9
- Weight (lb): 180
- Weight (kg): 81.6
- BSA: 2.04
- BMI: 24.4

**SECTION A: Does the patient have any major VTE risk factors?**
- Previous VTE: Yes
- Cancer - Metastatic or under treatment: No
- Known hypercoagulable state: No
- Procedure greater than 2 hours: No
- Congestive heart failure: No
- Mechanical ventilation: No
- Stroke with paresis less than 3 months: No
- Perioperative bedrest more than 3 days: Yes
- No major risk factors known: No

**SECTION B: Does the patient have any minor VTE risk factors?**
- Sepsis: No
- Central venous catheter: Yes
- Current systemic estrogen use: No
- Tamoxifen or Raloxifene use: No
- Active inflammatory bowel disease: No
- No minor risk factors known: Yes

**SECTION C: Does the patient have any contraindications to pharmacologic prophylaxis?**
- Current use of systemic anticoagulation: No
- High risk of bleeding: No
- Active bleeding: No
- INR greater than or equal to 1.3: No
- APTT greater than or equal to 1.3: No
- Platelet count less than 100,000 cu mm: No
- No contraindications known: Yes

**Creatinine Clearance (Estimated (Cockcroft-Gault))**
- Creatinine (mg/dl): 0.9
- Creat Clear (est): 103.7

**Recommended Prophylaxis:**
- Choose Heparin 5000 units Q8H or Enoxaparin 40 mg daily plus Mechanical Prophylaxis (TEDS/SCDs). (VERY HIGH Risk WITHOUT Renal Impairment)
Benefits of the Computerized VTE Prevention System

- Puts VTE prevention into the work flow
- Enables rapid, accurate risk stratification and risk-appropriate VTE prophylaxis
- Applies evidence directly to clinical care
- Allows for performance monitoring/reporting

Streiff, BMJ 2012
Keys to Success

- Multidisciplinary team
  - Physicians, Nurses, Pharmacists, Informatics
- Leadership buy-in
- Collaborate with service teams
- Educate front-line providers
- Measure baseline performance
- Conduct ongoing performance evaluations

Streiff, BMJ 2012
Does Improving Prophylaxis Change Outcomes?

• YES

• 2 examples
  – Johns Hopkins Trauma Surgery
  – Johns Hopkins Internal Medicine
Does Improving Prophylaxis Change Outcomes? The JHH Trauma Example

Building a Surgical Expertise in Informatics

Improved Prophylaxis and Decreased Rates of Preventable Harm With the Use of a Mandatory Computerized Clinical Decision Support Tool for Prophylaxis for Venous Thromboembolism

Elliott R. Haut, MD; Brandyn D. Lau, MPH; Franca S. Kraenzlin, MHS; Deborah B. Hobson, BSN; Peggy S. Kraus, PharmD, CACP; Howard T. Carolan, MPH, MBA; Adil H. Haider, MD, MPH; Christine G. Holzmueller, BLA; David T. Efron, MD; Peter J. Pronovost, MD, PhD; Michael B. Streiff, MD

Arch Surg. 2012;147(10):901-907
Does Improving Prophylaxis Change Outcomes? The JHH Trauma Example

- Single Center (Johns Hopkins Hospital)
- Pre/Post Intervention Study
- 1-year PRE vs. 3-years POST
- Retrospective data collection
- IRB approved

Haut, Arch Surg 2012
Does Improving Prophylaxis Change Outcomes? The JHH Trauma Example

- Significant increase in VTE prophylaxis
- Significant drop in preventable harm from VTE
  - 1.0% vs. 0.17% (p=0.04)

Haut, Arch Surg 2012
Does Improving Prophylaxis Change Outcomes? The JHH Medicine Example

Impact of a venous thromboembolism prophylaxis “smart order set”: Improved compliance, fewer events

Amer M. Zeidan, Michael B. Streiff,* Brandyn D. Lau, Syed-Rafay Ahmed, Peggy S. Kraus, Deborah B. Hobson, Howard Carolan, Lambrianidi Chryso, Paula B. Horn, Kenneth M. Shermock, Gabriel Tinoco, Salahuddin Siddiqui, and Elliott R. Haut

Zeidan, Am J Hematology 2013
Does Improving Prophylaxis Change Outcomes? The JHH Medicine Example

- Retrospective Review (PRE v. POST)
- Patients: 1,000 PRE v. 942 POST
- Patients prescribed Optimal Prophylaxis
  - 65.6% v. 90.1% (p<0.0001)
- Patients prescribed NO prophylaxis
  - 23.6% v. 4.4% (p<0.0001)

Zeidan, Am J Hematology 2013
# Does Improving Prophylaxis Change Outcomes? The JHH Medicine Example

<table>
<thead>
<tr>
<th></th>
<th>Preimplementation $N = 1,000$</th>
<th>Postimplementation $N = 942$</th>
<th>$P$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total VTE episodes</td>
<td>25 (2.5%)</td>
<td>7 (0.7%)</td>
<td>0.0022</td>
</tr>
<tr>
<td>Preventable harm from VTE</td>
<td>11 (1.1%)</td>
<td>0 (0)</td>
<td>0.001</td>
</tr>
<tr>
<td>Total in-house VTE</td>
<td>5 (0.5%)</td>
<td>5 (0.5%)</td>
<td>1.0000</td>
</tr>
<tr>
<td>Total 30-day post-discharge VTE</td>
<td>9 (1.1%)</td>
<td>2 (0.3%)</td>
<td>0.0300</td>
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<tr>
<td>Total 90-day post-discharge VTE</td>
<td>20 (2.7%)</td>
<td>2 (0.3%)</td>
<td>0.0003</td>
</tr>
<tr>
<td>Fatal PE</td>
<td>2 (0.2%)</td>
<td>1 (0.1%)</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Zeidan, Am J Hematology 2013
# ZERO Preventable VTE – A Realistic Goal

## TABLE IV. Clinical Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Preimplementation (N = 1,000)</th>
<th>Postimplementation (N = 942)</th>
<th>P-value</th>
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</tr>
</tbody>
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Zeidan, Am J Hematology 2013
VTE Prophylaxis - Computerized Decision Support

www.natfonline.org
Three Examples of Effective Implementation and Clinical Decision Support

The following are examples of effective order set design and implementation. They illustrate the central importance of implementation and clinical decision support techniques across disparate hospital settings and VTE risk assessment models.

The Johns Hopkins collaborative team used the “translating research into practice” (TRIP) model to implement mandatory VTE risk assessment and risk-appropriate prophylaxis. The TRIP model is consistent with the principles presented throughout this guide. Important steps included summarizing the evidence from a centralized steering group; identifying barriers through pilot testing, good measurement, and feedback; and reinforcing appropriate prophylaxis through staff engagement, education, regular evaluation, good clinical decision support in order sets, and layered interventions to reinforce the protocol.
Improving VTE Prophylaxis Administration with Targeted Performance Feedback
The Role of Health Informatics

• Harness the power of analytics
• Bringing performance data to individual providers and units
• Can competition drive improvements?
Trauma Attending & Resident Prophylaxis

Figure. Risk-Appropriate Venous Thromboembolism (VTE) Prophylaxis Prescription Compliance Rates

7 residents at 0%

42 residents at 100%

Lau, JAMA-Surg 2015
<table>
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<th>RANK</th>
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<th>CURRENT MONTH</th>
<th>Number of Orders</th>
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**Overall:** 235 Compliant Orders, 268 Total Orders, 87.7% Compliance

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**Overall:** 260 Compliant Orders, 277 Total Orders, 96.3% Compliance

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96.3% November

93.3% October

87.7% September
Surgery Resident Feedback Improves VTE Prophylaxis

Lau, Ann Surg 2015
Missed Doses of VTE Prophylaxis
A Big Assumption

• As physicians, we assume that medication orders we place are consistently delivered.
• But is that truly the case?
• Does prescription = administration?
Steps to Optimal Pharmacologic VTE Prophylaxis

Provider Prescription → Nurse Administration → Patient Acceptance
Do Missed VTE Prophylaxis Doses Matter?

- **Methods**
  - Retrospective analysis
  - 202 trauma and general surgery patients ordered enoxaparin

- **Results**
  - Overall incidence of DVT = 15.8%
  - 58.9% of patients missed $\geq 1$ dose
  - DVT compared missed vs. no missed doses
    - 23.5% vs. 4.8% ($p < 0.01$)

Louis, JAMA Surgery 2014
Do Missed VTE Prophylaxis Doses Matter?

- 92 VTE patients
- 39% missed $\geq 1$ dose of prophylaxis

Of the 92 patients with a venous thromboembolism (VTE), 43 (47%) received defect-free care, while 49 (53%) had truly potentially preventable VTE and were in the prophylaxis-failure group (ie, 13 of 92 patients were prescribed suboptimal prophylaxis [14%), and 36 of 92 patients missed $\geq 1$ dose of prescribed prophylaxis [39%]).

Haut, JAMA Surgery 2015
Missed Doses of VTE Prophylaxis Medications at Johns Hopkins

- December 1, 2007 to June 30, 2008
  - >100,000 doses
  - 12% of doses not administered
- Patient refusal most frequent (~60%) documented reason

Shermock, PlosOne 2013
Missed Doses are Clustered Within Floors

Shermock, PlosOne 2013
What’s the Real Story Behind Missed Doses?

- “Hidden Barriers to Delivery of Pharmacologic Venous Thromboembolism Prophylaxis”
- Mixed methods study (quantitative/qualitative)
  - Quantitative Nursing survey
  - Qualitative observations of nurse/patient interaction
  - Focus groups with nurses

What’s the Real Story Behind Missed Doses? - Quantitative

• “I have the clinical knowledge and experience to determine if it is necessary to administer DVT/PE prophylaxis injections to patients.”
  – AGREE 87%/79% medicine/surgery

• “Nurses use their clinical decision-making skills to determine when to omit unnecessary doses of prescribed DVT/PE prophylaxis injections for each individual patient”
  – AGREE 80%/50% medicine/surgery

Is VTE Prophylaxis Optional?

• “I push harder for my patients to accept heparin [prophylaxis] if they have, like, sickle cell disease, as opposed to say pneumonia or something where they are just here for [IV] antibiotics.”

• “Sometimes, if it is the middle of the night and [LDUH] is the only medication I have to give a patient, I won’t wake them up just to give VTE prophylaxis.”

The Ambulation Myth

• “We make the clinical decision all the time as to whether a patient needs VTE prophylaxis every day, based on how much the patient is ambulating.”

• “Hey Ms. R, it’s time for your heparin dose, but as long as I see you up, high-fiving me in the hallways, we can hold off for now.”

Our PCORI Project

- Preventing Venous Thromboembolism: Empowering Patients and Enabling Patient-Centered Care via Health Information Technology

Principal Investigator
Elliott Haut, MD, PhD

Organization
Johns Hopkins University

State
Maryland

Year Awarded
2013

Funding Announcement
Assessment of Prevention, Diagnosis, and Treatment Options

Project Budget
$1,499,194

Project Period
3 years

Our PCORI Objectives

• 1) Enable patients to make informed decisions about their preventive care by improving the quality of patient-nurse communication about the harms of VTE and benefits of VTE prophylaxis

• 2) Empower patients to take an active role in their VTE preventive care

• 3) Identify and facilitate active engagement of patients who are not administered doses of VTE prophylaxis using a real-time escalating alert

Our PCORI Collaborators / Key Stakeholders

ClotCare Online Resource
Helping others improve lives through anticoagulation

National Blood Clot Alliance
Stop The Clot®

JOHNS HOPKINS MEDICINE
THE JOHNS HOPKINS HOSPITAL

NATF
north american thrombosis forum

Patient and Family Advisory Council

Improving Patient-Nurse Communication to Prevent a Life-Threatening Complication

Hospitalized patients are at increased risk for potentially fatal blood clots in their legs and lungs; a Baltimore team is exploring how to ensure wider use of preventive measures.

Baltimore, MD—Susan Kulik, DNP, MBA, RN was at her job as a surgical nurse at Johns Hopkins University Hospital in Baltimore when she slipped on a patch of wet floor and fractured her hip. The hospital admitted her right away for surgery to insert pins to stabilize her fractured bones.

The morning after the surgery, Kulik woke around 7 a.m., unable to breathe. “I got very dizzy and scared,” Kulik says. “I thought I was going to die. It was an awful feeling.”

A blood clot had formed in a vein deep in Kulik’s leg, then broken off and traveled to her lung, where it blocked blood flow. This condition, venous thromboembolism (VTE), includes the formation of blood clots in deep veins and pulmonary embolism, in which a clot ends up in the lungs.

“I got very dizzy and scared ... I thought I was going to die. It was an awful feeling.”

Susan Kulik

AT A GLANCE

Principal investigator:
Elliott R. Haut, MD, PhD
Johns Hopkins University

Goal: To increase patient understanding and improve
Does Nurse Education Improve VTE Prophylaxis administration?
Kirkpatrick’s Learning Evaluation Theory

The first two levels of Kirkpatrick’s Four Levels of Evaluations

- Results → VTE events
- Behavior → Missed doses
- Learning → Module completion
- Reaction → They like it
Methods

- Partnered with Central Nursing Education to build an educational program
- Learner-centric interactive scenario-based dynamic education
Venous Thromboembolism Prevention: The Nurse's Perspective

Test Your Knowledge

Which syringe could be used for subcutaneous heparin administration?

A 3ml syringe or a 1 ml tuberculin syringe can be used. Administer with a 25 to 31 gauge needle. Needle length can be 1/2-5/8 inch. Most common is 26 gauge 5/8 inch.
Venous Thromboembolism Prevention: The Nurse's Perspective

Select the correct response

Hold the heparin injection and document "condition not appropriate" on the electronic medication administration record (eMAR) since she is ambulating well.

Mark it as refused on the eMAR but tell Mrs. Smith that if she ambulates less than 4 times a day you will need to restart it.

Educate Mrs. Smith on the risk of VTE which includes hospitalization, age, dehydration, and history of malignancy which increases her chance of clots significantly.
Future Directions

- Does it work?
- Is the effect sustained?
  - Need for “injection of education”?
  - What should that “injection” look like?
- Roll out to more nurses?
  - Our whole hospital and/or health system?
  - Other hospitals?
  - Illinois Surgical Quality Improvement Collaborative (ISQIC)
What VTE Education Do Patients Really Want? Results from a Delphi Survey
Modified Delphi Method

- Iterative process involving surveys, feedback and revisions
- Engaged patients and family members
- Recruited via email and/or social media (websites, Facebook, Twitter) through respective organizations
- > 400 respondents
What Do Patients Want?

How Do Patients Want To Learn About VTE?

- Doctor: 491
- Video: 255
- Paper: 232
- Nurse: 209
- Pharmacist: 69

What Do Patients Want to Learn about VTE

- Symptoms: 668
- Prevention VTE Education Topics: 498
- Risk Factors: 486
- Complications: 468

How Much Are Participants Willing to Read?

- 1-page: 93.9%
- 2-page: 92.9%
- 3-page: 73.6%
- 5-page: 56.1%
- Scientific Journal: 50.9%
- Reference List: 40.1%
- Guideline: 72.2%

Preferred Length Of Video?

- 5 minutes: 44
- 10 minutes: 65
- 15 minutes: 31
- 20 minutes: 55
What Do Patients Want?
Patient VTE Education Bundle
### What Do Patients Want?

#### Paper Form (2-pages)

- **The Johns Hopkins Hospital Patient Information**
- **Original Date:** 05/31/2014
- **Department:** VTE Collaborative/Surgery

#### How Do I Prevent Blood Clots?

**Venous Thromboembolism (VTE)**
**Deep Vein Thrombosis (DVT)**
**Pulmonary Embolus (PE)**

#### What is a blood clot or Venous Thromboembolism (VTE)?

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<tr>
<th>Blood clots are called Venous Thromboembolism (VTE). There are 2 main types:</th>
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<tbody>
<tr>
<td>• Deep Vein Thrombosis (DVT) is a clot in a deep vein, usually an arm or leg</td>
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<tr>
<td>• Pulmonary Embolism (PE) is a clot that has broken off and traveled to the lungs. This can cause death.</td>
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- [www.hopkinsmedicine.org/armstrong/bloodclots](http://www.hopkinsmedicine.org/armstrong/bloodclots)
  - They spoke, we listened
Make it Easy to Find
www.hopkinsmedicine.org/armstrong/bloodclots

The Johns Hopkins Hospital
Patient Education
Safety

Subject
How do I Prevent Blood Clots (VTE, DVT, PE)?

Policy Number: SAFE007
Effective Date: 06/17/2014
Approval Date: N/A
Page: 1 of 1
Supercedes: 06/17/2014

Keywords: DVT, PE, VTE, pulmonary embolism, deep vein thrombosis, venous thromboembolism

- Top of the list when searching
  - “VTE”
  - “DVT”
  - “PE”
  - “Blood Clots”
How do I Prevent Blood Clots (VTE, DVT, PE)?

Keywords: DVT, PE, VTE, pulmonary embolism, deep vein thrombosis, venous thromboembolism

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What Do Patients Want?

Video

• Patients wanted
  - 10 minute video
  - Physicians, nurses and patients talking

• Screened for JHH PFAC
  - Changes based on group feedback

They spoke, we listened  

Video
What Do Patients Want? Patient Education Intervention Project

- Real time alert of dose non-administration from POE system via pager/email
- Patient education bundle
  - Targeted education
  - Direct one-on-one discussion with nurse
  - Supported by paper handout and/or video
- Prospective Cohort Study
  - April 2015 thru December 2015 (8 months)
Blood Clot Prevention Is Higher Priority at Hospitals

Many patients don’t receive anticlotting drugs; nurses don’t always give them

“Everyone assumed that once we got doctors to order the right medications, the rest would magically fall into place,” says Dr. Haut. “It turns out that was very naive thinking. The nurse administration and patient acceptance phases are just as critical.”

Dr. Haut is now leading a new project funded by the nonprofit Patient-Centered Outcomes Research Institute that includes training sessions for nurses about improving communication with patients and a special admission package for patients about taking an active role in clot prevention. Hopkins turned to some patients who have suffered blood clots to review the materials, talk to nurses, and tell their own stories in a video to convey the dangers of clots.

http://on.wsj.com/1M18Aqu
Acknowledgements
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- Elliott R. Haut MD PhD  
  ehaut1@jhmi.edu  
  @elliotthaut
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- Peggy Kraus PharmD CACP  
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- Brandyn Lau MPH CPH  
  blau2@jhmi.edu  
  @LauzeeTweet
- Dauryne Shaffer MSN RN CCRN  
  dshaffe1@jhmi.edu
- Michael Streiff, MD  
  mstreif@jhmi.edu
Other Resources

• Johns Hopkins VTE Website (with paper forms)
  – http://www.Hopkinsmedicine.org/Armstrong/bloodclots

• Patient Education Video

• PCORI Research in Action

• Wall Street Journal article
  – http://on.wsj.com/1M18Aqu