

Optimization of Risk Assessment and Prescription of Optimal Venous Thromboembolism Prophylaxis

Elliott R. Haut, MD, PhD, FACS

Vice Chair of Quality, Safety, & Service

Associate Professor of Surgery, Anesthesiology &
Critical Care Medicine, Emergency Medicine, Health Policy &
Management

@elliotthaut



JOHNS HOPKINS
MEDICINE

Disclosures

- Some of this work has been funded by
 - Patient Centered Outcomes Research Institute (PCORI)
 - Agency for Healthcare Research and Quality (AHRQ)
 - National Heart Lung & Blood Institute (NIH/NHLBI)



Disclosures

- Member of the Board of Directors of the National Blood Clot Alliance (NBCA)
 - Unpaid, Volunteer



National Blood Clot Alliance
Stop The Clot®

Venous Thromboembolism (VTE)



JOHNS HOPKINS
MEDICINE

@elliotthaut

Why focus on VTE?

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

<http://www.surgeongeneral.gov/topics/deepvein/calltoaction/call-to-action-on-dvt-2008.pdf>

The Surgeon General's Call to Action
to Prevent Deep Vein Thrombosis
and Pulmonary Embolism

2008



Why focus on VTE?

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

<http://www.surgeongeneral.gov/topics/deepvein/calltoaction/call-to-action-on-dvt-2008.pdf>

The Surgeon General's Call to Action
to Prevent Deep Vein Thrombosis
and Pulmonary Embolism

2008





Johns Hopkins DVT Symposium 2009

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
- \$7-10 billion total yearly cost the US

Spyropoulos 2002, Lefebvre 2012,
Ashrani 2009, Heit 2001, Grosse 2016

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

quency of these events in routine clinical care because clinical trial participants are typically healthier than general orthopedic patient populations. The Table outlines the detailed exclu-

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)
- American Society of Hematology (ASH)
- 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 comorbidities 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*



**DEEP-VEIN THROMBOSIS:
ADVANCING AWARENESS
TO PROTECT PATIENT LIVES**

White Paper

Public Health Leadership Conference on Deep-Vein Thrombosis
Washington, D.C. • February 26, 2003

American Public Health Association

**DVT: Advancing
Awareness to Protect
Patient Lives**

**American Public
Health Association
(APHA)
White Paper 2003**

Agency for Healthcare Research and Quality (AHRQ)

Deep vein thrombosis (DVT)-related pulmonary embolism (PE) is the most common cause of preventable hospital death¹

DVT prophylaxis of at-risk patients is the #1 strategy to improve patient safety in hospitals¹

Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices



Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

Evidence-Based
Practice

Patient Safety

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

<http://www.ahrq.gov/research/findings/evidence-based-reports/services/quality/ptsafetysum.pdf>

Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices



Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

Evidence-Based
Practice

Patient Safety

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”

<http://www.ahrq.gov/research/findings/evidence-based-reports/patientsftyupdate/ptsafetyIIchap28.pdf>

Can a Systems Approach Improve VTE Prevention and Outcomes



JOHNS HOPKINS
M E D I C I N E

@elliotthaut

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.”

Toohar, A Systematic Review of Strategies to Improve Prophylaxis for Venous Thromboembolism in Hospitals. Ann Surg 2005.

Improving VTE Prophylaxis at The Johns Hopkins Hospital

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

BMJ 2012;344:e3935

BMJ

Michael B Streiff *associate professor of medicine*^{1,2}, Howard T Carolan *quality and innovations project administrator*³, Deborah B Hobson *patient safety clinical specialist, surgical intensive care nurse and coordinator*^{3,4}, Peggy S Kraus *clinical specialist for anticoagulation*⁵, Christine G Holzmüller *senior research coordinator II, medical writer and editor*^{3,6}, Renee Demski *senior director, quality and safety*³, Brandyn D Lau *medical informatician*⁷, Paula Biscup-Horn *clinical pharmacy specialist, anticoagulation management*⁸, Peter J Pronovost *professor, director, senior vice president for patient safety and quality*^{6,9,10}, Elliott R Haut *associate professor of surgery*^{3,4,6,9,11}

Streiff, BMJ 2012

Improving VTE Prophylaxis at The Johns Hopkins Hospital

Paper Order Sets

Streiff, BMJ 2012

Prevention of Venous Thromboembolism (VTE)
Adult Order Form – **GENERAL SURGERY, SURGICAL ONCOLOGY, UROLOGIC, OR VASCULAR SURGERY**

PILOT WORKSHEET

Patient Identification

Allergies:	Weight: _____ Kg	Serum Creatinine⁴: _____
-------------------	-------------------------	--

INDICATE RISK FACTORS (Check all that apply)

Serious Risk Factors	Other Risk Factors
<input type="checkbox"/> Current, active cancer ² <input type="checkbox"/> Previous DVT and/or PE ² <input type="checkbox"/> Stroke within the past 3 months (non-hemorrhagic) <input type="checkbox"/> Trauma (major or lower extremity) <input type="checkbox"/> Heart or respiratory failure undergoing acute treatment <input type="checkbox"/> Pregnancy and post-partum (< 1 month) <input type="checkbox"/> Inherited or acquired thrombophilia	<input type="checkbox"/> Immobility (bedrest/sitting ≥ 3 days) or paralysis <input type="checkbox"/> Central venous catheterizations <input type="checkbox"/> Acute medical illness or sepsis <input type="checkbox"/> Myeloproliferative disorder <input type="checkbox"/> Inflammatory bowel disease <input type="checkbox"/> Nephrotic syndrome <input type="checkbox"/> Obesity (BMI > 30 kg/M ²) ³ <input type="checkbox"/> Smoking (active, not history) <input type="checkbox"/> Estrogen use (OC or HRT) <input type="checkbox"/> Selective estrogen receptor modulators (SERMs) <input type="checkbox"/> Varicose veins

RISK CATEGORIES

Low Risk <input type="checkbox"/> Minor surgery (< 30 min), Age <40 years, with NO additional risk factors OR <input type="checkbox"/> Vascular surgery with NO additional risk factors OR <input type="checkbox"/> Laparoscopic procedures with NO additional risk factors OR <input type="checkbox"/> Low risk urologic procedures (TURP, etc.)	Moderate Risk¹ <input type="checkbox"/> Minor surgery (<30 min), age <40 years, WITH any additional risk factors (one or more) OR <input type="checkbox"/> Minor surgery (<30 min), age 40-60 years, with NO additional risk factors OR <input type="checkbox"/> Major surgery (>30 min), age < 40 years with NO additional risk factors OR <input type="checkbox"/> Laparoscopic surgery WITH any additional risk factors (one or more)	High Risk¹ <input type="checkbox"/> Any surgery age > 60 years WITHOUT any additional risk factors OR <input type="checkbox"/> Minor surgery (<30 min), age 40-60 years WITH any additional risk factors (one or more) OR <input type="checkbox"/> Major surgery (>30 min), age < 40 years WITH any additional risk factors (one or more); OR age 40-60 years WITH or WITHOUT any additional risk factors (one or more) OR <input type="checkbox"/> Major vascular surgery (>30 min) WITH any additional risk factors (one or more)	Very High Risk^{1,2} <input type="checkbox"/> Major surgery (>30 min) at any age WITH any SERIOUS RISK FACTORS OR <input type="checkbox"/> Major surgery (>30 min), age >60 years WITH any additional risk factors (one or more)
--	--	--	--

ORDER

Low Risk <input type="checkbox"/> No pharmacologic prophylaxis is indicated; Early and persistent mobilization recommended; Please specify ambulation plan	Moderate Risk <input type="checkbox"/> Heparin 5,000 Units SC Q12 hours ³ <i>With the option to add</i> <input type="checkbox"/> TED ⁶ <input type="checkbox"/> SCD ⁶	High Risk <input type="checkbox"/> Heparin 5,000 Units SC Q8 hours ³ <i>With the option to add</i> <input type="checkbox"/> TED ⁶ <input type="checkbox"/> SCD ⁶	Very High Risk <input type="checkbox"/> Heparin 5,000 Units SC Q8 hours ³ OR <input type="checkbox"/> Enoxaparin 40 mg SC QDay ^{3,4,5} (Trade-off: fewer PE with more bleeds) AND <input type="checkbox"/> TED ⁶ and <input type="checkbox"/> SCD ⁶
--	---	--	---

CONTRAINDICATIONS¹

<input type="checkbox"/> Active, uncontrolled bleeding or high risk of bleeding <input type="checkbox"/> Systemic anticoagulation <input type="checkbox"/> Active aneurysm (cerebral or aortic dissecting) <input type="checkbox"/> Bacterial endocarditis or pericarditis <input type="checkbox"/> Active peptic ulcer disease, ulcerative GI lesions <input type="checkbox"/> Malignant hypertension <input type="checkbox"/> Severe head trauma <input type="checkbox"/> INR or aPTT ratio > 1.5 (unless antiphospholipid antibodies)	<input type="checkbox"/> Threatened abortion <input type="checkbox"/> Severe thrombocytopenia (platelet count < 30,000) <input type="checkbox"/> Recent TURP <input type="checkbox"/> Eye, brain, or spinal cord injury within the past 48 hrs. <input type="checkbox"/> For Heparin or Enoxaparin: history of HIT <input type="checkbox"/> For Enoxaparin: Epidural catheter removal or spinal tap < 2 hours prior to dose; weight < 45kg; hemodialysis ³ <input type="checkbox"/> For SCD: open wounds or extremity with known DVT
---	---

ORDERS¹

If contraindication present:
(Check one or more)
☐ Discontinue orders above
☐ Early and persistent mobilization
 Please specify ambulation plan
☐ TED/SCD⁶

- For patients with contraindications to pharmacologic prophylaxis, use mechanical prophylaxis with properly fitted TED and/or SCD until the bleeding risk decreases.
- 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.
- Manipulation of epidural catheter** should be undertaken at the nadir (trough) of anticoagulant effect. With enoxaparin remove the catheter at least 10-12 hours after the dose and wait 2 hours to redose. If catheter is to remain in place, heparin use is **strongly** recommended, with redose > 1 hour after removal. If blood is present with catheter manipulation or multiple punctures employed, wait 24 hours to re-start any pharmacologic thromboprophylaxis.
- Patients with CrCL (<30 ml/min)**, heparin is **strongly** recommended over enoxaparin. If enoxaparin is used, the manufacturer recommends 30mg SC QDay.
- For morbidly obese patients (BMI > 40 kg/M²) following bariatric surgery, enoxaparin 40mg SC Q12 hours was more effective than 30mg SC Q12 hours in an open trial.
- TED and SCD are most effective when properly applied to the patient and are operating for > 23 hours per day.

Date	Time	MD Signature	MD Name (printed)	MD I.D. Number
Order Noted	Date	Time	Signature	Name (printed)

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

Order Set: **Surgery General Post Op Orders**

Order Items

<input type="checkbox"/>	NHO	T	Routine
IV Therapy			
<input checked="" type="checkbox"/>	Peripheral IV Catheter, Insert 2nd VAT -	Order Update: Ordered	Routine
	Nurse will activate order to support medication/fluid administration <Avail. Activations=1>		
<input checked="" type="checkbox"/>	Peripheral IV Maintain Orderset		
IV Therapy			
<input checked="" type="checkbox"/>	.Peripheral IV Catheter, Maintain NUR - VAD Protocol MUST be implemented and followed! <Continuous>	T	Routine
Pharmacy			
<input checked="" type="checkbox"/>	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
<input type="checkbox"/>	Central Line, Maintain Orderset		
IV Therapy			
<input checked="" type="checkbox"/>	.Central Line, Maintain NUR - VAD Protocol MUST be implemented and followed! <Continuous>	T	Routine
Pharmacy			
<input type="checkbox"/>	Informational Message - Please select Heparin if patient is not allergic.		
<input checked="" type="checkbox"/>	Normal Saline Flush Inj - 10 ml IV q5min; PRN for VAD Protocol. Flush each lumen after each use or at least daily when not in continuous use. (Central Line)		Routine
<input type="checkbox"/>	Heparin Flush (10 units/mL) - 60 unit IV q5min PRN in each lumen of central line after medication administration or blood drawing AND AFTER NSS FLUSH. (for VAD Protocol) 60 units/6 mL syringe.		Routine
VTE Prophylaxis			
<input checked="" type="checkbox"/>	VTE Prophylaxis: General Surgery		
Nutrition			
<input type="checkbox"/>	NPO Diet - Starting: Now	T	Now
	Prior diet will not resume automatically. Enter new diet after NPO expires.		
<input type="checkbox"/>	Advance as Tolerated Diet - Adult		
<input checked="" type="checkbox"/>	NPO Diet - Starting: Next Meal	T	Next Meal
	Advance as tolerated <Avail. Activations=Unlimited>		
	Prior diet will not resume automatically. Enter new diet after NPO expires.		
<input checked="" type="checkbox"/>	Clear Liquid Diet	T	Next Meal
	Advance as Tolerated <Avail. Activations=Unlimited>		
<input checked="" type="checkbox"/>	Full Liquid Diet	T	Next Meal
	Advance as Tolerated <Avail. Activations=Unlimited>		
<input checked="" type="checkbox"/>	Soft Diet	T	Next Meal
	Advance as Tolerated <Avail. Activations=Unlimited>		
Please Choose a GOAL DIET			
<input checked="" type="checkbox"/>	Goal Diet Generic Set		

Parent order set

Different Order Sets have Different VTE Modules. Use is Mandatory in POE workflow.

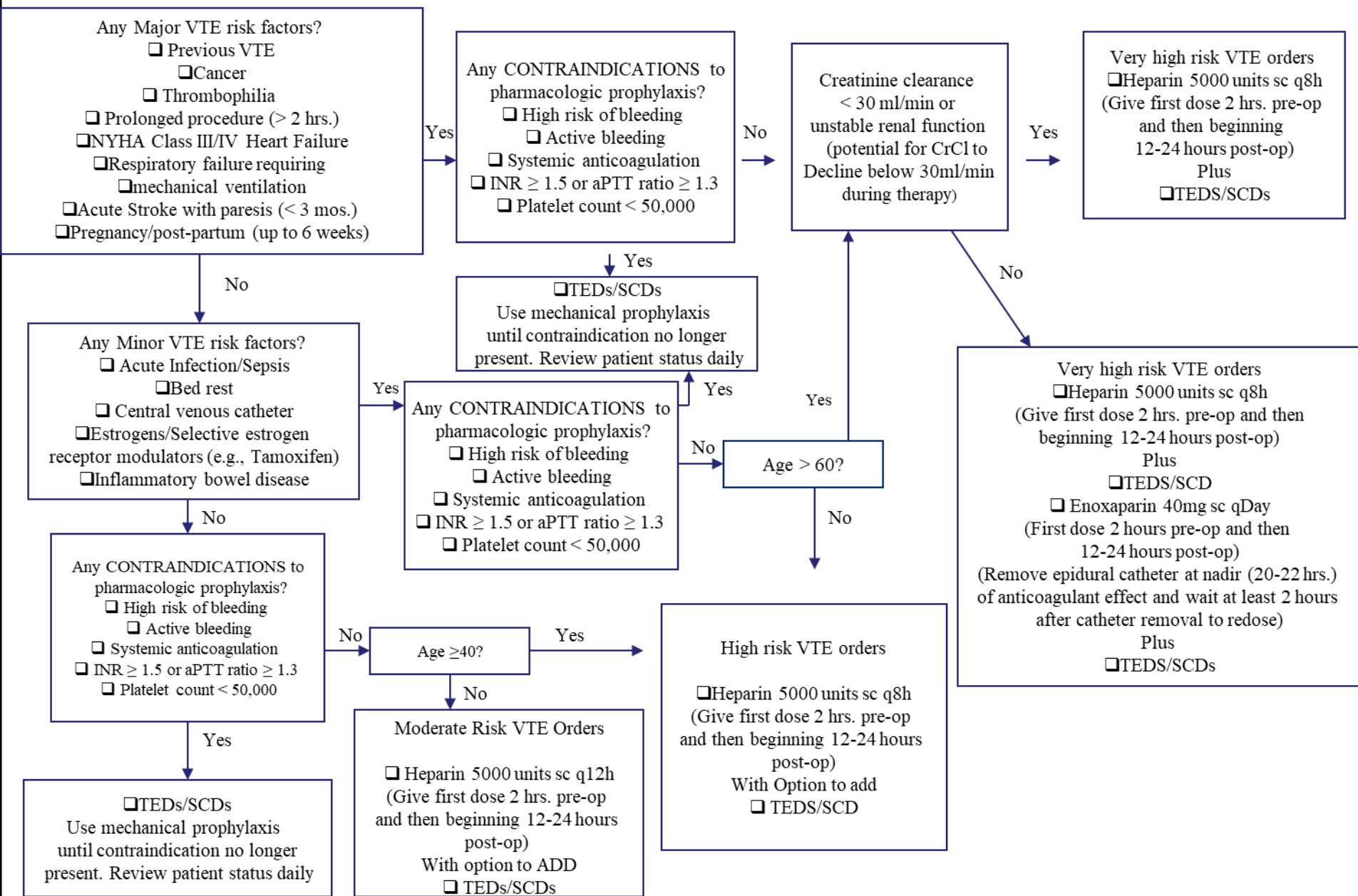
Relevant Info Select All Deselect All Edit... Change Date...

OK

Cancel

Help

General Surgery VTE Prophylaxis



- Previous VTE ☐
- Cancer - Metastatic or under treatment ☐
- Known hypercoagulable state ☐
- Procedure greater than 2 hours ☐
- Congestive heart failure ☐
- Mechanical ventilation ☐
- Stroke with paresis less than 3 months ☐
- Perioperative bedrest more than 3 days ☐
- No major risk factors known ☐

**Mandatory choice
from each section for
risk factors and
contraindications**

- Acute infection or sepsis ☐
- Central venous catheter ☐
- Current estrogen use ☐
- Tamoxifen or Raloxifene use ☐
- Active inflammatory bowel disease ☐
- No minor risk factors known ☐

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

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

Recommended Prophylaxis:


Orders and Order Sets with Warnings or Errors

Order Set: VTE Prophylaxis: General Surgery

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: General Surgery -

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

Select All Deselect All Edit OK Help

Prophylaxis Orders

	Order	Dose	UOM	Route	Frequency	Start Date	Start Time Priority	Pharmacy Instructions	Side of Body
<input checked="" type="checkbox"/>	Enoxaparin Inj	40	mg	SubQ	q24h		Time Critical	First dose 2 hours Pre-Op and...	
<input type="checkbox"/>	Heparin Inj	5000	unit	SubQ	q8h		Time Critical	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		

OK

Cancel

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. Holzmüller, BLA; David T. Efron, MD; Peter J. Pronovost, MD, PhD; Michael B. Streiff, MD

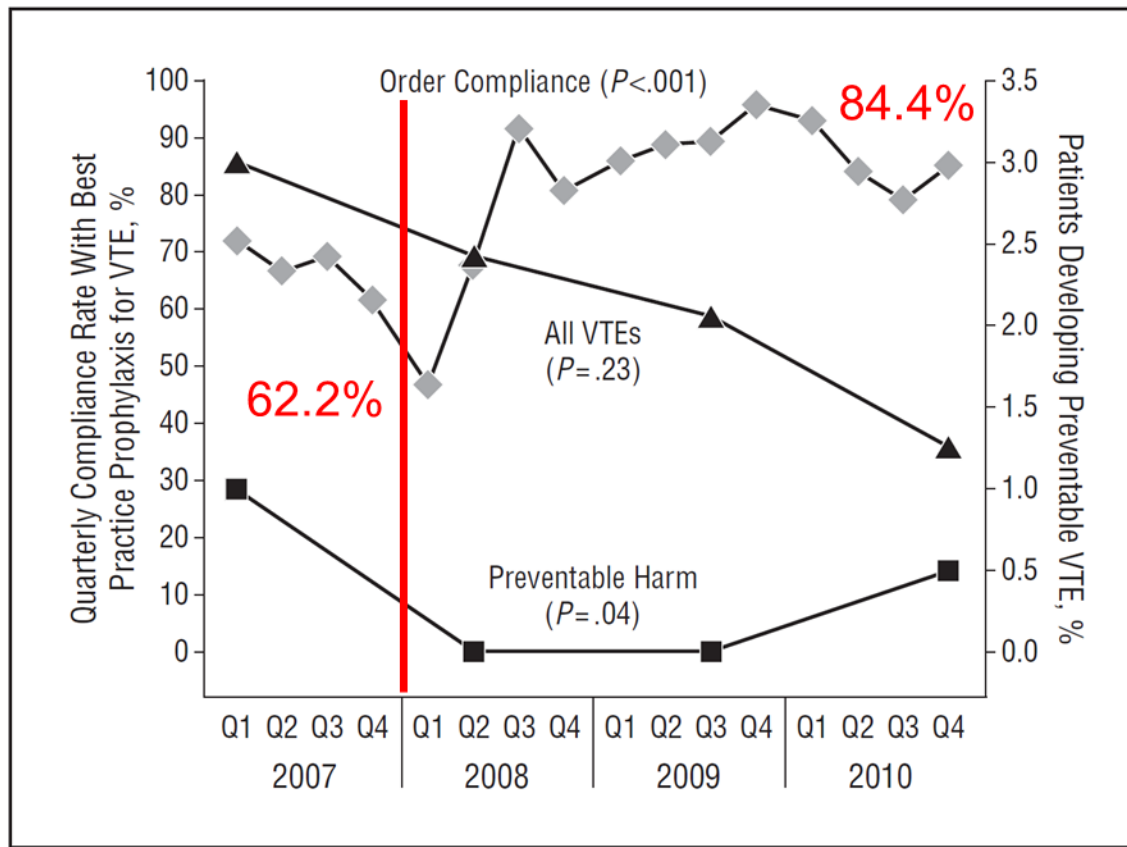
Arch Surg. 2012;147(10):901-907

Haut, Arch Surg 2012

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

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% ($p=0.04$)

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 IV. Clinical Outcomes

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

Zeidan, Am J Hematology 2013

ZERO Preventable VTE – A Realistic Goal



TABLE IV. Clinical Outcomes

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

Zeidan, Am J Hematology 2013

VTE Prophylaxis- Computerized Decision Support



Search



DVTeamCare™ Hospital Award

Tell Us How You Fight



**DVTEAM™ CARE
HOSPITAL AWARD
WINNER**

**The Johns Hopkins
Hospital**

DVTeamCare™ Hospital Award

Award Nomination Deadline October 15, 2010

Latest News and Updates

*Consensus Statement:
Call To Action On*

www.natfonline.org

The North American Thrombosis Forum is proud to have been selected by Eisai, Inc. to help develop the DVTeamCare(TM) Hospital Award. The DVTeamCare™ Hospital Award is a new award providing national recognition to hospitals that have made significant commitment to preventing DVT and its potentially fatal complications. NATF has been engaged to identify judges for the award, who also developed appropriate criteria.* The applications from the 22 hospitals nominated for the 2009 DVTeamCare™ Hospital Award are currently being reviewed by a three-judge panel was selected by NATF. Winners will be announced shortly

Preventing Hospital-Acquired Venous Thromboembolism

A Guide for Effective Quality Improvement



Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

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.⁵ 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.⁶

CDC Healthcare-Associated VTE Prevention Challenge Champions

2015 CDC HA-VTE PREVENTION CHALLENGE CHAMPION



ORGANIZATION:

The Johns Hopkins Hospital | Baltimore, Maryland

PATIENT POPULATION:

- 50,000 inpatient admissions in 2014
- 951 staffed beds



The Johns Hopkins Venous Thromboembolism Collaborative: Multidisciplinary Team Approach to Achieve Perfect Prophylaxis

Michael B. Streiff, MD, FACP^{1,2,3*}, Brandyn D. Lau, MPH, CPH^{3,4,5,6}, Deborah B. Hobson, BSN^{3,4,7},
Peggy S. Kraus, PharmD, CACP⁸, Kenneth M. Shermock, PharmD, PhD^{1,8,9}, Dauryne L. Shaffer, MSN, CCRN^{4,7},
Victor O. Popoola, MBBS, MPH, ScM⁴, Jonathan K. Aboagye, MBChB, MPH⁴, Norma A. Farrow, MD⁴,
Paula J. Horn, PharmD, BCACP¹⁰, Hasan M. Shihab, MBChB, MPH⁴, Peter J. Pronovost, MD, PhD, FCCM^{3,6,11,12},
Elliott R. Haut, MD, PhD, FACS^{3,4,6,11,13}

Improving VTE Prophylaxis Administration with Targeted Performance Feedback



JOHNS HOPKINS
M E D I C I N E

@elliotthaut

The Role of Health Informatics

- Harness the power of analytics
- Bringing performance data to individual providers and units
- Can competition drive improvements?

en

nts

VTE Prophylaxis Prescription Compliance Rate, %

Attending physicians ($P = .87$)

Residents ($P = .001$)

42 residents at 100%

Resident Number	Compliance Rate (%)	Provider Type
1	0	Resident
2	0	Resident
3	0	Resident
4	0	Resident
5	0	Resident
6	0	Resident
7	20	Resident
8	40	Resident
9	40	Resident
10	40	Resident
11	43	Resident
12	50	Resident
13	50	Resident
14	50	Resident
15	50	Resident
16	55	Resident
17	55	Resident
18	57	Resident
19	61	Resident
20	62	Resident
21	64	Attending physician
22	66	Resident
23	66	Resident
24	68	Resident
25	71	Resident
26	72	Attending physician
27	72	Attending physician
28	73	Attending physician
29	75	Resident
30	75	Attending physician
31	76	Resident
32	78	Attending physician
33	78	Attending physician
34	80	Resident
35	80	Resident
36	80	Resident
37	80	Resident
38	87	Resident
39	90	Resident
40	92	Resident
41	93	Resident
42	100	Resident
43	100	Resident
44	100	Resident
45	100	Resident
46	100	Resident
47	100	Resident
48	100	Resident
49	100	Resident
50	100	Resident
51	100	Resident
52	100	Resident
53	100	Resident
54	100	Resident
55	100	Resident
56	100	Resident
57	100	Resident
58	100	Resident
59	100	Resident
60	100	Resident
61	100	Resident
62	100	Resident
63	100	Resident
64	100	Resident
65	100	Resident
66	100	Resident
67	100	Resident
68	100	Resident
69	100	Resident
70	100	Resident
71	100	Resident
72	100	Resident
73	100	Resident
74	100	Resident
75	100	Resident
76	100	Resident
77	100	Resident
78	100	Resident
79	100	Resident
80	100	Resident
81	100	Resident

42 residents at 100%



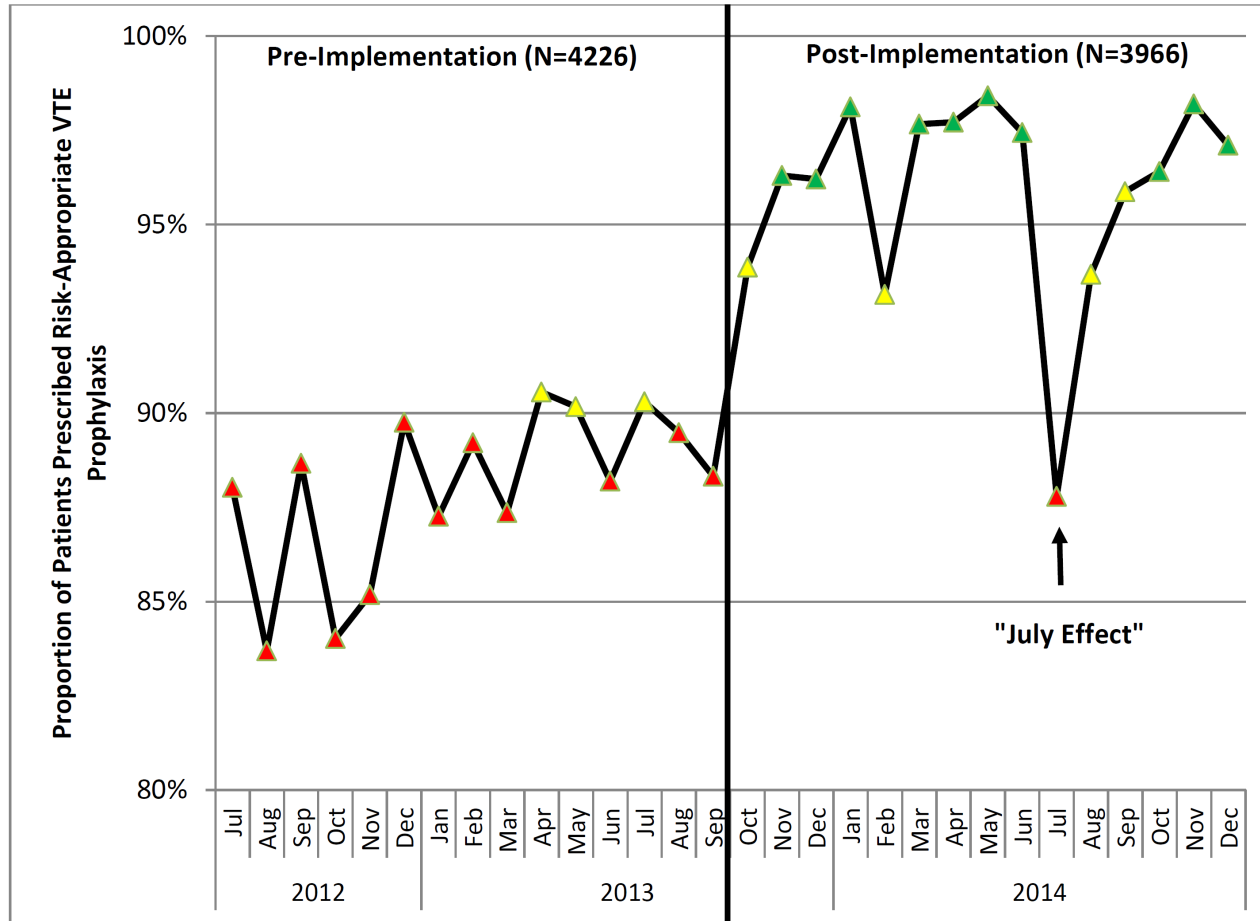
JOHNS HOPKINS
MEDICINE

RANK	UID	CURRENT MONTH		
		September 2013		
		Compliant Orders	Number of Orders	Compliance
1	A033	11	11	100%
1	A111	12	12	100%
1	A092	2	2	100%
1	A112			n/a
1	A072	14	14	100%
1	A131	7	7	100%
1	A053	2	2	100%
1	A034	4	4	100%
1	A024	8	8	100%
1	A161	2	2	100%
1	A045			n/a
1	A025	5	5	100%
1	A035			n/a
1	A043	7	7	100%
1	A055	2	2	100%
1	A004	1	1	100%
1	A122			n/a
1	A121	1	1	100%
1	A014			n/a
1	A082			n/a
1	A062			n/a
22	A012	4	4	100%
23	A015	9	9	100%
23	A071	8	8	100%
25	A052	10	11	90.9%
26	A091	11	12	91.7%
26	A102	8	9	88.9%
28	A032	4	4	100%
29	A141	13	15	86.7%
30	A005	9	9	100%
31	A023	14	15	93.3%
32	A051	2	2	100%
32	A081	6	7	85.7%
34	A042	7	8	87.5%
35	A022	6	7	85.7%
36	A061		1	0.0%
87.7% Sept			1	100%
			14	85.7%
			4	100%
			6	83.3%
			12	50.0%
			2	50.0%
		9	66.7%	
		12	41.7%	
45	A003	5	5	100%
46	A013	1	4	25.0%
OVERALL		235	268	87.7%

RANK	UID	CURRENT MONTH		
		October 2013		
		Compliant Orders	Number of Orders	Compliance
1	A033	4	4	100%
1	A111	7	7	100%
1	A072	8	8	100%
1	A131	8	8	100%
1	A025	13	13	100%
1	A043	13	13	100%
1	A092	3	3	100%
1	A161	10	10	100%
1	A034	8	8	100%
1	A112	2	2	100%
1	A053	1	1	100%
1	A055	5	5	100%
1	A122	8	8	100%
1	A024			
1	A035	3	3	100%
1	A004	2	2	100%
1	A082			
1	A062			
19	A012	7	7	100%
20	A102	7	7	100%
93.3% October			6	100%
			9	100%
			12	100%
			6	100%
			9	100%
			3	100%
			13	100%
		1	100%	
29	A045	4	5	80.0%
30	A023	6	6	100%
31	A061	10	10	100%
32	A121	7	8	87.5%
33	A051	6	7	85.7%
34	A001	11	12	91.7%
35	A022			
35	A042	5	6	83.3%
37	A002	2	2	100%
38	A031	2	2	100%
39	A065	6	8	75.0%
39	A151	2	2	100%
41	A044	1	1	100%
42	A041			
42	A014	2	3	66.7%
44	A011	6	7	85.7%
45	A021	6	6	100%
46	A101	2	7	28.6%
47	A003	14	17	82.4%
48	A013			
Overall		260	277	93.9%

RANK	UID	CURRENT MONTH		
		November 2013		
		Compliant Orders	Number of Orders	Compliance
1	A033	4	4	100%
1	A111	5	5	100%
1	A072	18	18	100%
1	A025	9	9	100%
1	A161	7	7	100%
1	A092	3	3	100%
1	A131	3	3	100%
1	A034	3	3	100%
1	A062	3	3	100%
18	A102	14	14	100%
19	A043	3	4	75.0%
20	A012			n/a
21	A091	9	9	100%
22	A081	9	9	100%
23	A141	1	1	100%
23	A052	2	2	100%
23	A032			n/a
23	A053	3	4	75.0%
27	A015	4	4	100%
28	A005			n/a
29	A045	1	1	100%
30	A023	8	8	100%
31	A121	4	4	100%
32	A061	17	18	94.4%
33	A042	12	12	100%
34	A071	10	12	83.3%
35	A065	11	11	100%
36	A001	1	1	100%
37	A051			n/a
38	A022			n/a
39	A002	1	1	100%
39	A014	2	2	100%
41	A041	11	11	100%
42	A031			n/a
43	A151	13	16	81.3%
44	A044			n/a
45	A101	9	9	100%
46	A003	7	7	100%
47	A021	2	2	100%
48	A011			n/a
49	A013	2	4	50.0%
Overall		260	270	96.3%

Surgery Resident Feedback Improves VTE Prophylaxis



Lau / Arnaoutakis, Ann Surg 2016

Quality Improvement can Lead to Fundable Research

- 5-year R01 grant
- AHRQ
- “Individualized Performance Feedback on Venous Thromboembolism Prevention Practice”



Agency for Healthcare Research and Quality

Grants On-Line Database

Grant Summary

Grant Number: R01 HS24547-01
Grant Title: Individualized Performance Feedback on Venous Thromboembolism Prevention Practice
PI Name: HAUT, ELLIOTT R.
RFA/PA: PA14-291 - AHRQ Health Services Research Projects (R01)

Abstract:
?
DESCRIPTION (provided by applicant): Venous thromboembolism (VTE) has been called the number one cause of preventable death in the United States. We have reported that appropriate VTE prophylaxis is under-prescribed for hospitalized patients. Efforts to improve practice are suboptimal and varies significantly between individual prescribers. At most hospitals across the country, VTE prevention is not monitored with little direct oversight or input from attending physicians. We began a pilot study in 2013 where we implemented a performance feedback tool with individualized feedback, we are able to improve practice and provide appropriate care for nearly 100% of patients. We are including interns, residents, clinical fellows, NPs, PAs, and attending physicians, about their own VTE prevention practice. We will evaluate the performance feedback tool and identify specific barriers to prescribing optimal, risk-appropriate VTE prophylaxis across a health system, which contains two academic medical centers and three community practices and positively impact outcomes. Successful completion of the proposed research will have a national impact on a model that may be adapted to target hundreds of other process-linked quality measures that are driven by patient safety.

Fiscal Year: 2016
Award: \$249,685
Department: JOHNS HOPKINS UNIVERSITY
Grant State/District: MD-7
Project Start:
Project End: 02/28/21
Related Publications:

Defect Free Care



JOHNS HOPKINS
MEDICINE

@elliotthaut

Measuring Defect Free VTE Prevention

- Defect-free VTE prevention process measure requires
 - (1) documentation of a standardized VTE risk assessment
 - (2) prescription of optimal, risk-appropriate VTE prophylaxis
 - (3) administration of all risk-appropriate VTE prophylaxis as prescribed

Measuring Defect Free VTE Prevention

- An ideal VTE outcome measure should define potentially preventable VTE as VTE that developed in patients who experienced **any** VTE prevention process failures.

Circulation

Volume 137, Issue 12, 20 March 2018; Pages 1278-1284
<https://doi.org/10.1161/CIRCULATIONAHA.116.026897>



STATE OF THE ART

Venous Thromboembolism Quality Measures Fail to Accurately Measure Quality

Lau, Circulation 2018

Brandyn D. Lau, MPH, CPH, Michael B. Streiff, MD, Peter J. Pronovost, MD, PhD, and Elliott R. Haut, MD, PhD

Changing Practice is a Team Effort



JOHNS HOPKINS
M E D I C I N E

@elliotthaut



For More Info

@elliotthaut (Twitter) or ehaut1@jhmi.edu

- Armstrong Institute massive open online course (MOOC)
 - <https://www.coursera.org/learn/patient-safety-implementation>
- Hopkins VTE Website
 - <http://www.Hopkinsmedicine.org/Armstrong/bloodclots>
- Patient Education Video and Paper Handouts
 - <http://bit.ly/bloodclots>
- Nurse Education
 - https://www.hopkinsmedicine.org/armstrong_institute/training_services/eLearning/ or bit.ly/NurseEducationVTE