The Johns Hopkins VTE Collaborative

Annotated Bibliography

(Updated 02/26/2018)

Peer Reviewed Publications

   
   **Mini-abstract:** This study analyzed data from the Nationwide Inpatient Sample (NIS), which contains a nationally representative sample of patients admitted to nonfederal hospitals in the United States, with the goal of quantifying the proportion of patients who develop VTE during hospitalization for lung transplantation and identifying associated risk factors. The findings of this study emphasize the need to critically evaluate prophylaxis guidelines and practice habits in hospitals across the country.

   
   **Mini-abstract:** This study examined the prevalence of postoperative VTE among patients undergoing abdominal surgery who were and were not prescribed extended VTE prophylaxis. It establishes an important link between extended VTE prophylaxis and post-discharge VTE in surgical patients, which has been recognized by previous studies.

   
   **Mini-abstract:** This study compared VTE prophylaxis medication non-administration between a major quaternary academic university hospital and three community hospitals within a large health system. Our findings support the need to promote efforts to reduce the incidence of VTE by improving administration of prescribed doses of VTE prophylaxis.

Mini-abstract: The purpose of this retrospective study was to examine patient adherence, comparing subcutaneous VTE prophylaxis to oral cardiovascular and ID prophylaxis and therapeutic medications. We found that doses of subcutaneous VTE prophylaxis were not administered more frequently than oral infectious disease or cardiovascular prophylaxis or medications ordered for therapeutic indications. We also identified several risk factors for VTE prophylaxis non-administration.

5. Lau BD, Streiff M B, Kraus P S, Hobson DB, Shaffer DL, Aboagye JK, Pronovost PJ, Haut ER. Missed doses of venous thromboembolism (VTE) prophylaxis at community hospitals: Cause for alarm. J Gen Intern Med. 2017 Oct. Mini-abstract: This study compared VTE prophylaxis medication non-administration between a major quaternary academic university hospital and three community hospitals within a large health system. The results support the need to promote efforts to reduce the incidence of VTE by improving administration of prescribed doses of VTE prophylaxis. All hospitals should monitor VTE prophylaxis medication administration practice, and adopt successful and sustainable interventions to improve these practices. While VTE prophylaxis prescription has historically been the focus, the next frontier of VTE prevention should focus on interventions to improve administration of prescribed VTE prophylaxis in all hospital settings.

6. Lau BD, Shaffer DL, Hobson DB, Yenokyan G, Wang J, Sugar EA, Canner JK, Bongiovanni D, Kraus PS, Popoola VO, Shihab HM, Farrow NE, Aboagye JK, Haut ER. Effectiveness of two distinct web-based education tools for bedside nurses on medication administration practice for venous thromboembolism prevention: A randomized clinical trial. PloS One 2017 Aug; 12(8), e0181664. Mini-abstract: The purpose of this trial was to evaluate the effectiveness of nurse education on medication administration practice. Overall, non-administration improved significantly following education (12.4% vs. 11.1%, conditional OR: 0.87, 95% CI: 0.80–0.95, p = 0.002) achieving our primary objective. Inference drawn from this study lead to the conclusion that education for nurses significantly improves medication administration practice. Dynamic learner-centered education is more effective at engaging nurses. These findings suggest that education should be tailored to the learner.

7. Popoola VO, Tavakoli F, Lau BD, Lankiewicz M, Ross P, Kraus P, Shaffer D, Hobson DB, Aboagye JK, Farrow NA, Haut ER, Streiff MB. Exploring the impact of route of administration on medication acceptance in hospitalized patients: Implications for venous thromboembolism prevention. Sci Direct 2017 oc. Mini-abstract: The primary study goal was to determine if non-administration of parenteral VTE prophylaxis is more frequent than other prophylactic or treatment medications. Subcutaneous VTE prophylaxis doses were not administered nearly 4-fold more frequently than oral infectious disease and cardiovascular prophylaxis (RR = 3.93; 95% CI 3.36–4.59) and 3-fold more frequently than treatment medications (RR = 3.06; 95% CI 2.91–3.22). These findings suggest that subcutaneous VTE prophylaxis was not administered more frequently than oral infectious diseases or cardiac prophylaxis and treatment medications. These data also suggest that availability of an oral medication could improve the effectiveness of VTE prophylaxis in real world settings.


Mini-abstract: The purpose of this study was to understand how VTE risk changes with age to update current practice guidelines and determine the most appropriate way to treat age in models of VTE for trauma patients. We found that patients in our analysis experienced a constant, approximately linear increase in VTE risk until age 65. Our findings provides important information on the appropriate model specification for age in VTE models in adult trauma patients.


Mini-abstract: This study aimed to determine the prevalence of sGCS-associated pressure injuries in a large cohort of SICU patients. Our findings highlight the importance of regular examination of ICU patients for signs and symptoms of pressure injury with regular reassessment of lower extremity and sGCS size. The unintended negative consequences manifested as GCS-associated pressure injury underscore the need to reexamine our approach to mechanical prophylaxis against VTE, especially in critically ill patients in which the harms may outweigh the benefits.


Mini-abstract: This study aimed to characterize missed doses of VTE prophylaxis associated with epidural catheter placement and removal, and also to measure the effect of an enhanced recovery after surgery (ERAS) pathway on the rate of TEA-associated missed VTE prophylaxis. We found that Thoracic epidural analgesia was associated with a 1.5-fold increased risk of missed dose of preoperative VTE prophylaxis, which was not affected by implementation of an ERAS program.


Mini-abstract: This is an update of an earlier article. We highlight the efforts made to ensure that every hospitalized patient receives VTE prophylaxis consistent with their individual risk level and personal care preferences, and the goal of perfect prophylaxis for every patient with emphasis our evidence-based, and specialty-specific computerized clinical decision support VTE prophylaxis order sets that assist providers in ordering risk-appropriate VTE prevention.


Mini-abstract: This prospective cohort study was designed to evaluate the impact of performance feedback on the prescription of appropriate venous thromboembolism (VTE) prophylaxis among general surgery residents. The study compared outcomes among 49 general surgery residents and
2,420 surgical patients at baseline versus during two intervention periods (scorecard alone or scorecard plus coaching). The authors found that appropriate VTE prophylaxis prescription increased during the scorecard period from 89.4% to 95.4% ($p<0.001$) and more residents prescribed appropriate prophylaxis for every patient (78% vs 45%, $p=0.0017$) during the scorecard plus coaching period. There were no cases of preventable VTE during the intervention periods (0 vs 0.35%, $p=0.046$).


**Mini-abstract:** This study evaluated prescriber opinions on issues relating to non-administration of missed doses of VTE prophylaxis through a survey. Study findings indicate the need for additional resident physician education. Medicine residents were more likely to agree that VTE prophylaxis was not necessary for independently ambulating patients (32% vs 3%, $p<0.001$) and that it is appropriate for nurses to make clinical decisions to determine whether a dose of pharmacologic VTE prophylaxis should be administered to a patient (24 vs. 0 %, $P < 0.001$) compared with surgery residents.


**Mini-abstract:** This study focused on the indirect or “halo effect” of providing individual performance feedback to general surgery residents regarding prescription of appropriate VTE prophylaxis. After providing individualized feedback about general surgery patients, general surgery residents' prescribing practice for writing appropriate VTE prophylaxis orders for adult trauma patients significantly improved (93.9% versus 78.1%, $P < 0.001$). Although prescription improved also among other providers, (84.9 % versus 75.1, $p=0.025$) prescription among general surgery residents improved the most.


**Mini-abstract:** The purpose of this study was to review one full year of consecutive cases of hospital-associated VTE identified during fiscal year 2011 by a state-run pay-for-performance quality improvement program algorithm for DVT and PE. The research team hypothesized that a substantial number of VTE identified using this strategy would not meet the definition of preventable episodes of VTE. We found that found that more than one third of “potentially preventable” VTE classified by a state-run pay-for-performance program were either invalid or not preventable with current best-practice VTE prophylaxis.


**Mini-abstract:** The objective of this study was assess the validity of Meaningful Use VTE-6 measure by reviewing he VTE prophylaxis provided to hospitalized patients and to identify opportunities to improve the quality of VTE preventive care. After retrospectively reviewing charts on all patients
identified by VTE-6 during the first year of Meaningful Use stage 1, the authors found that majority of patients identified by the Meaningful Use VTE-6 algorithm did not suffer truly potentially preventable VTE.


Mini-abstract: The objective of this study was to develop a patient-centered approach to education of patients and their families on VTE: including importance, risk factors and benefit/harm of VTE prophylaxis in hospital settings. Using a national sample of patients the authors assessed participant preferences for VTE education topics and methods of delivery. Participant wanted to learn about VTE symptoms, risk factors, prevention and complications in a context of a doctor-patient encounter. The next most common preferences were for video and paper educational materials.


Mini-abstract: This is a retrospective study whose aim was to characterize the preventability of venous thromboembolism (VTE). Hospital-acquired VTE cases were identified by the Maryland Hospital Acquired Conditions pay-for-performance initiative at the Johns Hopkins Hospital. The authors measured the proportion of patients with VTE who received “defect-free care”, defined as receiving all doses of VTE prophylaxis recommended by a validated, mandatory clinical decision support tool before the diagnosis of VTE was made. Of 92 patients who had hospital-acquired VTE and met inclusion criteria, 79 (86%) were prescribed optimal prophylaxis while 43 (47%) received defect-free care. The authors conclude that half of all VTE events identified had received defect-free care and so were not truly preventable.


Mini-abstract: The objective of this retrospective review was to compare variability among residents and attending physicians regarding prescription of appropriate venous thromboembolism (VTE) prophylaxis. Specifically, they compared the proportion of risk-appropriate VTE prophylaxis orders placed by each of 75 residents to those attributed to each of 8 attending physicians. They found a statistically significant difference (p=0.001) in performance among the residents (median compliance rate, 100%; IQR, 73.2%-100%; range, 0%-100%) but no difference (p=0.87) among the attending physicians (median compliance rate, 74.2%; IQR, 72.66%-77.3%; range, 63.6%-78.9%). The authors conclude that attribution of process measures to attending physicians may be inappropriate and residents may be a more reliable target for quality improvement efforts.

**Mini-abstract:** This was a retrospective study to sequentially examine an individualized physician dashboard and pay-for-performance program to improve VTE prophylaxis rates among hospitalists. The intervention included a Web-based hospitalist dashboard providing feedback, followed by 6 months of feedback only, and a pay-for-performance program was incorporated, with graduated payouts for compliance rates of 80% to 100% VTE compliance practices. Direct feedback using dashboards was associated with significantly improved compliance, with further improvement after incorporating an individual physician pay-for-performance program.


**Mini-abstract:** This study evaluated patient preferences regarding pharmacologic VTE prophylaxis in single center mixed-method survey. Majority (60%) of patients preferred an oral medication, if equally effective as subcutaneous heparin. Their preferences were influenced by dislike of needles (30%) and pain from injection (27.7%). Patients preferring subcutaneous injections were less likely to refuse doses of prophylaxis than patients who preferred the oral route of administration (37.5% vs 51.3%, P < 0.0001)


**Mini-abstract:** This retrospective study was designed to examine the effect of implementation of a computerized clinical decision support (CCDS) tool on race-based and sex-based health care disparities across two distinct clinical services. When the proportion of patients prescribed risk-appropriate, best-practice VTE prophylaxis was evaluated pre-implementation, there were racial disparities in compliance between black and white patients. However, implementation of the CCDS tool improved compliance with best-practice VTE prophylaxis prescription and racial disparities were eliminated.


**Mini-abstract:** The purpose of this study was to define the incidence and risk factors associated with the highest likelihood of a VTE event after liver surgery. In addition, our objective was to determine the relative effectiveness of thromboprophylaxis in reducing clinically significant VTE in patients, as well as characterize the incidence of complications possibly attributable to chemoprophylaxis. We found that patients undergoing hepatectomy were at significant risk of VTE within 90 days of surgery. Specifically, the incidence of VTE in the current study was 4.7%, which was consistent with other published data. We conclude that most VTE events occurred among patients who received current best practice prophylaxis for VTE. More aggressive strategies to identify and reduce the risk of VTE in patients at highest risk of VTE, including those who have an extended operative time and LOS, are warranted.


**Mini-abstract:** This study was designed to determine whether or not there was an association between the process measure, the Surgical Care Improvement Project VTE-2, and the outcome, the Agency for
Healthcare Research and Quality Patient Safety Indicator, PSI-12. A sensitivity analysis and comparison of hospitals by quintiles of prophylaxis and VTE rates revealed no association between these two measures.


**Mini-abstract:** To compare the proportion of doses of thromboprophylaxis not administered between patients with and without HIV, the proportion of non-administered doses in all patients hospitalized on medicine units during a one-year period was measured and patients were stratified by HIV status. The proportion of doses not administered was significantly greater for patients with HIV compared with patients without HIV. Documented dose refusal accounted for a greater proportion of non-administered doses in patients with HIV.


**Mini-abstract:** This study describes characteristics of patients developing VTE in the early postoperative period. Most VTE events occurred in colorectal surgery patients that received current best practice VTE prophylaxis.


**Mini-abstract:** This article reviews the practices and interventions that have been directed towards improvement of VTE prophylaxis prescription in hospitals from 2001-2012 and assesses their efficacy. The authors recommend provider education and active mandatory tools such as computerized clinical decision support, combined with other interventions.


**Mini-abstract:** This Morbidity and Mortality Weekly Report provides an overview of the epidemiology and pathogenesis of venous thromboembolism and describes institutional efforts to improve venous thromboembolism prophylaxis at the Johns Hopkins Hospital, venous thromboembolism prevention as a component of patient safety and public health strategies to prevent venous thromboembolism.


**Mini-abstract:** This study was designed to explore causes of variability in the rate of administration of ordered doses of pharmacological venous thromboembolism prophylaxis among nurses on 12 inpatient hospital units using mixed-methods. Findings from the study showed that nurses on units with low administration rates often believe they have the skills to determine which patients require pharmacological venous thromboembolism prophylaxis and are more likely to offer the medication as optional to patients.

Mini-abstract: This was a systematic review and meta-analysis to examine the comparative effectiveness of prophylactic IVC filters in trauma patients for prevention of PE, fatal PE and mortality. Although the strength of evidence was low, IVC filter placement was associated with a lower incidence of PE and fatal PE in trauma patients.


Mini-abstract: The objective of this retrospective study was to determine the incidence and clinical characteristics of hospital-associated venous thromboembolism in pediatric patients. Young adults and adolescents had significantly increased rates of VTE compared with children. Infants and patients with a malignancy were most likely to have CVC–related VTE. Renal and cardiac conditions were associated with the highest rates of VTE.


Mini-abstract: This publication houses the NCCN Clinical Practice Guidelines in oncology for VTE including risk evaluation, diagnosis, prevention, and treatment of VTE in patients with cancer.


Mini-abstract: The principal objective of this study was to examine the impact of surveillance bias on the validity of reported VTE rates. Hospital-level VTE event rates were compared across VTE diagnostic imaging rate quartiles and hospitals with higher quality scores were found to have higher prophylaxis rates but worse risk-adjusted VTE rates. Increased hospital VTE event rates were associated with increasing hospital VTE imaging use rates.


Mini-abstract: This chapter reviews current practices in VTE prevention and approaches for improving rates of risk-appropriate VTE prophylaxis.

**Mini-abstract:** This retrospective study was carried out to identify efficient intervention strategies based on patterns of non-administration of ordered VTE prophylaxis. Overall, 11.9% of doses were not administered. The small proportion of patients that missed multiple ordered doses accounted for a large majority of non-administered doses.


**Mini-abstract:** The objective of this retrospective cohort study was to examine the impact of a “smart order set” on VTE prophylaxis and events in medical inpatients. The “smart order set” increased the prescription of risk-appropriate prophylaxis and reduced the number of symptomatic VTE episodes without increasing the frequency of VTE-prophylaxis associated major bleeding.


**Mini-abstract:** This is a comparative effectiveness study on efficacy and safety of VTE prophylaxis in patients with renal insufficiency, obesity, or those who are on antiplatelet drugs. The authors found insufficient evidence regarding optimal VTE prophylaxis for these populations.


**Mini-abstract:** The objective of this systematic review was to assess the comparative effectiveness and safety of pharmacologic and mechanical strategies to prevent venous thromboembolism in patients undergoing bariatric surgery. We found no evidence to support the use of filters or augmented dosing of pharmacotherapy in this population of patients.


**Mini-abstract:** The objective of this study was to link process and outcome data from disparate sources in order to determine the proportions of surgical patients prescribed risk-appropriate VTE prophylaxis who developed potentially preventable VTE.

**Mini-abstract:** To determine factors associated with increased risk of developing VTE within 30 days of colorectal surgery, this retrospective study reviewed institutional comprehensive data on 615 colorectal surgery patients from the National Surgical Quality Improvement Program. Most VTE events occurred in colorectal surgery patients that had been ordered appropriate VTE prophylaxis.

**Mini-abstract:** The objective of this retrospective study was to determine the age at which the low risk of VTE after trauma observed in children approaches the higher rates seen in adults. The risk of VTE in trauma patients increased most dramatically at age 16 years.

**Mini-abstract:** This meta-analysis seeks to evaluate the efficacy of pharmacologic prophylaxis in medical-ill patients. The benefits of prophylaxis far outweighed the risk of major bleeding. Low molecular weight heparin appeared to be associated with less risk of bleeding than unfractionated heparin although both prevent venous thromboembolism. Extended prophylaxis for venous thromboembolism reduced symptomatic VTE in medically ill patients but the benefits were only in a limited population of patients. There was no evidence that VTE prophylaxis reduced all-cause mortality.

**Mini-abstract:** This study was designed to evaluate the impact of a mandatory clinical decision support tool on compliance with prophylaxis for venous thromboembolism and VTE outcomes among admitted trauma patients. Implementation of this tool was found to significantly increase compliance with VTE prophylaxis and decrease the rate of preventable harm.

**Mini-abstract:** This study describes the experience of the Johns Hopkins VTE Collaborative in implementing a prospective quality improvement program which featured a mandatory clinical decision support tool for VTE risk stratification and risk-appropriate VTE prophylaxis for all hospitalized adult patients. Implementation of the tool resulted in a marked increase in risk-appropriate VTE prophylaxis.

**Mini-abstract:** This study’s main objective was to determine whether or not use of sequential compression devices (SCDs) is a common risk factor for in-hospital falls. SCD use was found to be rarely associated with in-hospital patient falls.

Mini-abstract: This study surveyed trauma surgeons to obtain opinions regarding duplex ultrasound screening for DVT in asymptomatic trauma patients. There was wide variation in trauma surgeons’ opinions and trauma centers’ practices regarding duplex ultrasound screening for DVT in asymptomatic trauma patients.


Mini-abstract: This is a prospective cohort study designed to measure the impact of a standardized risk assessment tool and specialty-specific, risk-adjusted venous thromboembolism order sets on compliance with American College of Chest Physicians guidelines and the frequency of symptomatic VTE reported in administrative data. Implementation of the VTE risk assessment tool and prophylaxis order set was associated with a 6-fold reduction in the number of symptomatic VTEs.


Mini-abstract: This article tries to draw attention to the significant risk of surveillance bias inherent in measurement of performance through reported outcome measures in the absence of standardized surveillance.


Mini-abstract: This paper reviews literature regarding the relationship between ABO blood group and VTE risk. The authors conclude that the effect of ABO blood groups on risk of VTE is genotype-dependent and partly mediated by the association between ABO blood groups and levels of plasma von Willebrand factor and factor VIII.


Mini-abstract: This article comments on the designation of deep venous thrombosis and pulmonary embolism after total knee arthroplasty and total hip arthroplasty to the list of never events. It argues that the CMS rule may have a number of unintended consequences that could cause additional harm to patients undergoing TKA and THA.


Mini-abstract: This study examined the incidence of VTE and risk factors for VTE and bleeding in a cohort of 1514 patients undergoing hematopoietic stem cell transplantation. VTE was primarily catheter related and thrice more prevalent in this population than clinically significant bleeding.
Mini-abstract: This retrospective study was designed to determine whether or not the rate of DVT identification increases as the number of screening duplex examinations in trauma patients increase.