

The Johns Hopkins Medicine VTE Collaborative Annotated Bibliography (Updated March 2021)

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Peer Reviewed Publications

1. Varasteh Kia M, Lau BD, Owodunni OP, Kraus PS, Holzmüller CG, Hobson BD, Shaffer DL, Streiff MB, Haut ER. [Nonadministration of pharmacologic venous thromboembolism prophylaxis is less common in hospitalized patients with COVID-19](#). J Thromb Thrombolysis (2021).
Mini-abstract: In this retrospective study, we found that VTE events remain an important cause of mortality and morbidity in patients with COVID-19. These data should help allay fears that missed doses of pharmacologic VTE prophylaxis are contributing to VTE events in patients with COVID-19. Therefore, we should prioritize research to discover more effective approaches to VTE prevention in patients with COVID-19.
2. Owodunni OP, Lau BD, Shaffer DL, McQuigg D, Samuel D, Kantsiper M, Harris Jr JE, Hobson DB, Kraus PS, Webster KLW, Holzmüller CH, Varasteh Kia M, Streiff MB, Haut ER. [Disseminating a patient-centered education bundle to reduce missed doses of pharmacologic venous thromboembolism \(VTE\) prophylaxis to a community hospital](#). Journal of Patient Safety and Risk Management. November 2020.
Mini-abstract: In this pre-post analysis, we found that a real-time alert-triggered patient-centered education bundle developed and tested in an academic hospital, significantly reduced missed doses of prescribed pharmacologic VTE prophylaxis when disseminated to a community hospital.
3. Lau BD, Wang J, Hobson DB, Kraus PS, Shaffer DL, Streiff MB, Haut ER. [Missed Doses of Venous Thromboembolism Prophylaxis: a Growing Problem Without an Active Management Strategy](#). J GEN INTERN MED **36**, 540–542 (2021).
Mini-abstract: In this retrospective study, we found that non-administration of VTE prophylaxis increases as prescriptions increase, unless interventions targeting missed doses are employed. To replicate reductions in VTE with thromboprophylaxis demonstrated in randomized trials in real-world settings, it is essential to actively monitor and ensure appropriate administration.

4. Lau BD, Murphy P, Nastasi AJ, Seal S, Kraus PS, Hobson DB, Shaffer DL, Holzmueller CH, Aboagye JK, Streiff MB, Haut ER. [Effectiveness of ambulation to prevent venous thromboembolism in patients admitted to hospital: a systematic review](#). CMAJ Open. 2020;8(4):E832-E843.
Mini-abstract: In this systematic review, we did not find high-quality evidence supporting ambulation alone as an effective prophylaxis for venous thromboembolism. Ambulation should not be considered an adequate prophylaxis for venous thromboembolism, nor as an adequate reason to discontinue pharmacologic prophylaxis for venous thromboembolism during a patient's hospital admission.
5. Florecki KL, Owodunni OP, Varasteh Kia M, Borja MC, Holzmueller CG, Lau BD, Paul M, Streiff MB, Haut ER. [What Does Venous Thromboembolism Mean in the National Surgical Quality Improvement Program?](#) J Surg Res 2020 Feb 27;251:94-99.
Mini-abstract: In this retrospective study using the National Surgical Quality Improvement Program database, we identified a considerable number of surgical patients misclassified as having a VTE. Our findings highlight the need to improve definition specificity and standardize processes involved in data extraction, validation, and reporting to provide unbiased data for use in quality improvement.
6. Owodunni OP, Haut ER, Shaffer DL, Hobson DB, Wang J, Yenokyan G, Kraus PS, Aboagye JK, Florecki KL, Webster KLW, Holzmueller CG, Streiff MB, Lau BD. (2020) [Using electronic health record system triggers to target delivery of a patient-centered intervention to improve venous thromboembolism prevention for hospitalized patients: Is there a differential effect by race?](#) PLoS ONE 15(1): e0227339.
Mini-abstract: In this post hoc analyses of a controlled preintervention-postintervention comparison trial, we found that the intervention was equitable and effective for all patients regardless of race. The odds of a patient refusing a prophylaxis dose significantly decreased on intervention units for all race groups after the education bundle was implemented, with approximately the same effect size.
7. Haut ER, Aboagye JK, Shaffer DL, Wang J, Hobson DB, Yenokyan G, Sugar ES, Kraus PS, Farrow NE, Canner JK, Owodunni OP, Florecki KL, Webster LW, Holzmueller CG, Pronovost PJ, Streiff MB, Lau BD. [Effect of Real-time Patient-Centered Education Bundle on Administration of Venous Thromboembolism Prevention in Hospitalized Patients](#). JAMA Netw Open. 2018;1(7):e184741.
Mini-abstract: In this controlled preintervention-postintervention comparison trial of 19 652 adult patients on medical and surgical units, nonadministration of venous thromboembolism prophylaxis significantly declined on units that received an intervention that combined an alert to a health educator about a missed dose of venous thromboembolism prophylaxis with patient education compared with control units.
8. Murphy PB, Vogt KN, Lau BD, Aboagye JK, Neil GP, Streiff MB, Haut ER. [Venous Thromboembolism Prevention in Emergency General Surgery: A Review](#). JAMA Surg. 2018;153(5):479–486.
Mini-abstract: In this study we found that operatively and nonoperatively treated EGS patients are at a comparatively high risk of VTE. Despite gaps in existing literature with respect to this increasing patient population, successful best practices can be applied. Best practices include assessment of VTE risk, optimal prophylaxis, and physician, nurse, and patient education regarding the use of mechanical and pharmacologic VTE prophylaxis and institutional policies.

9. Lau BD, Streiff MB, Pronovost PJ, Haut ER. [Venous thromboembolism quality measures fail to accurately measure quality](#). *Circulation*. 2018;137(12):1278-1284.
Mini-abstract: We developed a rubric for defect-free VTE prevention, graded each organizational VTE quality measure, and found that none of the current VTE-related quality measures adequately characterizes VTE prevention efforts or outcomes in hospitalized patients.
10. Aboagye JK, Hayanga JWA, Lau BD, Bush EL, Shaffer DL, Hobson DB, Kraus PS, Streiff MB, Haut ER, D’Cuhna J. [Venous Thromboembolism in Patients Hospitalized for Lung Transplantation](#). *Annals of Thoracic Surgery*. *Ann Thorac Surg*. 2018;105(4):1071-1076.
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.
11. Farrow NA, Aboagye JK, Lau BD, Najjar P, Orgill DP, Popoola VO, Kraus PS, Hobson DB, Shaffer DL, Safar B, Gearhart S, Efron JE, Streiff MB, Haut ER. [The Role of Extended/Outpatient Venous Thromboembolism Prophylaxis After Abdominal Surgery For Cancer or Inflammatory Bowel Disease](#). *Journal of Patient Safety and Risk Management*. 2018. 23(1) 19–26.
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.
12. Lau BD, Streiff MB, Kraus PS, Hobson DB, Shaffer DL, Aboagye JK, Pronovost PJ, Haut ER. [Missed Doses of VTE Prophylaxis Across a Large Health System: Cause for Alarm](#). *Journal of General Internal Medicine*. 2018 Jan;33(1):19-20
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.
13. Popoola VO, Tavakoli F, Lau BD, Lankiewicz M, Ross P, Kraus PS, Shaffer DL, Hobson DB, Aboagye JK, Farrow NA, Haut ER, Streiff MB. [Non-administration of Venous Thromboembolism Prophylaxis in Hospitalized Patients: The Impact of Route of Administration](#). *Thrombosis Research*. 2017 Oct 21;160:109-113.
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.
14. 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*. 2018;33(1):19-20.

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.

15. 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.

16. 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.](#) Thromb Res. 2017 Dec; 160, 109-113.

Mini-abstract: In this study, we found that subcutaneous VTE prophylaxis doses were not administered nearly 4-fold more frequently than oral infectious disease and cardiovascular prophylaxis. 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.

17. Nastasi AJ, Canner JK, Lau BD, Streiff MB, Aboagye JK, Van Arendonk KJ, Haut ER. [Characterizing the Relationship Between Age and Venous Thromboembolism in Adult Trauma Patients: Findings from the National Trauma Databank and the National Inpatient Sample.](#) Journal of Surgical Research. 2017 Aug;216:115-122.

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 provide important information on the appropriate model specification for age in VTE models in adult trauma patients.

18. Hobson DB, Chang TY, Aboagye JK, Lau BD, Shihab HM, Fisher B, Young S, Sujeta N, Shaffer DL, Popoola VO, Kraus PS, Knorr G, Farrow NE, Streiff MB, Haut ER. [Prevalence of Graduated Compression Stocking Associated Pressure Ulcers in Surgical Intensive Care Units.](#) Journal of Critical Care. 2017 Feb 27;40:1-6.

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.

19. Stone A, Grant M, Lau BD, Hobson DB, Streiff MB, Haut ER, Wu CL, Wick L. [Thoracic Epidural Anesthesia and Venous Thromboembolism Prophylaxis within an Enhanced Recovery After Surgery Pathway for Colorectal Surgery](#). *Journal of Regional Anesthesia*. 2017 Mar/Apr;42(2):197-203.

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.

20. Streiff MB, Lau BD, Hobson DB, Kraus PS, Shaffer DL, Popoola VO, Aboagye JA, Farrow NA, Haut ER. [The Johns Hopkins Venous Thromboembolism Collaborative: Multidisciplinary Team Approach to Achieve Perfect Prophylaxis](#). *Journal of Hospital Medicine*. 2016 Dec;11 Suppl 2:S8-S14.

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 on evidence-based, and specialty-specific computerized clinical decision support VTE prophylaxis order sets that assist providers in ordering risk-appropriate VTE prevention.

21. Lau BD, Arnaoutakis GJ, Streiff MB, Howley IW, Poruk KE, Beaulieu R, Ellison TA, Van Arendonk KJ, Kraus PS, Hobson DB, Holzmueller CG, Black JH 3rd, Pronovost PJ, Haut ER. [Individualized Performance Feedback to Surgical Residents Improves Appropriate Venous Thromboembolism Prophylaxis Prescription and Reduces Potentially Preventable VTE: A Prospective Cohort Study](#). *Ann Surg*. 2016 Dec;264(6):1181-1187.

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 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%, $p = 0.046$).

22. Piechowski KL, Elder S, Efird LE, Haut ER, Streiff MB, Lau BD, Kraus PS, Rand CS, Popoola VO, Hobson DB, Farrow NE, Shaffer D, Shermock KM. [Prescriber knowledge and attitudes regarding non-administration of prescribed pharmacologic venous thromboembolism prophylaxis](#). *J Thromb Thrombolysis*. 2016 Nov;42(4):463-70.

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.

23. Lau BD, Streiff MB, Hobson DB, Kraus PS, Shaffer DL, Popoola VO, Farrow NE, Efron DT, Haut ER. [Beneficial "halo effects" of surgical resident performance feedback](#). J Surg Res. 2016 Sep;205(1):179-85.

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.

24. Lau BD, Haut ER, Hobson DB, Kraus PS, Maritim C, Austin JM, Shermock KM, Maheshwari B, Allen PX, Almario A, Streiff MB. [ICD-9 code-based venous thromboembolism \(VTE\) targets fail to measure up](#). American Journal of Medical Quality. 2016 Sep;31(5):448-53.

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 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.

25. Farrow NE, Lau BD, JohnBull EA, Hobson DB, Kraus PS, Taffe ER, Shaffer DL, Popoola VO, Streiff MB, Pronovost PJ, Haut ER. [Is the Meaningful Use Venous Thromboembolism VTE-6 Measure Meaningful? A Retrospective Analysis of One Hospital's VTE-6 Cases](#). Jt Comm J Qual Patient Saf. 2016 Sep;42(9):410-6.

Mini-abstract: The objective of this study was assessing the validity of Meaningful Use VTE-6 measure by reviewing the 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.

26. Popoola VO, Lau BD, Shihab HM, Farrow NE, Shaffer DL, Hobson DB, Kulik SV, Zaruba PD, Shermock KM, Kraus PS, Pronovost PJ, Streiff MB, Haut ER. [Patient Preferences for Receiving Education on Venous Thromboembolism Prevention - A Survey of Stakeholder Organizations](#). PLoS One. 2016 Mar 31;11(3):e0152084.

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.

27. Haut ER, Lau BD, Kraus PS, Hobson DB, Maheshwari B, Pronovost PJ, Streiff MB. [Preventability of Hospital-Acquired Venous Thromboembolism](#). *JAMA Surg*. 2015; 150(9): 912–915.

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.

28. Lau BD, Streiff MB, Pronovost PJ, Haider AH, Efron DT, Haut ER. [Attending Physician Performance Measure Scores and Resident Physicians’ Ordering Practices](#). *JAMA Surg*. 2015;150(8):813–814.

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.

29. Michtalik HJ, Carolan HT, Haut ER, Lau BD, Streiff MB, Finkelstein J, Pronovost PJ, Durkin N, Brotman DJ. [Use of provider-level dashboards and pay-for-performance in venous thromboembolism prophylaxis](#). *J Hosp Med*. 2015 Mar;10(3):172-8.

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.

30. Wong A, Kraus PS, Lau BD, Streiff MB, Haut ER, Hobson DB, Shermock KM. [Patient preferences regarding pharmacologic venous thromboembolism prophylaxis](#). *J Hosp Med*. 2015 Feb;10(2):108-11.

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 those who preferred the oral route of administration (37.5% vs 51.3%, $P < 0.0001$)

31. Lau BD, Haider AH, Streiff MB, Lehmann CU, Kraus PS, Hobson DB, Kraenzlin FS, Zeidan AM, Pronovost PJ, Haut ER. [Eliminating Health Care Disparities With Mandatory Clinical Decision Support: The Venous Thromboembolism \(VTE\) Example.](#) *Med Care.* 2015 Jan;53(1):18-24.
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.
32. Ejaz A, Spolverato G, Kim Y, Lucas DL, Lau BD, Weiss M, Johnston FM, Kheng M, Hirose K, Wolfgang CL, Haut ER, Pawlik TM. [Defining incidence and risk factors of venous thromboembolism after hepatectomy.](#) *Journal of Gastrointestinal Surgery.* 2014 Jun;18(6):1116-24.
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.
33. JohnBull EA, Lau BD, Schneider EB, Streiff MB, Haut ER. [No association between hospital-reported perioperative venous thromboembolism prophylaxis and outcome rates in publicly reported data.](#) *JAMA Surg.* 2014;149(4):400–401.
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.
34. Newman M, Kraus P, Shermock K, Lau B, Haut E, Hobson D, Streiff M. [Non-administration of Thromboprophylaxis in Hospitalized Patients With HIV: A Missed Opportunity for Prevention.](#) *J. Hosp. Med* 2014;4:215-220.
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.
35. Monn MF, Haut ER, Lau BD, Streiff M, Wick EC, Efron JE, Gearhart SL. [Is Venous Thromboembolism in Colorectal Surgery Patients Preventable or Inevitable? One Institution's Experience.](#) *JACS* 2013;216(3):395-401.

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.

36. Lau BD, Haut ER. [Practices to Prevent Venous Thromboembolism: A Brief Review](#). *BMJ Quality & Safety*. 2014; 23:187-95.
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.
37. Streiff MB, Brady JP, Grant AM, Grosse SD, Wong B, Popovic T. [CDC Grand Rounds: Preventing Hospital-Associated Venous Thromboembolism; Johns Hopkins Medical Institutions Anticoagulation Management Service](#). *MMWR Morb Mortal Wkly Rep*. 2014 Mar 7;63(9):190-3.
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.
38. Elder SL, Hobson DB, Rand CS, Streiff MB, Haut ER, Efid LE, Kraus PS, Lehmann CU, Shermock KM. [Hidden barriers to the delivery of pharmacologic venous thromboembolism prophylaxis: the role of nursing beliefs and practices](#). *J Patient Saf*. 2016 Jun;12(2):63-8.
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.
39. Haut ER, Garcia LJ, Shihab HM, Brotman DJ, Stevens KA, Sharma R, Chelladurai Y, Akande TO, Shermock K, Kebede S, Segal JB, Singh S. [The Effectiveness of Prophylactic Inferior Vena Cava \(IVC\) Filters in Trauma Patients: A Systematic Review and Meta-Analysis](#). *JAMA – Surgery*. 2014; 149(2):194-202
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.
40. Takemoto CM, Sohi S, Desai K, Bharaj R, Khanna A, McFarland S, Klaus S, Irshad A, Goldenberg NA, Strouse JJ, Streiff MB. [Hospital-Associated Venous Thromboembolism in Children: Incidence and Clinical Characteristics](#). *The Journal of Pediatrics* 2013 Dec 4. pii: S0022-3476(13)01275-4.
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.

41. Streiff MB, Bockenstedt PL, Cataland SR, Chesney C, Eby C, Fanikos J, Fogerty AE, Gao S, Goldhaber SZ, Hassoun H, Hendrie P, Holmstrom B, Kuderer N, Lee JT, Millenson MM, Neff AT, Ortel TL, Siddiqi T, Smith JL, Yee GC, Zakarija A, McMillian N, Naganuma M. [Venous thromboembolic disease](#). *J Natl Compr Canc Netw*. 2013 Nov;11(11):1402-29.
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.
42. Bilimoria KY, Chung J, Ju Mila, Haut, ER, Bentrem DJ, Ko CY, Baker DW. [Evaluation of Surveillance Bias and the Validity of the Venous Thromboembolism Quality Measure. Original Investigation](#). *Journal of the American Medical Association (JAMA)* 2013 Oct 9;310(14): 1482-9.
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.
43. Haut ER, Lau BD. [Chapter 28: Prevention of Venous Thromboembolism: Brief Update Review](#). In "Making Health Care Safer II: An Updated Critical Analysis of the Evidence for Patient Safety Practices." March 2013. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.ahrq.gov/research/findings/evidencebased-reports/ptsafetyuptp.html>
Mini-abstract: This chapter reviews current practices in VTE prevention and approaches for improving rates of risk-appropriate VTE prophylaxis.
44. Shermock KM, Lau BD, Haut ER, Hobson DB, Ganetsky VS, Kraus PS, Efirid LE, Lehmann CU, Pinto BL, Ross PA, Streiff MB. [Patterns of non-administration of ordered doses of venous thromboembolism prophylaxis: implications for novel intervention strategies](#). *Public Library of Science One (PLoS One)* 2013;8(6):e66311.
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.
45. Zeidan AM, Streiff MB, Lau BD, Ahmed SR, Kraus PS, Hobson DB, Carolan H, Lambrianidi C, Horn PB, Shermock KM, Tinoco G, Siddiqui S, Haut ER. [Impact of a Venous Thromboembolism \(VTE\) Prophylaxis "Smart Order Set": Improved Compliance, Fewer Events](#). *American Journal of Hematology* 2013;88(7):545-549.
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.
46. Kebede S, Prakasa KR, Shermock K, Shihab HM, Brotman DJ, Sharma R, Chelladurai Y, Haut ER, Singh S, Segal JB. [A systematic review of venous thromboembolism prophylaxis strategies in patients with renal insufficiency, obesity, or on antiplatelet agents](#). *Journal of Hospital Medicine* 2013;8(7):394-401.

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.

47. Brotman DJ, Shihab HM, Prakasa KR, Kebede S, Haut ER, Sharma R, Shermock K, Chelladurai Y, Singh S, Segal JB. [Pharmacologic and mechanical strategies for preventing venous thromboembolism after bariatric surgery: a systematic review and meta-analysis.](#) *Journal of the American Medical Association (JAMA) Surgery* 2013;148(7):675-86.

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.

48. Aboagye JK, Lau BD, Schneider EB, Streiff MB, Haut ER. [Linking Processes and Outcomes: A Key Strategy to Prevent and Report Harm from Venous Thromboembolism in Surgical Patients.](#) *Journal of the American Medical Association (JAMA) Surgery* 2013;148(3):299-300.

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.

49. Monn MF, Haut ER, Lau BD, Streiff M, Wick EC, Efron JE, Gearhart SL. [Is Venous Thromboembolism in Colorectal Surgery Patients Preventable or Inevitable? One Institution's Experience.](#) *J Am Coll Surg.* 2013; 216(3):395-401.

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.

50. Van Arendonk KJ, Schneider EB, Haider AH, Colombani PM, Stewart FD, Haut ER. [Venous Thromboembolism After Trauma: When Do Children Become Adults?](#) *JAMA – Surgery.* 2013; 148(12):1123-30.

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.

51. Streiff MB, Lau BD. [Thromboprophylaxis in nonsurgical patients.](#) *Hematology Am Soc Hematol Educ Program.* 2012;2012:631-7.

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.

52. Haut ER, Lau BD, Kraenzlin FS, Hobson DB, Kraus PS, Carolan HT, Haider AH, Holzmueller CG, Efron DT, Pronovost PJ, Streiff MB. [Improved Prophylaxis and Decreased Rates of Preventable Harm With the Use of a Mandatory Computerized Clinical](#)

[Decision Support Tool for Prophylaxis for Venous Thromboembolism in Trauma](#). *Archives of Surgery* 2012;147(10):901-7.

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.

53. Streiff MB, Carolan HT, Hobson DB, Kraus PS, Holzmueller CG, Demski R, Lau BD, Biscup-Horn P, Pronovost PJ, Haut ER. [Lessons from the Johns Hopkins Multi-Disciplinary Venous Thromboembolism \(VTE\) Prevention Collaborative](#). *BMJ* 2012;344:e3935.

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.

54. Boelig M, Streiff MB, Hobson DB, Kraus PS, Pronovost PJ, Haut ER. [Are Sequential Compression Devices Commonly Associated with In-Hospital Falls? A Myth-Busters Review Using the Patient Safety Net Database](#). *The Journal of Patient Safety* 2011;7: 77-79.

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.

55. Haut ER, Schneider EB, Patel A, Streiff MB, Haider AH, Stevens KA, Chang DC, Neal ML, Hoefft C, Nathens AB, Cornwell EE 3rd, Pronovost PJ, Efron DT. [Duplex Ultrasound Screening For Deep Vein Thrombosis in Asymptomatic Trauma Patients: A Survey of Individual Trauma Surgeon Opinions and Current Trauma Center Practices](#). *J Trauma*. 2011; 70(1):27-34.

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.

56. Mayer RS, Streiff MB, Hobson DB, Halpert DE, Berenholtz SM. [Evidence-based Venous Thromboembolism Prophylaxis is Associated With a Six-fold Decrease in Numbers of Symptomatic Venous Thromboembolism in Rehabilitation Inpatients](#). *PM R*. 2011 Dec;3(12):1111-1115.

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.

57. Haut ER, Pronovost PJ. [Surveillance Bias in Outcomes Reporting](#). *JAMA – J Am Med Assoc*. 2011; 305(23):2462-3.

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.

58. Muellner SK, Haut ER, Streiff MB, Holcomb JB, Cotton BA. [ABO blood group as a potential risk factor for venous thromboembolism in acutely injured patients.](#) *Thromb Haemost.* 2011 Jan;105(1):5-13.
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.
59. Streiff MB, Haut ER. [The CMS Ruling on Venous Thromboembolism After Total Knee or Hip Arthroplasty: Weighing Risks and Benefits.](#) *JAMA – J Am Med Assoc.* 2009; 301(10):1063-1065.
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.
60. Gerber DE, Segal JB, Levy MY, Kane J, Jones RJ, Streiff MB. [The incidence of and risk factors for venous thromboembolism \(VTE\) and bleeding among 1,514 patients undergoing hematopoietic stem cell transplantation: Implications for VTE prevention.](#) *Blood* 2008 Aug 1;112(3):504-10.
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.
61. Haut ER, Noll K, Efron DT, Berenholz SM, Haider A, Cornwell 3rd EE, Pronovost PJ. [Can Increased Incidence of Deep Vein Thrombosis \(DVT\) Be Used as a Marker of Quality of Care in the Absence of Standardized Screening? The Potential Effect of Surveillance Bias on Reported DVT Rates.](#) *J Trauma.* 2007; 63(5):1132-1137
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.

Editorials

1. Torres C, Haut ER. [Prevention, diagnosis, and management of venous thromboembolism in the critically ill surgical and trauma patient.](#) *Curr Opin Crit Care.* 2020 Dec;26(6):640-647.
2. Brown L, Streiff MB, Haut ER. [Venous Thromboembolism Prevention and Treatment in Cancer Surgery.](#) *Adv Surg.* 2020 Sep;54:17-30.
3. Murphy PB, Haut ER. **Invited Commentary:** [Venous Thromboembolism in Emergency General Surgery Patients—A Call to Action to Improve Data, Clinical Care, and Patient Outcomes.](#) *JAMA Surg.* 2020;155(6):511–512.
4. Sterling RS, Haut ER. [Should Aspirin Be Routinely Used for Venous Thromboembolism Prophylaxis After Total Knee Arthroplasty? Even the Authors of This Commentary Cannot Agree.](#) *JAMA Surg.* 2019;154(1):72–73.
5. Webster KLW, Owodunni OP, Haut ER. [Addressing Clinical Significance.](#) *JAMA Surg.* 2019;154(2):188–189.

6. **Owodunni OP, Weiss MJ, Haut ER. Invited Commentary: [Is Venous Thromboembolism in Asian Patients Undergoing Gastrectomy Different From Venous Thromboembolism in Their Western Counterparts?](#)** JAMA Surg. 2018;153(10):946–947.
7. **Etchill EW, Fang R, Haut ER. [Does Tranexamic Acid Cause Venous Thromboembolism After Trauma? Who Cares, if it Saves Lives?](#)** JAMA Surg. 2018;153(2):175-176.
8. **Kent AJ, Aboagye JK, Haut ER. Invited Commentary: [“The Role of Vena Cava Filters \(VCF\) For Injured Patients Remains Unclear; But, Please Don’t Throw the Baby Out with the Bathwater”](#)** JAMA Surg. 2017;152(8):732-733.
9. **Lau BD, Haut ER. [Computerized Clinical Decision Support for Venous Thromboembolism Prevention: Why Can’t my Electronic Health Record be more like Netflix, Amazon, Google, and Apple?](#)** JAMA-Surgery. 2017 Jul 1;152(7):646-647.
10. **Kodadek, L.M., Haut, E.R. [Screening and Diagnosis of VTE: The More You Look, The More You Find?](#)** *Curr Trauma Rep* 2, 29–34 (2016).
11. **Kodadek LM, Lau BD, Haut ER. [How Can a Valid Research Agenda for Patient-Reported Outcomes be Defined Without Patient Input?](#)** Invited Commentary. JAMA-Surgery 2016 Oct 1;151(10):936-937.
12. **Haut ER, Lau BD, Streiff MB. [New oral anticoagulants for venous thromboembolism \(VTE\) prophylaxis: Are we at the point of diminishing returns?](#)** Invited Critique. BMJ. 2012;344:e3820.
13. **Haut ER. [Preventing venous thromboembolism in surgical patients: current prophylaxis practices and quality improvement initiatives.](#)** Invited Commentary. Am J Surg. 2010;200(3):424-425.
14. **Haut ER. [“Venous Thromboembolism: Are Regulatory Requirements Reasonable?”](#)** Critical Connections (Society of Critical Care Medicine news magazine). 2008. (COVER article)

Letters, correspondence

1. **Owodunni OP, Lau BD, Streiff MB, Kraus PS, Hobson DB, Shaffer DL, Webster KLW, Varasteh Kia M, Holzmueller CG, Haut ER. [What the 2018 ASH venous thromboembolism guidelines omitted: Nonadministration of pharmacologic prophylaxis in hospitalized patients.](#)** *Blood Adv.* 2019;3(4):596-598.
2. **Aboagye JK, Hobson DB, Lau BD, Shaffer DL, Kraus PS, Streiff MB, Haut ER. [Reply about the letter regarding: Prevalence of graduated compression stocking-associated pressure injuries in surgical intensive care units.](#)** *Journal of Critical Care.* 2017 Aug;40:287-288.
3. **Popoola VO, Lau BD, Haut ER. [Misclassification of Acceptable Venous Thromboembolism Prophylaxis Leading to Flawed Inferences and Recommendations Regarding Prevention Efforts.](#)** JAMA Surgery. 2016 Feb 1;151(2):197-198.
4. **Lau BD, Streiff MB, Kraus PS, Hobson DB, Shaffer DL, Shihab HM, Haut ER. [No Evidence to Support Ambulation for Reducing Postoperative Venous Thromboembolism.](#)** *Journal of the American College of Surgeons.* 2014 Nov;219(5):1101-3.
5. **Streiff MB, Lau BD, Carolan HT, Hobson DB, Kraus PS, Haut ER. [Authors response to letter to the editor regarding: Heparin prophylaxis has no benefit in medical patients.](#)** BMJ. 2012; 345:e4940.
6. **Rosenberg JJ, Haut ER. [Letter to the Editor: "Surveillance Bias and Postoperative Complication Rates."](#)** Arch Surg. 2012;147(2):199-200.
7. **Haut ER, Pronovost PJ, Schneider EB. [Limitations of Administrative Databases.](#)** JAMA. 2012;307(24):2589.