

AORN Guideline for Prevention of Venous Thromboembolism  
Evidence Table

REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS SCORE
1	Venous Thromboembolism (Blood Clots). <a href="https://www.cdc.gov/ncbddd/dvt/index.html">https://www.cdc.gov/ncbddd/dvt/index.html</a> . Updated 2022. Accessed 6/21, 2022	Expert Opinion	n/a	n/a	n/a	n/a	Provides national statistics for venous thromboembolism disease.	VA
2	Gould MK, Garcia DA, Wren SM, et al. Prevention of VTE in nonorthopedic surgical patients: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest. 2012;141(2 Suppl):e227S-e277S	Guideline	n/a	n/a	n/a	n/a	Provides specific guidance for selection of VTE prophylaxis in nonorthopedic surgical patients, considering the risk of venous thromboembolism, risk of bleeding complications, and the values and preferences of individual patients.	IVA
3	Reyad A, Sweeney K, Mavanur A, Salous AK. A significant proportion of venous thromboembolism events in general surgical patients occurs after discharge: Analysis of the ACS-NSQIP Essentials database. Perioperative Med. 2019;8(1):18	Nonexperimental	18,220 patients who underwent general surgery/ACS NSQIP Essentials database; 75 patients who underwent general surgery/single site, Maryland	n/a	n/a	incidence of VTE	In general surgery patients, VTE risk remains elevated with 40% of VTE events occurring after discharge. VTE prophylaxis should extend to 30 days after discharge for high-risk surgical patients, defined as one with a Caprini score of $\geq 4$ .	IIIB
4	Exposito-Ruiz M, Arcelus JJ, Lopez-Espada C, et al. Timing and characteristics of venous thromboembolism after noncancer surgery. J Vasc Surg Venous Lymphatic Disord. 2021;9(4):859	Nonexperimental	3,296 patients who underwent non-cancer surgery/Computerized Registry on Venous Thromboembolism (RIETE) database	n/a	n/a	3-month postoperative risk of symptomatic VTE	VTE risk for patients who underwent non-cancer surgery remains elevated for longer than 7-days after surgery. 25% of patients developed VTE after the fourth postoperative week. Postoperative prophylaxis needs to be improved.	IIIB
5	Brady MT, Patts GJ, Rosen A, et al. Postoperative Venous Thromboembolism in Patients Undergoing Abdominal Surgery for IBD: A Common but Rarely Addressed Problem. Dis Colon Rectum. 2017;60(1):61-67	Nonexperimental	7,078 patients undergoing surgery for Crohn's disease or ulcerative colitis/irritable bowel disease (IBD)/Optum Labs Data Warehouse insurance claims database (US)	n/a	n/a	postdischarge VTE prophylaxis rates and 90-day postdischarge thromboembolic events	The risk of developing VTE in patients with IBD undergoing major colon and rectal surgery remains elevated through the 90-day postoperative period. Only as small proportion of patients receive appropriate chemoprophylaxis after discharge. There is a need to develop a risk-stratified model to guide VTE chemoprophylaxis post discharge.	IIIB
6	El Dhuwaib Y, Selvasekar C, Corless DJ, Deakin M, Slavin JP. Venous thromboembolism following colorectal resection. Colorectal Dis. 2017;19(4):385-394	Nonexperimental	35,997 patients who underwent colorectal resection/Hospital Episode Statistics database, England	n/a	n/a	1-year VTE rate after surgery	The risk of VTE in patients with cancer remained elevated for 6 months compared with 2 months for patients with benign disease. Those undergoing emergency surgery for IBD, cancer, and those with an extended hospital stay had an increased risk. Additional VTE prophylaxis may be needed as determined by a stratified approach.	IIIB

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7	Bohl DD, Ondeck NT, Basques BA, Levine BR, Grauer JN. What Is the Timing of General Health Adverse Events That Occur After Total Joint Arthroplasty? Clin Orthop. 2017;475(12):2952-2959	Nonexperimental	124,657 patients undergoing primary THA and primary TKA/ACS NSQIP database	n/a	n/a	adverse event timing after surgery	Early discharge for patients who underwent primary THA and TKA should be managed cautiously as many adverse events that occur after surgery may go unnoticed in an outpatient setting.	IIIA
8	Pikovskiy O, Rabinovich A. Prevention and treatment of the post-thrombotic syndrome. Thromb Res. 2018;164:116-124	Literature Review	n/a	n/a	n/a	n/a	Post-thrombotic syndrome is a common complication that develops in up to 50% of patients with DVT. Prevention of DVT and appropriate anticoagulation can reduce the incidence of PTS.	VB
9	Maynard G. Preventing hospital-associated venous thromboembolism: a guide for effective quality improvement. 2016;AHRQ Publication No. 16-0001-EF	Expert Opinion	n/a	n/a	n/a	n/a	There are many lost opportunities to optimize VTE prophylaxis in virtually every hospital. This guide targets these failure modes in the process of preventing VTE in the inpatient setting and provides improvement teams with field-tested strategies and tools to enhance their chances of success.	VA
10	Heit JA, Ashrani A, Crusan DJ, McBane RD, Petterson TM, Bailey KR. Reasons for the persistent incidence of venous thromboembolism. Thromb Haemost. 2017;117(2):390-400	Nonexperimental	493,000 individuals (30-year longitudinal)/Rochester Epidemiology Project database	n/a	n/a	Incidence of VTE	Almost 80% of incident VTE events are attributable to known major VTE risk factors and one-third of incident idiopathic VTE events are attributable to obesity. Increasing surgery population-attributable risk suggests that concurrent efforts to prevent VTE may have been insufficient. Better VTE risk assessment tools are needed that identify the individual at risk, especially the individual with active cancer and undergoing surgery.	IIIB
11	Shahi A, Chen AF, Tan TL, Maltenfort MG, Kucukdurmaz F, Parvizi J. The Incidence and Economic Burden of In-Hospital Venous Thromboembolism in the United States. J Arthroplasty. 2017;32(4):1063-1066	Nonexperimental	1,762,496 patients who underwent primary or revision TKA and THA/National Inpatient Sample AHRQ database	n/a	n/a	in-hospital incidence of DVT and PE, VTE-associated hospital charges	In-hospital incidence of DVT in TKA and THA patients has decreased, though rates of PE have remained the same. Associated hospital charges have increased significantly, burdening the healthcare system. Current recommendations are adequate for preventing DVT and without increasing the rate of PE. Further work should be completed to reduce the cost of VTE events and to decrease the rate of PE.	IIIB

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12	Cohoon KP, Leibson CL, Ransom JE, et al. Direct medical costs attributable to venous thromboembolism among persons hospitalized for major operation: a population-based longitudinal study. <i>Surgery</i> . 2015;157(3):423-431.	Nonexperimental	355 patients diagnosed with VTE within 92 days of hospitalization for major operation and matched controls/ Olmsted County, Minnesota	n/a	n/a	Cost of VTE	Adjusted mean costs were 1.5 fold greater for cases than controls (\$55,956 vs \$32,718) up to 5 years after surgery.	IIIA
13	Lockwood R, Kable A, Hunter S. Evaluation of a nurse-led intervention to improve adherence to recommended guidelines for prevention of venous thromboembolism for hip and knee arthroplasty patients: A quasi-experimental study. <i>Journal of Clinical Nursing</i> (John Wiley & Sons, Inc ). 2018;27(5-6):e1048-e1060	Quasi-experimental	383 patients scheduled for elective hip or knee arthroplasty (intervention n = 196; control n = 187)/multi center, Australia	nurse-led VTE prevention program	routine care	Adherence to VTE prevention	A nurse-led intervention achieved higher adherence to VTE prevention as compared to routine care for patients undergoing elective hip and knee arthroplasty. Nurses can improve patient outcomes and reduce postoperative VTE through the implementation of evidence based care.	IIIB
14	Wittig-Wells D, Shapiro S, Higgins M, et al. Self-Reported Rates of Adherence to Aspirin Prescribed as an Antithrombotic Therapy Following Postoperative Total Joint Replacement. <i>Orthop Nurs</i> . 2017;36(4):287-292	Nonexperimental	99 adult patients undergoing total hip or knee arthroplasty and prescribed ASA postoperatively	n/a	n/a	Adherence to ASA antithrombotic therapy	Nurses can impact patient adherence to ASA antithrombotic therapy.	IIIB
15	Krauss ES, Cronin M, Dengler N, Simonson BG, Enker P, Segal A. Lessons Learned: Using the Caprini Risk Assessment Model to Provide Safe and Efficacious Thromboprophylaxis Following Hip and Knee Arthroplasty. <i>Clin Appl Thromb Hemost</i> . 2020;26:1076029620961450	Organizational Experience	Total joint arthroplasty patients; New York	n/a	n/a	n/a	The Caprini score is useful only when data are accurately collected and verified. Training clinicians on the use of the Caprini risk assessment is critical.	VB
16	Ellis HB,Jr, Sabatino MJ, Clarke Z, et al. The Importance of a Standardized Screening Tool to Identify Thromboembolic Risk Factors in Pediatric Lower Extremity Arthroscopy Patients. <i>J Am Acad Orthop Surg</i> . 2019;27(9):335-343	Quasi-experimental	325 adolescent (ages 5-19) patients undergoing elective lower extremity arthroscopy/single center, TX	targeted VTE screening tool during preoperative visit with patient and family	no targeted VTE screening tool (retrospective chart review)/332 adolescent patients who underwent elective lower extremity arthroscopy	identification of VTE risk factors	Targeted screening improves identification of important clinical data and should be considered for any condition or situation that affects outcomes or minimize complications. A TS used during the preoperative clinical visit for VTE noted approximately 30% more risk factors, especially a significant family history, and provided a cost savings. It is important to include the family during the VTE assessment to ensure family history of VTE is captured accurately.	IIIB
17	Baker D, Sherrod B, McGwin GJ, Ponce B, Gilbert S. Complications and 30-day outcomes associated with venous thromboembolism in the pediatric orthopaedic surgical population. <i>J Am Acad Orthop Surg</i> . 2016;24(3):196-206.	Nonexperimental	14,776 orthopedic surgery patients between 2012 and 2013/ACS NSQIP Pediatric database, US	n/a	n/a	VTE	VTE risk factors included hyponatremia, abnormal partial thromboplastin time, elevated aspartate transaminase level, and gastrointestinal, renal, and hematologic disorders.	IIIA
18	Heit JA. Epidemiology of venous thromboembolism. <i>Nat Rev Cardiol</i> . 2015;12(8):464-474.	Literature Review	n/a	n/a	n/a	n/a	Provides review of VTE epidemiology.	VB
19	Giordano NJ, Jansson PS, Young MN, Hagan KA, Kabrhel C. Epidemiology, Pathophysiology, Stratification, and Natural History of Pulmonary Embolism. <i>Tech Vasc Intervent Radiol</i> . 2017;20(3):135-140	Literature Review	n/a	n/a	n/a	n/a	Provides epidemiology, pathophysiology, stratification, and history of pulmonary embolism.	VA

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20	Kakkos S, Kirkilesis G, Caprini JA, et al. Combined intermittent pneumatic leg compression and pharmacological prophylaxis for prevention of venous thromboembolism. Cochrane Database of Systematic Reviews. 2022(1)	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	The use of intermittent pneumatic compression with pharmacological prophylaxis may reduce the incidence of DVT and PE. Compared to pharmacologic prophylaxis alone, IPC and pharmacological prophylaxis reduces the incidence of DVT and PE. When added, pharmacological prophylaxis may increase the risk of bleeding. The results of the review agree with the current recommendations supporting the use of combined modalities for trauma and surgical hospitalized patients at risk of VTE.	IIA
21	Chahal R, Alexander M, Yee K, et al. Impact of a risk-stratified thromboprophylaxis protocol on the incidence of postoperative venous thromboembolism and bleeding. Anaesthesia. 2020;75(8):1028-1038	Organizational Experience	single center, Australia	n/a	n/a	n/a	Implementation of a novel risk-stratified thromboprophylaxis protocol (Surgical-thrombo-embolism-prevention [STEP] protocol) was associated with a sustained reduction of VTE and readmission due to bleeding.	VB
22	Connors JM, Middeldorp S. Transgender patients and the role of the coagulation clinician. J Thromb Haemost. 2019;17(11):1790-1797	Literature Review	n/a	n/a	n/a	n/a	The coagulation clinician should be familiar with endocrine therapy and VTE risks associated with currently used hormone regimens when managing the medical care of transgender patients.	VB
23	Haywood N, Nickel I, Zhang A, et al. Enhanced Recovery After Thoracic Surgery. Thorac Surg Clin. 2020;30(3):259-267	Literature Review	n/a	n/a	n/a	n/a	Continued multidisciplinary review and protocol revision are of paramount importance for ERP improvement. It is likely that the full potential of thoracic ERPs has not yet been realized and that more widespread adoption and study of these pathways will lead to further improvements in care and outcomes.	VC
24	Wainwright TW, Gill M, McDonald DA, et al. Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. 2020;91(1):3-19	Consensus	n/a	n/a	n/a	n/a	Patients undergoing THR and TKR who are at risk of VTE should receive pharmacologic and mechanical prophylaxis in accordance with local policy. Patients should be mobilized as early as possible to facilitate early discharge and reduce risk of thromboembolism.	IVA
25	Debono B, Wainwright TW, Wang MY, et al. Consensus statement for perioperative care in lumbar spinal fusion: Enhanced Recovery After Surgery (ERAS®) Society recommendations. The Spine Journal. 2021;21(5):729-752	Consensus	n/a	n/a	n/a	n/a	Provides clinical consensus on the ERAS recommendations for patients undergoing lumbar spinal fusion surgery.	IVA

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26	Moffatt-Bruce S, Hilligoss B, Gonsenhaus I. ERAS: Safety checklists, antibiotics, and VTE prophylaxis. <i>J Surg Oncol.</i> 2017;116(5):601-607	Literature Review	n/a	n/a	n/a	n/a	The success of ERAS protocols relative to safety checklists, antibiotic management, and VTE prevention require collaboration and leadership.	VB
27	Chiang HA, Cheng PJ, Speed JM, et al. Implementation of a Perioperative Venous Thromboembolism Prophylaxis Program for Patients Undergoing Radical Cystectomy on an Enhanced Recovery After Surgery Protocol. <i>Eur Urol Focus.</i> 2020;6(1):74-80	Organizational Experience	single center, Massachussettes	n/a	n/a	n/a	Implementation of an ERAS protocol for patients undergoing radical cystectomy resulted in lower VTE rates.	VA
28	Stone AB, Grant MC, Lau BD, et al. Thoracic Epidural Anesthesia and Prophylactic Three Times Daily Unfractionated Heparin Within an Enhanced Recovery After Surgery Pathway for Colorectal Surgery. <i>Reg Anesth Pain Med.</i> 2017;42(2):197-203	Nonexperimental	1264 patients who underwent colorectal surgery/Maryland	n/a	n/a	missed doses of VTE chemoprophylaxis	Thoracic epidural analgesia was associated with a 1.5-fold increased risk of missed dose of preoperative VTE prophylaxis, despite the implementation of a multimodal ERAS program. This highlights the challenge of providing VTE prophylaxis in the setting of perioperative neuraxial analgesia.	IIIC
29	Jenny J, Bulaid Y, Boisrenoult P, et al. Bleeding and thromboembolism risk of standard antithrombotic prophylaxis after hip or knee replacement within an enhanced recovery program. <i>Orthop Traumatol Surg Res.</i> 2020;106(8):1533-1538	Nonexperimental	1949 patient who underwent primary total hip or total knee arthroplasty/multi center, France	n/a	n/a	VTE	The prescription of LMWH or DOAC after primary THA or TKA within an ERAS protocol could significantly increase the risk of bleeding events over VTE events. Personalization of antithrombotic prophylaxis in the context of ERAS is desirable, although the criteria must still be defined.	IIIC
30	Helm MC, Simon K, Higgins R, Kindel TL, Gould JC. Perioperative complications increase the risk of venous thromboembolism following bariatric surgery. <i>Am J Surg.</i> 2017;214(6):1135-1140	Nonexperimental	59,424 patients who underwent bariatric surgical procedures/ACS NSQIP database	n/a	n/a	VTE risk	Intraoperative and postoperative complications may contribute to an increased risk of postoperative VTE in bariatric surgery patients.	IIIA
31	McAlpine K, Breau RH, Knee C, et al. Venous thromboembolism and transfusion after major abdominopelvic surgery. <i>Surgery.</i> 2019;166(6):1084-1091	Nonexperimental	896,441 patients who underwent an abdominopelvic procedure/ACS NSQIP database	n/a	n/a	VTE risk and transfusion	Patients undergoing abdominopelvic surgery are at a high risk of VTE and transfusion. Procedural information should be included in risk stratification.	IIIB
32	McAlpine, Kristen, Breau, Rodney H., Mallick, Ranjeeta, et al. Current guidelines do not sufficiently discriminate venous thromboembolism risk in urology 2017	Nonexperimental	65,100 patients who underwent major abdominal or pelvic urologic surgery/ACS NSQIP database	n/a	n/a	postoperative VTE	Procedure-specific VTE risk should be included in risk stratification protocol. Procedure-specific thromboprophylaxis guidelines are needed in urology.	IIIB

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33	Vaughn, Stephanie C., Talutis, Stephanie D., Cassidy, Michael R., et al. Two novel risk factors for postoperative venous thromboembolism: A reconsideration of standard risk assessment and prophylaxis 2020	Nonexperimental	1,610,086 patients who underwent general surgery/ACS NSQIP database	n/a	n/a	postoperative VTE	Patients having emergency general surgery, multiple operations, and perioperative sepsis have a greater likelihood of developing postoperative VTE. These patients may not receive sufficient prophylaxis because these factors are not captured in contemporary risk assessment models. Patients with any of these three risk factors, and especially with combinations of the factors, should be regarded as having a particularly increased risk of developing postoperative thromboembolic complications.	IIIB
34	Ross, Samuel W., Reinke, Caroline E., Kuhlenschmidt, Kali M., et al. Association of the risk of a venous thromboembolic event in emergency vs elective general surgery 2020	Nonexperimental	604,537 patients who underwent general surgical procedures/ACS NSQIP database	n/a	n/a	30-day postop VTE	Emergency general surgery and increased invasiveness were independently associated with VTE compared to elective surgery. Further research is needed to improve VTE prophylaxis in patients undergoing emergency general surgery.	IIIB
35	Sanchez, Carol, Nguyen, Jackie, Baroutjian, Amanda, Gill, Sabrina, McKenney, Mark and Elkbuli, Adel. Venous Thromboembolism Chemoprophylaxis in Trauma and Emergency General Surgery Patients: A Systematic Review 2021	Systematic Review	n/a	n/a	n/a	n/a	Patients undergoing trauma and emergency general surgery are at high risk of VTE. VTE chemoprophylaxis in these patients should be initiated within 72 hours of initial injury. Additional research is needed regarding VTE prophylaxis for this patient population.	IIIB
36	American College of Obstetricians and Gynecologists' Committee on Practice Bulletins-Gynecology. Prevention of Venous Thromboembolism in Gynecologic Surgery: ACOG Practice Bulletin, Number 232 2021	Guideline	n/a	n/a	n/a	n/a	Provides guidance on the prevention of VTE in gynecologic surgery.	IVA
37	Fleischer AE, Abicht BP, Baker JR, Boffeli TJ, Jupiter DC, Schade VL. American College of Foot and Ankle Surgeons' clinical consensus statement: risk, prevention, and diagnosis of venous thromboembolism disease in foot and ankle surgery and injuries requiring immobilization. J Foot Ankle Surg. 2015;54(3):497-507.	Consensus	n/a	n/a	n/a	n/a	Consensus statement for VTE prevention after foot and ankle surgery. Patients should be treated according to individual VTE risk level, addressing modifiable risk factors, use of mechanical prophylaxis, early mobilization, and careful consideration of chemical prophylaxis.	IVB
38	Richardson, William S., Hamad, Giselle G., Stefanidis, Dimitrios and the SAGES, Guidelines C. SAGES VTE prophylaxis for laparoscopic surgery guidelines: an update 2017	Position Statement	n/a	n/a	n/a	n/a	The SAGES guidelines committee has approved the endorsement of the ACCP guidelines. Acknowledges minimal data in MIS procedures and that individual risk, comorbidities, and procedure must be considered in risk stratification.	IVB

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39	Falck-Ytter Y, Francis CW, Johanson NA, et al. Prevention of VTE in orthopedic surgery patients: antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians evidence-based clinical practice guidelines. Chest. 2012;141(2)(suppl):e278S-e325S.	Guideline	n/a	n/a	n/a	n/a	Provides specific guidance for selection of VTE prophylaxis in orthopedic surgical patients, considering the risk of venous thromboembolism, risk of bleeding complications, and the values and preferences of individual patients.	IVA
40	Anderson, David R., Morgano, Gian P., Bennett, Carole, et al. American Society of Hematology 2019 guidelines for management of venous thromboembolism: prevention of venous thromboembolism in surgical hospitalized patients 2019	Guideline	n/a	n/a	n/a	n/a	Guideline on pharmacological and mechanical VTE prophylaxis for patients undergoing major surgery.	IVA
41	American Academy of Orthopaedic Surgeons (AAOS). Preventing Venous Thromboembolic Disease in Patients Undergoing Elective Hip and Knee Arthroplasty. Evidence-Based Clinical Practice Guideline 2011	Guideline	n/a	n/a	n/a	n/a	Provides guidance on VTE prevention in patients undergoing orthopedic surgery.	IVC
42	American Society of Clinical Oncology. Key, Nigel S., Khorana, Alok A., Kuderer, Nicole M., et al. Venous Thromboembolism Prophylaxis and Treatment in Patients With Cancer: ASCO Clinical Practice Guideline Update 2020	Guideline	n/a	n/a	n/a	n/a	Provides guidance on the prevention of VTE in patients with cancer.	IVB
43	Mahajerin, Arash, Petty, John K., Hanson, Sheila J., et al. Prophylaxis against venous thromboembolism in pediatric trauma: A practice management guideline from the Eastern Association for the Surgery of Trauma and the Pediatric Trauma Society 2017	Guideline	n/a	n/a	n/a	n/a	Provides VTE prophylaxis guidance for children hospitalized after trauma.	IVB
44	LeCuyer, Melissa, Nyman, Victoria, Sykes, Frances and Thomas, Kimberly. Reducing Venous Thromboembolism Risk Through a Collaborative Team Approach 2021	Organizational Experience	159-bed Magnet hospital/Illinois	n/a	n/a	SCD application and Patient Safety Indicator-12	Implementation of best practices of risk assessment, nurse driven protocols, interdisciplinary collaboration, and autonomy resulted in a decrease of VTE in the organization.	VB
45	Guideline for information management. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2022	Guideline	n/a	n/a	n/a	n/a	Provides guidance on the management of information in the perioperative setting.	IVA
46	Fan, Chaofeng, Jia, Lu, Fang, Fang, et al. Adjunctive Intermittent Pneumatic Compression in Hospitalized Patients Receiving Pharmacologic Prophylaxis for Venous Thromboprophylaxis: A Systematic Review and Meta-Analysis 2020	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Intermittent pneumatic compression, when added to pharmacologic prophylaxis, has moderate benefits on DVT and PE in surgical patients.	IB
47	Borab, Zachary M., Lanni, Michael A., Tecce, Michael G., Pannucci, Christopher J. and Fischer, John P. Use of Computerized Clinical Decision Support Systems to Prevent Venous Thromboembolism in Surgical Patients: A Systematic Review and Meta-analysis 2017	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	The use of computerized clinical decision support systems (CCDSS) increases the proportion of surgical patients who were prescribed adequate prophylaxis for VTE and correlates with a reduction in VTE events.	IIIB
48	Kahn SR, Morrison DR, Cohen JM, et al. Interventions for implementation of thromboprophylaxis in hospitalized medical and surgical patients at risk for venous thromboembolism. Cochrane Database Syst Rev. 2013;(7):CD008201.	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Use of alerts significantly improved prescription of VTE prophylaxis, especially as part of a multifaceted intervention to improve compliance.	IIA

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49	Aufwerber, Susanna, Heijne, Annette, Edman, Gunnar, Gravare Silbernagel, Karin and Ackermann, Paul W. Early mobilization does not reduce the risk of deep venous thrombosis after Achilles tendon rupture: a randomized controlled trial 2020	RCT	150 patients undergoing Achilles tendon rupture surgical repair/single center, Sweden	early functional mobilization	plaster cast	postoperative DVT	Patients with lower limb immobilization after surgical repair of ATR do not have reduced rates of DVT when using early functional mobilization, including early weightbearing and ankle range of motion, compared to lower limb plaster cast followed by orthosis immobilization. Postoperative orthosis leg immobilization is still linked with a high incidence of DVT, which is mainly explained by the three independent risk factors: decreased weightbearing less than 50%, increased age and BMI > 26.	IB
50	Benlice, Cigdem, Holubar, Stefan D., Gorgun, Emre, et al. Extended Venous Thromboembolism Prophylaxis After Elective Surgery for IBD Patients: Nomogram-Based Risk Assessment and Prediction from Nationwide Cohort 2018	Nonexperimental	24,182 patients with IBD undergoing elective abdominopelvic bowel surgery/ACS NSQIP	n/a	n/a	In-hospital and 30-day VTE risk	The 30-day total and postdischarge VTE rate was 2.5% and 1.0%. In-hospital VTE development was associated with patients with older age, higher rates of steroid use, preoperative transfusion, underlying bleeding disorders, open surgery, ASA 3 to 4, hypertension requiring medication, complex pelvic surgery or with ileostomy, longer operative time, and hospital stay before surgery.	IIIB
51	Xin, Wen-Qiang, Xin, Qi-Qiang, Ming, Hao-Lang, et al. Predictable Risk Factors of Spontaneous Venous Thromboembolism in Patients Undergoing Spine Surgery 2019	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	A higher rate of postoperative VTE is closely associated with the elderly, longer duration of surgery, thoracolumbar surgery, greater blood loss, and patients with a history of hypertension, preoperative walking disability, or diabetes after spinal surgery; these risk factors should be guarded against.	IIIA
52	Courtney, P. M., Boniello, Anthony J., Levine, Brett R., Sheth, Neil P. and Paprosky, Wayne G. Are Revision Hip Arthroplasty Patients at Higher Risk for Venous Thromboembolic Events Than Primary Hip Arthroplasty Patients? 2017	Nonexperimental	74,405 patients who underwent hip arthroplasty/ACS NISQIP database	n/a	n/a	venous thrombotic events	Independent risk factors for DVT in patients undergoing THA were age over 70 years, malnutrition, kidney disease, general anesthesia, joint infection, operating time over 3 hours, ASA IV or greater. Revision surgery is not an independent risk factor for VTE. Surgeons should weigh risks and benefits of anticoagulation in high risk patients.	IIIB



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53	Sing, David C., Tangtiphaibootana, Jennifer, Ma, C. B., Feeley, Brian T. and Zhang, Alan L. Incidence and Risk Factors for Venous Thromboembolic Events After Open Shoulder Surgery 2017	Nonexperimental	315,423 patients who underwent open shoulder procedures/Nationwide Inpatient Sample (NIS) database	n/a	n/a	risk of VTE	There is a low overall risk of VTE after open shoulder surgery. Patients with VTE were older, male, African-American, and had a longer hospital stay. Comorbidities associated with higher risk of VTE included hypercoagulability, cancer, congestive heart failure, electrolyte abnormalities, and obesity.	IIIB
54	Li, Mao, Guo, Qiang and Hu, Weiming. Incidence, risk factors, and outcomes of venous thromboembolism after oncologic surgery: A systematic review and meta-analysis 2019	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	The risk of VTE after oncologic surgery remains high with an overall incidence of 2.3%, and this risk varied according to the cancer type, study region, surgical location, and thromboprophylactic strategy. VTE is associated with increased mortality at the early stage of cancer surgery.	IIIB
56	Qiu, Cecil S., Jordan, Sumanas W., Dorfman, Robert G., Vu, Michael M., Alghoul, Mohammed S. and Kim, John Y. S. Surgical Duration Impacts Venous Thromboembolism Risk in Microsurgical Breast Reconstruction 2018	Nonexperimental	4,782 patients who underwent microsurgical breast reconstruction/ACS NSQIP database	n/a	n/a	VTE risk	Increasing duration of surgery elevates the risk of VTE in microsurgical breast reconstruction. Higher BMI and age heightens this risk. Limiting surgical duration to 11 hours or less can result in a four-fold decrease in VTE risk compared to baseline.	IIIB
56	Li, Junyong, Zhu, Yanbin, Chen, Wei, et al. Incidence and locations of deep venous thrombosis of the lower extremity following surgeries of tibial plateau fractures: a prospective cohort study 2020	Nonexperimental	987 patients undergoing tibial plateau fracture surgery/China	n/a	n/a	Incidence of postoperative DVT	Age >40, general anesthesia, hyponatremia, prolonged surgical time, and elevated D-dimer was associated with postoperative DVT in patients undergoing tibial plateau fracture surgery.	IIIB
57	You, Daniel Z., Krzyzaniak, Halli, Viner, Benny, et al. Thromboembolic complications after surgical fixation of bone metastases: A systematic review 2021	Systematic Review	n/a	n/a	n/a	n/a	Relative to other cancer and orthopedic patients, the VTE rate is extremely high in patients with metastatic bone disease undergoing major orthopedic surgery.	IIIB
58	Salazar Adum, Juan, P., Diaz Quintero, Luis, Fuentes, Harry E., Lind, Benjamin B., Caprini, Joseph A. and Tafur, Alfonso J. Predictors of active cancer thromboembolic outcomes: mortality associated with calf deep vein thrombosis 2017	Nonexperimental	109 patients with active cancer with metastatic disease or treatment with chemotherapy	n/a	n/a	thromboembolic outcomes	Cancer-specific variables (ie, metastasis, gastrointestinal cancer, lung cancer) and smoking predicted mortality among patients with calf DVT in patients with active cancer.	IIIB
59	Graul, Ashley, Latif, Nawar, Zhang, Xiaochen, et al. Incidence of Venous Thromboembolism by Type of Gynecologic Malignancy and Surgical Modality in the National Surgical Quality Improvement Program 2017	Nonexperimental	104,368 patients who underwent gynecologic surgery for malignancy/ACS NSQIP database	n/a	n/a	VTE rate	Patients undergoing surgery for ovarian cancer had the highest rate of VTE of all gynecologic cancer surgery. VTE rates were lower in those who had minimally invasive surgery but higher in those with disseminated disease.	IIIA

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60	Groot, Olivier Q., Ogink, Paul T., Janssen, Stein J., et al. High risk of venous thromboembolism after surgery for long bone metastases: A retrospective study of 682 patients 2018	Nonexperimental	682 patients who underwent surgery for long bone metastases/multi center, Boston	n/a	n/a	VTE risk	The risk of symptomatic 90-day VTE is high in patients undergoing surgery for long bone metastases.	IIIC
61	Aneja, Arun, Jiang, Jimmy J., Cohen-Rosenblum, Anna, et al. Thromboembolic Disease in Patients with Metastatic Femoral Lesions: A Comparison Between Prophylactic Fixation and Fracture Fixation 2017	Nonexperimental	5,579 patients who underwent femoral fixation for femoral metastatic lesions/NIS database	n/a	n/a	postoperative adverse events (VTE, death, pneumonia, MI, stroke, UTI, blood transfusion)	Patients with metastatic femoral disease who undergo prophylactic intramedullary nailing have higher rate of VTE than those who undergo fracture treatment.	IIIB
62	Ruff, Samantha M., Weber, Kathryn T., Khader, Adam, et al. Venous thromboembolism in patients with cancer undergoing surgical exploration 2019	Nonexperimental	128,864 patients who underwent surgery for gastric, pancreatic, colorectal, and gynecologic malignancy/ACS NSQIP database	n/a	n/a	30-day postop VTE	Patients who undergo an operation for malignancy with pre-operative sepsis, disseminated cancer, congestive heart failure, gastric cancer, or pancreatic cancer are more likely to develop a VTE within 30 days of their operation. Of those patients who developed a VTE, approximately one-third occurred after discharge during a 30 day post-operative period. This data supports that further studies are needed to determine the appropriate length of post-operative VTE chemoprophylaxis in patients with cancer.	IIIB
63	Pirkle, Sean, Cook, David J., Kaskovich, Samuel, et al. Comparing Bleeding and Thrombotic Rates in Spine Surgery: An Analysis of 119 888 Patients 2021	Nonexperimental	119,888 patients who underwent elective spine surgery/PearlDiver database	n/a	n/a	bleeding and thrombotic complications	When controlling for patient comorbidity, patients with atrial fibrillation, cancer, or a prior history of thrombotic complications experienced the greatest increased risks of postoperative thrombosis after spine surgery. Further study is necessary to determine optimal prevention strategies for both thrombotic and bleeding complications in spine surgery.	IIIB
64	Aminian, Ali, Andalib, Amin, Khorgami, Zhamak, et al. Who Should Get Extended Thromboprophylaxis After Bariatric Surgery?: A Risk Assessment Tool to Guide Indications for Post-discharge Pharmacoprophylaxis 2017	Nonexperimental	91,963 patients who underwent bariatric surgery/ACS NSQIP database	n/a	n/a	VTE risk	30-day post-discharge VTE incidence in patients who underwent bariatric surgery was 0.29%. Patients continue to be at high risk of VTE post-discharge. Bariatric surgery patients with congestive heart failure, paraplegia, dyspnea at rest, and reoperation are at highest risk.	IIIA

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65	Moussa, Osama, Ardissino, Maddalena, Tang, Alice, et al. Long-term Impact of Bariatric Surgery on Venous Thromboembolic Risk: A Matched Cohort Study 2021	Nonexperimental	8,112 patients with obesity: 4,056 who underwent bariatric surgery matched with nested cohort; England	n/a	n/a	VTE risk	Although the short-term risk of VTE after bariatric surgery in patients with obesity is high, there may be a long-term benefit of lowering VTE risk.	IIIB
66	Kong, Lingde, Meng, Fei, Liu, Zhao and Shen, Yong. Prevalence and risk factors for venous thromboembolism after elective spinal surgery: A meta-analysis 2017	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Advanced age, high BMI, and preoperative elevated D-dimer are significant risk factors for postoperative VTE after spinal surgery.	IIIB
67	Schlick, Cary J. R., Yang, Anthony D., Liu, Jessica Y., Bilimoria, Karl Y., Merkow, Ryan P. and Bentrem, David J. Pre-Operative, Intra-Operative, and Post-Operative Factors Associated with Post-Discharge Venous Thromboembolism Following Colorectal Cancer Resection 2020	Nonexperimental	51,139 patients who underwent colorectal cancer resection/ACS NSQIP database	n/a	n/a	Post-discharge VTE	Patient-specific factors are associated with varying rates of post-discharge VTE. We present the first post-discharge VTE risk calculator designed for use at the time of discharge following colorectal cancer resection.	IIIB
68	Alizadeh, Reza F., Sujatha-Bhaskar, Sarath, Li, Shiri, Stamos, Michael J. and Nguyen, Ninh T. Venous thromboembolism in common laparoscopic abdominal surgical operations 2017	Nonexperimental	750,159 patients who underwent laparoscopic abdominal surgical procedures/ACS NSQIP database	n/a	n/a	VTE risk	Patients undergoing laparoscopic colorectal, bariatric, and esophageal surgical procedures may have higher risk of 30-day post-operative VTE compared to other laparoscopic abdominal operations.	IIIA
69	Yang, Yipei, Li, Ziyue, Liang, Haifeng and Tian, Jing. Association between metabolic syndrome and venous thromboembolism after total joint arthroplasty: a meta-analysis of cohort studies 2020	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Metabolic syndrome might be associated with an increased risk of DVT but not PE after TJA.	IIIB
70	Ikeda, Terumasa, Miyamoto, Hiroshi, Hashimoto, Kazuki and Akagi, Masao. Predictable factors of deep venous thrombosis in patients undergoing spine surgery 2017	Nonexperimental	194 patients undergoing spine surgery/Japan	n/a	n/a	postoperative DVT	Patients undergoing spine surgery who are female, immobile, and have higher preoperative D-dimer levels should have a preoperative doppler ultrasound to detect DVT.	IIIB
71	Malik, Azeem T., Phieffer, Laura S., Ly, Thuan V., Khan, Safdar N., Quatman, Carmen E. and Quatman-Yates, Catherine. Factors Associated With Inability to Bear Weight Following Hip Fracture Surgery: An Analysis of the ACS-NSQIP Hip Fracture Procedure Targeted Database 2019	Nonexperimental	6,404 patients who underwent hip fracture surgery/ACS NSQIP Targeted Hip Fracture database	n/a	n/a	ability to weight-bear POD 1	Patients with significant functional and cognitive comorbidities undergoing surgery for intertrochanteric/subtrochanteric versus nondisplaced femoral neck fractures were less likely to weight-bear immediately after surgery. Providers should identify patients who are at risk for immobility after hip fracture surgery and implement mobility strategies to overcome barriers to early mobilization.	IIIB
72	Shore, Benjamin J., Flaugh, Rachel, Shannon, Brett A., Curran, Patrick and Hogue, Grant. Preoperative Considerations for Teenagers Undergoing Orthopaedic Surgery: VTE Prevention, Mental Health Assessment, Vaping, and Drug Addiction 2021	Literature Review	n/a	n/a	n/a	n/a	VTE prophylaxis should be considered in adolescents over the age of 12, females, patients experience a change in mobility status after surgery, and those with a family history of a clotting disorder.	VA

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73	Tashiro, Jo, Fujii, Manato, Watanabe, Yasuo, et al. Perioperative management of laparoscopic surgery in a patient with protein S deficiency complications: A case report 2019	Case Report	n/a	n/a	n/a	n/a	Patients with protein S deficiency are at risk of developing thrombosis. The case report describes the care of a patient with protein S deficiency undergoing laparoscopic surgery.	VC
74	Takhviji, Vahideh, Zibara, Kazem, Maleki, Asma, et al. A case-control study on factor V Leiden: an independent, gender-dependent risk factor for venous thromboembolism 2021	Nonexperimental	288 patients with factor V Leiden mutation and 288 control cases/single center, Iran	n/a	n/a	VTE	Factor V Leiden mutation and activated protein C resistance abnormality are risk factors for VTE. Phenotypic testing for activated protein C resistance may be performed for patients with VTE.	IIIC
75	Brown, James A., Aranda-Michel, Edgar, Kilic, Arman, et al. Outcomes With Heparin-Induced Thrombocytopenia After Cardiac Surgery 2021	Nonexperimental	11,820 patients undergoing cardiac surgery/single center database, Pennsylvania	n/a	n/a	In-hospital and 30-day mortality	Thromboembolic events occurred in 29.1% of the Heparin-induced thrombocytopenia (HIT) patients compared to 2.9% of non-HIT patients. Heparin-induced thrombocytopenia is highly morbid and potentially lethal.	IIIB
76	Singh D, et al. Genetics of hypercoagulable and Hypocoagulable states. <i>Neurosurgery Clinics</i> . 2018;29(4):493–501	Literature Review	n/a	n/a	n/a	n/a	Reviews the genetics of hypercoagulable states.	VA
77	Bass, Anne R., Zhang, Yi, Mehta, Bella, et al. Periprosthetic Joint Infection Is Associated with an Increased Risk of Venous Thromboembolism Following Revision Total Knee Replacement: An Analysis of Administrative Discharge Data 2021	Nonexperimental	25,441 patients who underwent total knee replacement revision between 1998-2014 (New York Statewide Planning and Research Cooperative System database)	n/a	n/a	VTE risk	The 90-day odds of developing VTE after total knee replacement revision surgery for infection were twice as great as compared to aseptic total knee revision surgery.	IIIB
78	Landisch, Rachel M., Hanson, Sheila J., Cassidy, Laura D., Braun, Kristin, Punzalan, Rowena C. and Gourlay, David M. Evaluation of guidelines for injured children at high risk for venous thromboembolism: A prospective observational study 2017	Nonexperimental	4,061 pediatric trauma patients/Children's Hospital of Wisconsin (trauma thrombosis database)	n/a	n/a	risk of VTE in critically injured children	Clinical factors of the presence of a central venous catheter, inotrope administration, immobilization, and GCS <9 were predictive of VTE. Incorporating VTE prophylaxis guidelines for critically injured children facilitates more accurate risk stratification.	IIIB
79	Hanify, Jennifer M., Dupree, Lori H., Johnson, Donald W. and Ferreira, Jason A. Failure of chemical thromboprophylaxis in critically ill medical and surgical patients with sepsis 2017	Nonexperimental	355 patients admitted to the intensive care unit/single site, US	n/a	n/a	Incidence of VTE and chemical thromboprophylaxis failure in critically ill patients with sepsis	Critically ill patients with sepsis have a higher incidence of VTE. ARDS and higher PEEP was associated with an increased risk of prophylaxis failure.	IIIB
80	Hazeltine, Max D., Guber, Robert D., Buettner, Hannah and Dorfman, Jon D. Venous thromboembolism risk stratification in trauma using the Caprini risk assessment model 2021	Nonexperimental	1279 trauma patients/single site Trauma Registry, Massachusetts	n/a	n/a	VTE	Higher Caprini scores are associated with elevated odds of inpatient VTE within hospitalized trauma patients. The Caprini RAM can be used in the trauma population to stratify risk of VTE.	IIIB

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81	Frank, Brian, Maher, Zoe, Hazelton, Joshua P., et al. Venous thromboembolism after major venous injuries: Competing priorities 2017	Nonexperimental	435 major vascular injury patients	n/a	n/a	VTE	Patients with major vascular injury are at high risk of VTE. Pharmacological prophylaxis should be initiated promptly postoperatively.	IIIB
82	Bronheim, Rachel S., Oermann, Eric K., Cho, Samuel K. and Caridi, John M. Coagulation Profile as a Risk Factor for 30-Day Morbidity and Mortality Following Posterior Lumbar Fusion 2017	Nonexperimental	9,295 patients who underwent posterior lumbar fusion/ACS NSQIP database	n/a	n/a	30-day morbidity and mortality	Abnormal coagulation profile was an independent predictor of morbidity and mortality in patients undergoing posterior lumbar fusion. High INR was an independent risk factor for DVT (OR = 4.8, p = 0.011). Abnormal coagulation should be considered in preoperative risk stratification.	IIIB
83	Fogerty AE. Management of venous thromboembolism in pregnancy. Curr Treat Options Cardiovasc Med 2018; 20(8):69.	Literature Review	n/a	n/a	n/a	n/a	Pregnancy is associated with a 6- to 10-fold higher risk of VTE compared to age-matched women, with risk extending into 6-8 weeks postpartum.	VA
84	Auron, Moises, Duran Castillo, Marina Y. and Garcia, Omar F. D. Perioperative management of pregnant women undergoing nonobstetric surgery 2020	Literature Review	n/a	n/a	n/a	n/a	Perioperative management of pregnant women undergoing nonobstetric surgery should include VTE prophylaxis. Pregnancy is associated with a 6- to 10-fold higher risk of DVT than age-matched women.	VA
85	National Institute for Health and Care Excellence. Venous thromboembolism in over 16s: reducing the risk of hospital-acquired deep vein thrombosis or pulmonary embolism. 2018	Guideline	n/a	n/a	n/a	n/a	Provides guidance on reducing the risk of hospital-acquired DVT or PE.	IVA
85	DailyMed. US National Library of Medicine. <a href="https://dailymed.nlm.nih.gov/dailymed/">https://dailymed.nlm.nih.gov/dailymed/</a> .	Regulatory	n/a	n/a	n/a	n/a	Database of medication package inserts submitted to FDA. Reviewed package inserts for tofacitonab, low molecular weight heparin, low-dose unfractionated heparin, warfarin, factor Xa inhibitors (ie, fondaparinux, rivaroxaban, apixaban), dabigatran, vitamin K antagonists, and aspirin.	n/a
86	Chen, Tai-Li, Lee, Ling-Ling, Huang, Hwei-Kai, et al. Association of Psoriasis With Incident Venous Thromboembolism and Peripheral Vascular Disease: A Systematic Review and Meta-analysis 2021	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Psoriasis and psoriatic conditions (psoriatic arthritis) are associated with an increased risk of VTE and PVD. Meta-analysis results illustrated a significant association of psoriasis with VTE (pooled HR 1.26; 95% CI, 1.08-1.48). Increased risk associated with psoriatic arthritis, women, those in Asia, and those in Europe.	IIIB

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87	Hontscharuk, Rayisa, Alba, Brandon, Manno, Catherine, et al. Perioperative Transgender Hormone Management: Avoiding Venous Thromboembolism and Other Complications 2021	Literature Review	n/a	n/a	n/a	n/a	There is an increased risk of VTE in transgender women as compared to cisgender women; however, the effect size of this difference may be small. Varying preparations of estrogen are used for hormone therapy that have different thrombogenic risk. More research is needed to understand perioperative hormone management in transgender individuals.	VB
88	American College of Obstetricians and Gynecologists (ACOG). Health Care for Transgender and Gender Diverse Individuals: ACOG Committee Opinion, Number 823 2021	Consensus	n/a	n/a	n/a	n/a	Committee opinion on the care of transgender and gender diverse individuals.	IVB
89	Kotamarti VS, Greige N, Heiman AJ, Patel A, Ricci JA. Risk for Venous Thromboembolism in Transgender Patients Undergoing Cross-Sex Hormone Treatment: A Systematic Review. J Sex Med. 2021 Jul;18(7):1280-1291. doi: 10.1016/j.jsxm.2021.04.006. Epub 2021 Jun 16. PMID: 34140253.	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Individuals assigned male at birth undergoing estrogen therapy are at higher risk of VTE compared to patients assigned female at birth undergoing testosterone therapy.	IIIB
90	Khan J, Schmidt RL, Spittal MJ, Goldstein Z, Smock KJ, Greene DN. Venous thrombotic risk in transgender women undergoing estrogen therapy: A systematic review and metaanalysis. Clin Chem. 2019;65:57–66.	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Our analysis indicates that transgender women have similar rates of VTE when compared with cisgender women prescribed estrogen.	IIIB
91	Greco, Patricia S., Bazzi, Ali A., McLean, Karen, et al. Incidence and Timing of Thromboembolic Events in Patients With Ovarian Cancer Undergoing Neoadjuvant Chemotherapy 2017	Nonexperimental	112 patients with ovarian cancer/single site, Michigan	n/a	n/a	VTE timing and rate	Patients receiving neoadjuvant chemotherapy for ovarian cancer before interval debulking surgery are at high risk of VTE.	IIIB
92	Wada, Takeyuki, Fujiwara, Hisataka, Morita, Shinji, Fukagawa, Takeo and Katai, Hitoshi. Incidence of and risk factors for preoperative deep venous thrombosis in patients undergoing gastric cancer surgery 2017	Nonexperimental	976 patients undergoing gastric cancer surgery/single site, Japan	n/a	n/a	DVT	Gastric cancer surgery patients receiving neoadjuvant chemotherapy may be at higher risk of DVT.	IIIB
93	Browne, Clíodhna, Davis, Níall F., Nolan, William J., et al. Neoadjuvant Platinum-Based Chemotherapy is an Independent Predictor for Preoperative Thromboembolic Events in Bladder Cancer Patients Undergoing Radical Cystectomy 2017	Nonexperimental	55 patients undergoing radical cystectomy for muscle invasive bladder cancer/single site, Ireland	n/a	n/a	Perioperative VTE	Neoadjuvant cisplatin-based chemotherapy is a significant predictor for perioperative VTE in patients undergoing radical cystectomy.	IIIC
94	Holubar, Stefan D., Lightner, Amy L., Poylin, Vitaliy, et al. The American Society of Colon and Rectal Surgeons Clinical Practice Guidelines for the Surgical Management of Ulcerative Colitis 2021	Guideline	n/a	n/a	n/a	n/a	Patients being treated for UC with tofacitinib may be at higher risk of venous thromboembolism.	IVB
96	Lee, Feng-You, Chen, Wei-Kung, Chiu, Chun-Hsiang, et al. Increased risk of deep vein thrombosis and pulmonary thromboembolism in patients with aortic aneurysms: A nationwide cohort study 2017	Nonexperimental	16,630 adult patients diagnosed with aortic aneurysm and hospitalized (each AA patient matched to 4 non-AA hospitalized patients)/Taiwan	n/a	n/a	Incidence of VTE	Patients with AAs have a significantly higher overall incidence of VTE. Patients with AA had a 1.88-fold higher risk of developing DVT compared to the general population.	IIIB

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97	Haqqani, Maha H., Levin, Scott R., Kalish, Jeffrey A., et al. High Mortality and Venous Thromboembolism Risk Following Major Penetrating Abdominal Venous Injuries 2021	Nonexperimental	9,984 adult patients with penetrating abdominal injuries/ACS Trauma Quality Program Participant Use File	n/a	n/a	VTE, morbidity and mortality	Survivors of penetrating abdominal trauma should be considered high risk for developing VTE.	IIIB
98	SARS-CoV-2 infection and venous thromboembolism after surgery: an international prospective cohort study 2021	Nonexperimental	128, 013 patients/National Institute for Health Research, UK	n/a	n/a	VTE	Perioperative and recent symptomatic SARS-CoV-2 infection was independently associated with an increased incidence of postoperative VTE.	IIIA
99	Nopp, S, Moik, F, Jilma, B, Pabinger, I, Ay, C. Risk of venous thromboembolism in patients with COVID-19: A systematic review and meta-analysis. Res Pract Thromb Haemost. 2020; 4: 1178– 1191. <a href="https://doi.org/10.1002/rth2.12439">https://doi.org/10.1002/rth2.12439</a>	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	There is a high prevalence of VTE in hospitalized patients with COVID-19, especially in ICU patients.	IIIA
100	Newman, Jared M., Abola, Matthew V., Macpherson, Alexandra, Klika, Alison K., Barsoum, Wael K. and Higuera, Carlos A. ABO Blood Group Is a Predictor for the Development of Venous Thromboembolism After Total Joint Arthroplasty 2017	Nonexperimental	28,025 patients who underwent total joint arthroplasty/Ohio	n/a	n/a	symptomatic VTE	Patients with AB blood group have an increased risk of VTE after TJA.	IIIB
101	Chia, Tze L., Chesney, Tyler R., Isa, David, et al. Thrombocytosis in splenic trauma: In-hospital course and association with venous thromboembolism 2017	Nonexperimental	156 patients with splenic trauma/Canada	n/a	n/a	VTE	Thrombocytosis in splenic trauma is more likely after splenectomy than with spleen preserving strategies. Splenectomy is associated with extreme thrombocytosis, which is associated with an increased risk of VTE.	IIIB
102	Hassenpflug, Matthias, Tjaden, Christin, Hinz, Ulf, et al. Hypercoagulability after distal pancreatectomy: Just meaningless alterations? 2017	Nonexperimental	41 patients who underwent distal pancreatectomy/Germany	n/a	n/a	hypercoagulability	Thrombotic events and hypercoagulability persist for years after distal pancreatectomy with splenectomy.	IIIC
103	Golemi, Iva, Salazar Adum, Juan P., Tafur, Alfonso and Caprini, Joseph. Venous thromboembolism prophylaxis using the Caprini score 2019	Literature Review	n/a	n/a	n/a	n/a	Provides review of VTE including PE and DVT with a focus on risk factors and risk assessment.	VA
104	Lovy, Andrew J., Keswani, Aakash, Beck, Christina, Dowdell, James E. and Parsons, Bradford O. Risk factors for and timing of adverse events after total shoulder arthroplasty 2017	Nonexperimental	5801 patients who underwent total shoulder arthroplasty/ACS NSQIP database	n/a	n/a	risk factors for adverse event and timing of adverse events	Thrombotic adverse event occurred in 14% of the sample. Patients at high risk of complication after total shoulder arthroplasty should be identified preoperatively.	IIIB
105	Krauss, Eugene S., Segal, Ayal, Dengler, Nancy, et al. Implementation and Validation of the 2013 Caprini Score for Risk Stratification of Arthroplasty Patients in the Prevention of Venous Thrombosis 2019	Nonexperimental	1078 patients who underwent total joint arthroplasty/single center, NY	n/a	n/a	postoperative VTE and bleeding	The 2013 Caprini RAM provided a consistent, accurate, and efficacious method for risk stratification and chemoprophylaxis selection for patients undergoing total joint arthroplasty.	IIIB
106	Boylan, Matthew R., Perfetti, Dean C., Kapadia, Bhaveen H., Delanois, Ronald E., Paulino, Carl B. and Mont, Michael A. Venous Thromboembolic Disease in Revision vs Primary Total Knee Arthroplasty 2017	Nonexperimental	225,584 patients who underwent primary or revision TKA/Statewide Planning and Research Cooperative System database (Ohio)	n/a	n/a	venous thromboembolic disease (DVT and PE)	The risk of venous thromboembolic disease was higher for primary TKA compared to revision TKA. Further research is needed to understand the differences in VTE prophylaxis for primary TKA vs revision TKA.	IIIB

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107	Nam, Ji-Hoon, Kim, Dae-Hwan, Yoo, Je-Hyun, Hwang, Ji-Hyo and Chang, Jun-Dong. Does preoperative mechanical prophylaxis have additional effectiveness in preventing postoperative venous thromboembolism in elderly patients with hip fracture?-Retrospective case-control study 2017	Nonexperimental	539 patients aged 70 years or older undergoing hip fracture surgery/Korea	mechanical thromboprophylaxis preoperatively (ICP and GCS)	no mechanical thromboprophylaxis preoperatively	postoperative VTE	Preoperative mechanical prophylaxis may offer additional benefit of preventing postoperative VTE without adding additional risk of bleeding in elderly patients with hip fracture.	IIIB
108	Ahmad, Jamal, Lynch, Mary-Katherine and Maltenfort, Mitchell. Incidence and Risk Factors of Venous Thromboembolism After Orthopaedic Foot and Ankle Surgery 2017	Nonexperimental	2,774 patients who underwent foot or ankle surgery/single center, IL	n/a	n/a	incidence of VTE	Patients undergoing foot and ankle surgery are at lower risk of VTE. Obesity significantly increases the risk of VTE, however.	IIIC
109	McKenna, Nicholas P., Behm, Kevin T., Ubl, Daniel S., et al. Analysis of Postoperative Venous Thromboembolism in Patients With Chronic Ulcerative Colitis: Is It the Disease or the Operation? 2017	Nonexperimental	18,833 patients with chronic ulcerative colitis and non-IBD undergoing colorectal resections/ACS NSQIP database	n/a	n/a	postoperative VTE within 30-days after surgery	The highest VTE risk factors in patients with chronic ulcerative colitis are emergency surgery and surgery type (subtotal colectomy or total proctocolectomy).	IIIB
110	Thadanipon, Kunlawat, Thakkinstian, Ammarin, Insin, Putsarat, et al. Prevention of venous thromboembolism in gynecological cancer patients undergoing major abdominopelvic surgery: A systematic review and network meta-analysis 2021	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	The results showed that SCD with LMWH represented the preferred strategy in terms of efficacy and safety. However, not one prophylactic strategy could be considered superior in all aspects.	IB
111	McKenna, Nicholas P., Bews, Katherine A., Behm, Kevin T., Mathis, Kellie L., Lightner, Amy L. and Habermann, Elizabeth B. Do Patients With Inflammatory Bowel Disease Have a Higher Postoperative Risk of Venous Thromboembolism or Do They Undergo More High-risk Operations? 2020	Nonexperimental	231,718 patients with Crohn's disease, ulcerative colitis, malignancy, or benign diverticular disease undergoing major abdominal surgery/ACS NSQIP database	n/a	n/a	postoperative VTE	Postoperative VTE risk varies based on operation performed and an underlying IBD diagnosis of CD or UC does not influence VTE risk.	IIIB
112	Pranata, Raymond, Vania, Rachel, Deka, Hadrian, et al. The use of intermittent pneumatic compression to prevent venous thromboembolism in neurosurgical patients-A systematic review and meta-analysis 2020	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Intermittent pneumatic compression was associated with a reduction in the incidence of VTE in neurosurgical patients.	IIIB
113	van Adrichem, Raymond A., Nemeth, Banne, Algra, Ale, et al. Thromboprophylaxis after knee arthroscopy and lower-leg casting. 2017	RCT	1543 (POT-KAST) and 1519 (POT-CAST) patients undergoing knee arthroscopy and lower leg cast	LMWH with casting	No LMWH with casting	VTE	LMWH is not effective in reducing VTE in patients with lower leg cast.	IB
114	Murphy, Patrick B., Vogt, Kelly N., Lau, Brandyn D., et al. Venous Thromboembolism Prevention in Emergency General Surgery: A Review 2018	Literature Review	n/a	n/a	n/a	n/a	Emergency general surgery patients are at a comparatively high risk of VTE. Best practices for this population include assessment of VTE risk, optimal prophylaxis, and physician, nurse, and patient education regarding the use of mechanical and pharmacologic VTE prophylaxis.	VA



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115	Matthay, Zachary A., Sanders, Katherine, Smith, Eric J., et al. Risk Factors for Venous Thromboembolism after Vascular Surgery and Implications for Chemoprophylaxis Strategies 2021	Nonexperimental	1,449 patients who underwent major vascular surgery/single center, California	n/a	n/a	rate of VTE	Caprini scores can risk stratify development of VTE in patients undergoing major vascular surgery.	IIIB
116	Nielsen, Alexander W., Helm, Melissa C., Kindel, Tammy, et al. Perioperative bleeding and blood transfusion are major risk factors for venous thromboembolism following bariatric surgery 2018	Nonexperimental	59,041 patients who underwent bariatric surgery/ACS NSQIP database	n/a	n/a	VTE risk	Patients who underwent bariatric surgery and receive blood transfusions as a result of perioperative bleeding are at significantly higher risk for VTE.	IIIB
117	Zan, P., Fan, L., Yang, D., et al. Release of the tourniquet immediately after the implantation of the components reduces the incidence of deep vein thrombosis after primary total knee arthroplasty 2017	Quasi-experimental	396 patients undergoing primary total knee arthroplasty/single center, China	early release of tourniquet	late release of tourniquet	Incidence of DVT	Early release of tourniquet after implantation of components during primary TKA may reduce the risk of DVT without increasing the rate of other complications.	IIC
118	Durand, Madeleine, Sinyavskaya, Liliya, Jin, Yu L., Tremblay, CÃ©cile L., Ducruet, Thierry and Laskine, Mikhael. Incidence of Venous Thromboembolism in Patients Living with HIV: A Cohort Study 2019	Nonexperimental	3820 HIV-positive and 16,074 HIV-negative participants/administrative health care database of the province of Quebec (RAMQ database), Canada	n/a	n/a	Risk of VTE	HIV infection was associated with increased risk of VTE, even after adjusting for confounding variables. Medical practitioners should be aware of this association.	IIIC
119	Pahlkotter, Maranda K., Mohidul, Shalwa, Moen, Micaela R., et al. BMI and VTE Risk in Emergency General Surgery, Does Size Matter?: An ACS-NSQIP Database Analysis 2020	Nonexperimental	83,272 patients who underwent emergency general surgery/ACS NSQIP database	n/a	n/a	incidence of VTE	Obese and underweight patients who underwent emergency general surgery had an increased incidence of VTE.	IIIB
120	Parkin, Lianne, Balkwill, Angela, Sweetland, Sian, et al. Antidepressants, Depression, and Venous Thromboembolism Risk: Large Prospective Study of UK Women 2017	Nonexperimental	734,092 women/United Kingdom	n/a	n/a	risk of VTE	Use of antidepressants is associated with an increased risk of VTE in UK women.	IIIA
121	Gangaraju, Radhika, Chen, Yanjun, Hageman, Lindsey, et al. Venous Thromboembolism in Autologous Blood or Marrow Transplantation Survivors: A Report from the Blood or Marrow Transplant Survivor Study 2019	Nonexperimental	820 autologous bone marrow transplant survivors and 644 siblings/Blood or Marrow Transplant Survivor Study database, Alabama and Minnesota	n/a	n/a	late-occurring VTE	Data indicate that autologous BMT survivors are at an elevated risk of developing late-occurring VTE. The development of risk prediction models to identify autologous BMT survivors at greatest risk for VTE and thromboprophylaxis may help decrease the morbidity and mortality associated with VTE.	IIIC
122	Yorkgitis, Brian K., Olufajo, Olubode A., Metcalfe, David, et al. Do Transferred Patients Increase the Risk of Venous Thromboembolism in Trauma Centers? 2017	Nonexperimental	736,274 trauma patients/National Trauma Database	n/a	n/a	VTE	Patients transferred to trauma centers after initial stabilization are at increased risk of developing VTE compared to patients admitted directly to trauma centers.	IIIB

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123	Pannucci, Christopher J., Swistun, Lukasz, MacDonald, John K., Henke, Peter K. and Brooke, Benjamin S. Individualized Venous Thromboembolism Risk Stratification Using the 2005 Caprini Score to Identify the Benefits and Harms of Chemoprophylaxis in Surgical Patients: A Meta-analysis 2017	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Individualized risk stratification using a Caprini score can identify a 14-fold variation in VTE risk among the larger group of surgical patients. Patients with Caprini scores of 7 to 8 and >8 have a demonstrable and significant VTE risk reduction when chemoprophylaxis is provided, without significant increase in bleeding. Patients with Caprini scores of <=6, which includes ~75% of surgical patients, have an unfavorable or unknown risk/benefit relationship. Routine provision of chemoprophylaxis may be unnecessary for these patients. A precision medicine approach to VTE risk stratification and prevention in surgical patients is justified.	IIIB
124	Cronin, MaryAnne, Dengler, Nancy, Krauss, Eugene S., et al. Completion of the Updated Caprini Risk Assessment Model (2013 Version) 2019	Literature Review	n/a	n/a	n/a	n/a	The Caprini RAM is a dynamic tool, requiring ongoing evaluation of the patient during their hospital course and the postoperative recovery period. Changes in clinical status could result in a change in the score, thereby resulting in a new score and potentially a revised treatment option. The 2013 Caprini scoring system provides a consistent, accurate, and efficacious method for risk stratification and selection of prophylaxis.	VB
125	Fuentes HE, Paz LH, Al-Ogaili A, Andrade XA, Oramas DM, Salazar-Adum JP, Diaz-Quintero L, Acob C, Tafur A, Caprini J. Validation of a Patient-Completed Caprini Risk Score for Venous Thromboembolism Risk Assessment. TH Open. 2017 Oct 20;1(2):e106-e112. doi: 10.1055/s-0037-1607339. PMID: 31249916; PMCID: PMC6524847.	Quasi-experimental	42 patients admitted to medical and surgical units/single center, Illinois	patient completed Caprini score	physician completed Caprini score	score accuracy	Patient-completed Caprini risk score for VTE risk assessment using a patient friendly form has excellent agreement with the physician-completed form.	IIB
126	Pannucci CJ, Fleming KI. Comparison of face-to-face interaction and the electronic medical record for venous thromboembolism risk stratification using the 2005 Caprini score. J Vasc Surg Venous Lymphat Disord. 2018 May;6(3):304-311. doi: 10.1016/j.jvsv.2017.10.016. Epub 2018 Feb 13. PMID: 29452956.	Quasi-experimental	536 patients (EMR review) and 207 patients (face-to-face) undergoing plastic or reconstructive surgery/Utah	Caprini scoring with face-to-face interaction and EMR review	Caprini scoring with EMR review only	Accuracy of Caprini VTE risk stratification	Electronic medical record review used without face-to-face interaction may miss key VTE risk factors.	IIB

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127	Mlaver, E., Lynde, G. C., Gallion, C., Sweeney, J. F. and Sharma, J. Development of a Novel Preoperative Venous Thromboembolism Risk Assessment Model 2020	Nonexperimental	18 patients with VTE and 171 case controls/ACS NSQIP database	n/a	n/a	predictive modeling of novel COBRA VTE risk stratification tool	The novel VTE risk stratification tool (COBRA) accurately predicted VTE within the sample population. Cancer, older age (>=60), high BMI (>=30), Black race, and ASA PS were identified as having the greatest statistical discrimination between high-risk and low-risk patients.	IIIB
128	Kunutsor, Setor K., Beswick, Andrew D., Whitehouse, Michael R. and Blom, Ashley W. Systematic review of risk prediction scores for venous thromboembolism following joint replacement 2018	Systematic Review	n/a	n/a	n/a	n/a	Few risk assessment models for VTE exist for lower limb joint replacement. These have methodological issues, have been inadequately reported, not been sufficiently validated, and their impact on patient outcomes and decision making is unknown.	IIIB
129	Lobastov K, Barinov V, Schastlivtsev I, Laberko L, Rodoman G, Boyarintsev V. Validation of the Caprini risk assessment model for venous thromboembolism in high-risk surgical patients in the background of standard prophylaxis. J Vasc Surg. 2016;4(2):153-160.	Nonexperimental	140 patients who underwent major surgery for general surgical or neurosurgical conditions/ Russia	n/a	n/a	Caprini risk score and DVT incidence	Caprini risk score correlated with DVT development in high risk surgical patients.	IIIB
130	Pannucci CJ, Barta RJ, Portschy PR, et al. Assessment of postoperative venous thromboembolism risk in plastic surgery patients using the 2005 and 2010 Caprini risk score. Plast Reconstr Surg. 2012;130(2):343-353.	Nonexperimental	3334 patients who underwent plastic surgery/ 4 tertiary care hospitals, United States	n/a	n/a	Caprini risk score using the 2005 and 2010 models, DVT incidence	The 2005 Caprini Risk Assessment Model provided superior risk stratification in plastic surgery patients.	IIIB
131	Obi AT, Pannucci CJ, Nackashi A et al (2015) Validation of the Caprini venous thromboembolism risk assessment model in critically ill surgical patients. JAMA Surg 150(10):941–948. <a href="https://doi.org/10.1001/jamasurg.2015.1841">https://doi.org/10.1001/jamasurg.2015.1841</a>	Nonexperimental	4844 adult patients admitted to a surgical intensive care unit/single site, Michigan	n/a	n/a	VTE	The Caprini VTE risk assessment model is valid. This study supports the use of individual risk assessment in critically ill surgical patients.	IIIB
132	Stroud W, Whitworth JM, Miklic M, et al. Validation of a venous thromboembolism risk assessment model in gynecologic oncology. Gynecol Oncol. 2014;134(1):160-163.	Nonexperimental	1123 gynecologic oncology patients/US	n/a	n/a	Caprini RAM, VTE	The use of the Caprini RAM accurately predicted patients at the highest risk of experiencing VTE.	IIIB
133	Lu, Xiuying, Zeng, Weirong, Zhu, Lin, Liu, Lu, Yang, Qing and Du, Fengmei. Application of the Caprini risk assessment model for deep vein thrombosis among patients undergoing laparoscopic surgery for colorectal cancer 2021	Nonexperimental	148 patients undergoing laparoscopic colorectal cancer surgery/single site, China	n/a	n/a	DVT	The Caprini risk assessment model can be used for the prediction of venous thromboembolism in laparoscopic colorectal cancer surgery patients.	IIIB
134	Tsaplin S, Schastlivtsev I, Zhuravlev S, Barinov V, Lobastov K, Caprini JA. The original and modified Caprini score equally predicts venous thromboembolism in COVID-19 patients. J Vasc Surg Venous Lymphat Disord. 2021 Nov;9(6):1371-1381.e4. doi: 10.1016/j.jvsv.2021.02.018. Epub 2021 Mar 17. PMID: 33744497; PMCID: PMC7965848.	Nonexperimental	168 patients admitted to the hospital with a diagnosis of COVID-19/single site, Russia	n/a	n/a	Caprini score, VTE	This study identifies a significant correlation between the Caprini score and the risk of VTE in patients with COVID-19.	IIIB

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135	Hazeltine MD, Scott EM, Dorfman JD. An abbreviated Caprini model for VTE risk assessment in trauma. <i>J Thromb Thrombolysis</i> . 2021 Nov 20. doi: 10.1007/s11239-021-02611-3. Epub ahead of print. PMID: 34800259.	Nonexperimental	1279 trauma patients/single site Trauma Registry, Massachusetts	n/a	n/a	VTE	The abbreviated Caprini RAM performs with similar discriminatory ability to the original Caprini RAM in trauma patients. Its use may increase workflow efficiency and reduce variability. Future research is needed for further validation in other surgical populations.	IIIB
136	Pannucci CJ, Laird S, Dimick JB, Campbell DA, Henke PK. A validated risk model to predict 90-day VTE events in postsurgical patients. <i>Chest</i> . 2014;145(3):567-573.	Nonexperimental	10,344 surgical patients/ Michigan Surgical Quality Collaborative, United States	n/a	n/a	90-day postop VTE rate	A 7-factor VTE risk model was created and validated in surgical patients. The model identified an 18-fold variation in VTE risk for surgical patients.	IIIA
137	Pannucci CJ, Basta MN, Fischer JP, Kovach SJ. Creation and validation of a condition-specific venous thromboembolism risk assessment tool for ventral hernia repair. <i>Surgery</i> . 2015;158(5):1304-1313.	Nonexperimental	113,873 hernia repair patients/ ACS-NSQIP database, United States	n/a	n/a	30-day VTE (DVT, PE), 30-day complications	A 14-factor, weighted risk assessment model was created and validated for ventral hernia repair patients, which also can be used to stratify risk for 30-day complications and mortality.	IIIA
138	Nemeth, Banne, Nelissen, Rob, Arya, Roopen and Cannegieter, Suzanne. Preventing VTE following total hip and knee arthroplasty: Is prediction the future? 2021	Literature Review	n/a	n/a	n/a	n/a	There is an urgent need for a well-performing and validated prediction model for VTE risk. The model needs to be user friendly to successfully implement its use in clinical practice, the number of predictors should therefore be kept to a minimum while maintaining good performance. This balance between usability in clinical practice and optimal model performance is challenging: too many predictors will scare off potential users, whereas a limited number of predictors can hamper model performance.	VB
139	Veith J, Collier W, Rockwell WB, Pannucci C. Direct Comparison of Patient-completed and Physician-completed Caprini Scores for Plastic Surgery Patients. <i>Plast Reconstr Surg Glob Open</i> . 2019 Aug 8;7(8):e2363. doi: 10.1097/GOX.0000000000002363. PMID: 31592033; PMCID: PMC6756651.	Quasi-experimental	50 patients undergoing plastic surgery/two centers, Utah	patient completed Caprini score	physician completed Caprini score	score accuracy	Patient completed Caprini scores should be validated by the physician to ensure accuracy and appropriate risk stratification.	IIIB
140	Bartlett, Matthew A., Mauck, Karen F., Stephenson, Christopher R., Ganesh, Ravindra and Daniels, Paul R. Perioperative Venous Thromboembolism Prophylaxis 2020	Literature Review	n/a	n/a	n/a	n/a	The authors conclude that perioperative VTE risk can be reduced but not eliminated. Perioperative risk stratification is critical to identify the optimal VTE prophylaxis.	VA
141	Guideline for team communication. In: <i>Guidelines for Perioperative Practice</i> . Denver, CO: AORN, Inc; 2022:155–186.	guideline	n/a	n/a	n/a	n/a	Provides guidelines for clinical perioperative practice related to team communication.	IVA

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142	Farrow, Norma E., Aboagye, Jonathan K., Lau, Brandyn D., et al. The role of extended/outpatient venous thromboembolism prophylaxis after abdominal surgery for cancer or inflammatory bowel disease 2018	Nonexperimental	489 patients who underwent abdominal surgery for cancer or inflammatory bowel disease/ACS NSQIP database from two institutions, MD and MA	n/a	n/a	VTE and bleeding within 30 days after discharge	Extended prophylaxis likely prevents postdischarge VTE after major abdominal surgery without an increased risk of bleeding.	IIIB
143	Burlingame, Byron L., Conner, Ramona. Guideline for Medication Safety 2021	Guideline	n/a	n/a	n/a	n/a	Provides perioperative nursing guidance for medication safety.	IVB
144	Miesbach, Wolfgang. Perioperative management for patients with von Willebrand disease: Defining the optimal approach 2020	Literature Review	n/a	n/a	n/a	n/a	von Willebrand disease (VWD) is the most common genetic bleeding disorder. There is a lack of evidence to guide optimal treatment for patients with VWD during the perioperative period.	VB
145	Balk, Ethan M., Ellis, Alexandra G., Di, Mengyang, Adam, Gaelen P. and Trikalinos, Thomas A. Venous Thromboembolism Prophylaxis in Major Orthopedic Surgery: Systematic Review Update 2017	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	There is insufficient evidence on comparative effectiveness and harms of thromboprophylaxis interventions after major orthopedic surgery. Further research is needed.	IIA
146	Shalhoub, Joseph, Lawton, Rebecca, Dhillon, Karen, et al. Graduated compression stockings as adjuvant to pharmaco-thromboprophylaxis in elective surgical patients (GAPS study): Randomised controlled trial 2020	RCT	1905 adult patients undergoing elective surgery and at moderate or high risk for DVT/UK	LMWH only	LMWH and graduated compression stockings	VTE rate	Low molecular weight heparin pharmacothromboprophylaxis alone is non-inferior to a combination of pharmacothromboprophylaxis and graduated compression stockings for moderate and high risk elective surgery patients. GCS may be unnecessary for most elective surgical patients.	IB
147	Sachdeva A, Dalton M, Lees T. Graduated compression stockings for prevention of deep vein thrombosis. Cochrane Database Syst Rev. 2018 Nov 3;11(11):CD001484. doi: 10.1002/14651858.CD001484.pub4. PMID: 30390397; PMCID: PMC6477662.	Systematic Review	n/a	n/a	n/a	n/a	High quality evidence demonstrates that GCS are effective in reducing the overall risk of developing DVTs	IA
148	Tan, Bo, Xiao, Chengwei, Cheng, Ming, et al. A systematic review and meta-analysis of elastic stockings for prevention of thrombosis after orthopedic surgery 2021	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	Elastic stockings have a preventive effect on DVT in patients undergoing ankle surgery, but not in patients undergoing lumbar, knee, or spinal surgery. It is necessary to combine anticoagulants with other physical therapies to prevent DVT.	IC
149	Machin, M., Younan, H. C., Smith, S., Salim, Safa, Davies, A. H. and Shalhoub, J. Systematic review on the benefit of graduated compression stockings in the prevention of venous thromboembolism in low-risk surgical patients 2021	Systematic Review	n/a	n/a	n/a	n/a	There is a lack of evidence relating to the use of graduated compression stockings in the prevention of VTE for low-risk surgical patients.	IB
150	American Society for Metabolic and Bariatric Surgery Clinical Issues Committee. ASMBS updated position statement on prophylactic measures to reduce the risk of venous thromboembolism in bariatric surgery patients 2013	Position Statement	n/a	n/a	n/a	n/a	Position statement on reducing VTE in patients undergoing bariatric surgery.	IVC

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151	Gordon, Ronald J., Lombard, Frederick W. Perioperative Venous Thromboembolism: A Review 2017	Literature Review	n/a	n/a	n/a	n/a	The first line of defense in VTE prevention should always be minimization of the period of nonpulsatile flow, which may be accomplished by (i) preinduction and prolonged utilization of portable ICDs, (ii) early ambulation following surgery, and (iii) regularly scheduled foot and calf exercises, at least every 2 hours.	VB
152	Cahn, Julie, Wood, Amber. Guideline for Sterile Technique 2021	Guideline	n/a	n/a	n/a	n/a	Provides perioperative nursing guidance for sterile technique.	IVA
153	Kwak, Hong S., Cho, Jai H., Kim, Jung T., Yoo, Jeong J. and Kim, Hee J. Intermittent Pneumatic Compression for the Prevention of Venous Thromboembolism after Total Hip Arthroplasty 2017	Nonexperimental	379 patients who underwent hip surgery/South Korea	Low-dose ASA and IPC	Low-dose ASA and no IPC	VTE	IPC may be a safe and useful method for prevention of VTE.	IIIB
154	Guideline for prevention of perioperative pressure injury. In: Guidelines for Perioperative Practice. Denver, CO: AORN, Inc; 2022	Guideline	n/a	n/a	n/a	n/a	Provides guidelines for clinical perioperative practice related to prevention of pressure injuries.	IVA
155	Feng, Jian-Ping, Xiong, Yu-Ting, Fan, Zi-Qi, Yan, Li-Jie, Wang, Jing-Yun and Gu, Ze-Juan. Efficacy of intermittent pneumatic compression for venous thromboembolism prophylaxis in patients undergoing gynecologic surgery: A systematic review and meta-analysis 2017	Systematic Review w/ Meta-Analysis	n/a	n/a	n/a	n/a	IPC is effective in reducing DVT complications in gynecologic surgery. IPC is neither superior nor inferior to pharmacological thromboprophylaxis. However, whether combination of IPC and chemoprophylaxis is more effective than IPC or chemoprophylaxis alone remains unknown in this patient population.	IB
156	John PR, Apau OS, Dosi G, Lal,B.K. Intermittent Pneumatic Compression of the Upper Extremity for Postoperative Deep Venous Thrombosis Prophylaxis: a Pilot Randomized Trial 2020	RCT	106 patients vascular and orthopedic surgery patients/single center, Maryland	pneumatic compression device applied to one upper extremity	pneumatic compression devices applied to one or both lower extremities	DVT occurrence within 45 days postoperatively	This pilot study results suggest that upper extremity pneumatic compression is equally effective to lower extremity pneumatic compression in preventing DVT. However, further research is needed to confirm these findings.	IC
157	Swanson, Eric. The Effect of Sequential Compression Devices on Fibrinolysis in Plastic Surgery Outpatients: A Randomized Trial 2020	RCT	50 patients undergoing outpatient plastic surgery with IV anesthesia without paralysis/single center, KS	calf length sequential compression use during surgery	no sequential compression use	tissue plasminogen activator and plasminogen activator inhibitor-1 levels	No significant change in systemic fibrinolytic activity occurs during outpatient plastic surgery under TIV anesthesia. Sequential compression device use did not have an effect on tissue plasminogen activator or plasminogen activator inhibitor-1 levels suggesting no fibrinolytic effect.	IC
158	Fearon, Mary C., Conner, Ramona. Guideline for Minimally Invasive Surgery 2021	Guideline	n/a	n/a	n/a	n/a	Provides perioperative nursing guidance for minimally invasive surgery.	IVA

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159	Maybody M, Taslakian B, Durack JC, et al. Feasibility of intermittent pneumatic compression for venous thromboembolism prophylaxis during magnetic resonance imaging-guided interventions. <i>Eur J Radiol.</i> 2015;84(4):668-670.	Nonexperimental	38 patients undergoing MR-guided ablations/ Single center, US	n/a	n/a	IPC device function	The sleeves and tubing of an intermittent compression device were MR safe, although the control unit was not MR safe. To comply with MRI safety requirements, the control unit was placed in the MR control room and connected to the sleeves using extended tubing. Use of the extended tubing did not cause device failure or interfere with the procedure.	IIIB
160	Haynes, J., Barrack, R. L. and Nam, D. Mobile pump deep vein thrombosis prophylaxis: just say no to drugs 2017	Nonexperimental	Phase 1: 1502 patients, Phase 2: 1641 patients undergoing total hip or knee arthroplasty/single site, US	n/a	n/a	VTE incidence, bleeding	Mobile compression device use was associated with a low incidence of symptomatic VTE and had high patient compliance. Further research is needed to understand the efficacy of mobile compression.	IIIB
161	Crawford, David A., Andrews, Richard L., Morris, Michael J., Hurst, Jason M., Berend, Keith R. and Lombardi, Adolph V. Ambulatory Portable Pneumatic Compression Device as Part of a Multimodal Aspirin-Based Approach in Prevention of Venous Thromboembolism in Outpatient Total Knee Arthroplasty 2020	Nonexperimental	1131 patients who underwent outpatient primary total knee arthroplasty and used a portable pneumatic compression device/single site, Ohio	n/a	n/a	rate of symptomatic VTE	The use of portable pneumatic compression pump as part of a multimodal VTE prophylaxis protocol was associated with a low rate of symptomatic VTE events in patients undergoing outpatient primary TKA.	IIIC
162	Takahashi, Yoshiki, Takahira, Naonobu, Shibuya, Manaka, et al. A portable pneumatic compression device to prevent venous thromboembolism in orthopedic patients with the highest risks of both venous thrombosis and bleeding: A case series study 2020	Nonexperimental	38 patients who underwent lower extremity orthopedic surgery with high VTE and bleeding risk and wore portable pneumatic compression devices/single center, Japan	n/a	n/a	DVT occurrence, patient compliance with wearing portable pneumatic compression devices, hemorrhagic adverse events	In this study, the use of portable pneumatic compression devices was associated with low rates of DVT. The reported compliance rate was 100%, with patients wearing the devices for at least 18 hours per day. The incidence of hemorrhagic adverse events was 21.1% in patients who received anticoagulants and wore an IPCD simultaneously and 0% in patients who wore an IPCD but did not receive anticoagulants. Portable pneumatic compression device use has the potential for safe VTE prophylaxis in patients at high risk for VTE and bleeding.	IIIC
163	Berner, Juan E., Geoghegan, Luke, Kyriazidis, Ioannis, Nanchahal, Jagdeep and Jain, Abhilash. Alternative physical treatments for deep venous thrombosis prophylaxis in surgical patients: a systematic review 2021	Systematic Review	n/a	n/a	n/a	n/a	Alternative physical therapies including electrostimulation, portable automatic pneumatic compression, and manual calf massage have demonstrated a prophylactic benefit in lower limb DVT prevention following surgery. These interventions are only significantly beneficial when used in conjunction with LMWH.	IIB

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164	Obi AT, Alvarez R, Reames BN, et al. A prospective evaluation of standard versus battery-powered sequential compression devices in postsurgical patients. <i>Am J Surg.</i> 2015;209(4):675-681.	RCT	67 general and orthopedic surgery patients/ US	battery-powered intermittent pneumatic compression devices	standard intermittent pneumatic compression devices (stationary plug-in)	patient compliance	Use of portable, battery-operated intermittent pneumatic compression devices significantly increased patient compliance compared to use of stationary devices.	IB
165	Wade, Ros, Paton, Fiona and Woolacott, Nerys. Systematic review of patient preference and adherence to the correct use of graduated compression stockings to prevent deep vein thrombosis in surgical patients 2017	Systematic Review	n/a	n/a	n/a	n/a	Patient adherence was higher with knee length than thigh length stockings in general. Patient adherence likely decreases after discharge. Patients preferred knee length over thigh length stockings.	IIIB
166	Siby, Tessy, Smith, Uniqua and Shajimon, Alice. Eliminating Hospital-Acquired Pressure Injuries Caused by Graduated Compression Stockings 2021	Organizational Experience	GI sarcoma unit/single center, Texas	n/a	n/a	n/a	The EBP highlights the risk of pressure injury versus limited benefit of using graduated compression stockings and pneumatic compression for DVT prevention when other methods are available. This project resulted in reduced patient pressure injury harm from GCS and cost savings.	VB
167	Bowling K, Ratcliffe C, Townsend J, Kirkpatrick U. Clinical thromboembolic deterrent stockings application: Are thromboembolic deterrent stockings in practice matching manufacturers application guidelines. <i>Phlebology.</i> 2015;30(3):200-203.	Nonexperimental	100 legs/ Single center, UK	n/a	n/a	Compliance with manufacturer's instructions for stockings and NICE recommendations	About 20% of stockings were worn incorrectly by patients. Stocking remeasurement was not taking place according to recommendations from NICE. Only 14% of stockings worn by patients had gradation in accordance with the manufacturers' intended compression, and 23% of stockings exerted more pressure at the calf than the ankle, which increases the risk for VTE.	IIIB



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REFERENCE #	CITATION	EVIDENCE TYPE	SAMPLE SIZE/ POPULATION	INTERVENTION(S)	CONTROL/ COMPARISON	OUTCOME MEASURE(S)	CONCLUSION(S)	CONSENSUS SCORE
168	Hinderland MD, Ng A, Paden MH, Stone PA. Lateral leg compartment syndrome caused by ill-fitting compression stocking placed for deep vein thrombosis prophylaxis during surgery: a case report. J Foot Ankle Surg. 2011;50(5):616-619.	Case Report	n/a	n/a	n/a	n/a	Patient developed lateral leg compartment syndrome after ankle surgery in a patient's nonoperative extremity. The authors attributed the compartment syndrome to a graduated compression stocking that was a size too small. The patient complained of severe pain when he awoke from surgery. Removal of the stocking and intermittent pneumatic compression device provided minimal relief of the patient's pain. No defect was found with the pneumatic compression device. The patient was assessed for compartment syndrome; however, the compartment pressures were initially normal. The patient returned 2 days later with severe, increasing pain and underwent surgical decompression fasciotomy.	VB
169	Delos Reyes AP, Partsch H, Mosti G, Obi A, Lurie F. Report from the 2013 meeting of the international compression club on advances and challenges of compression therapy. J Vasc Surg Venous Lymphat Disord. 2014;2(4):469-476.	Expert Opinion	n/a	n/a	n/a	n/a	Recommendations for compression therapy, including mechanical VTE prophylaxis. Elastic bandages should not be used for compression therapy due to inability to control compression pressures.	VA
170	Van Wicklin, Sharon A. Guideline for Positioning the Patient 2021	Guideline	n/a	n/a	n/a	n/a	Provides perioperative nursing guidance for positioning the patient.	IVB
171	Gelder, Chloe, McCallum, Audrey L., Macfarlane, Alan J. R. and Anderson, John H. A systematic review of mechanical thromboprophylaxis in the lithotomy position 2018	Systematic Review	n/a	n/a	n/a	n/a	There is limited evidence to suggest that mechanical prophylaxis modifies the risk of compartment syndrome in the lithotomy position. Thromboprophylaxis should be based upon individual patient and surgical risk factors. Further research is needed to understand the effect of mechanical thromboprophylaxis in the lithotomy position.	IIIA
172	Mandatory reporting requirements: Manufacturers, importers and device user facilities. U.S. Food & Drug Administration, <a href="https://www.fda.gov/medical-devices/postmarket-requirements-devices/mandatory-reporting-requirements-manufacturers-importers-and-device-user-facilities">https://www.fda.gov/medical-devices/postmarket-requirements-devices/mandatory-reporting-requirements-manufacturers-importers-and-device-user-facilities</a>	Regulatory	n/a	n/a	n/a	n/a	Provides mandatory reporting requirements for medical devices	n/a

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173	Wang Z, Chen Q, Ye M, Shi G, Zhang B. Active ankle movement may prevent deep vein thrombosis in patients undergoing lower limb surgery. <i>Ann Vasc Surg.</i> 2016;32:65-72.	RCT	174 patients undergoing lower limb surgery (ie, hip surgery, including arthroplasty; thighbone surgery; knee arthroplasty) at a university-affiliated hospital in China	Active ankle movement for 1-7 days postoperatively (30 times per minute, 20 times per day). Movements included a range of 20° dorsal flexion, 30° varus and valgus, and 40° plantar flexion. (n = 96)	routine nursing care	DVT occurrence up to 6 months postoperatively. Postoperative days 1-7: thigh and calf circumference in supine position with relaxed skeletal muscles; maximum venous outflow, capacity, and outflow ratio as measured by a method using blood pressure cuffs; thrombus as detected by color doppler ultrasound; and DVT occurrence using Chinese diagnostic criteria.	Postoperative active ankle movements after lower extremity surgery significantly reduced the occurrence of thrombus and DVT 1-7 days after surgery; significantly reduced limb circumference on days 5-7; and significantly improved the maximum venous outflow and maximum venous capacity, which may prevent DVT. The 6-month follow-up study (96.6% follow-up rate) found that the active ankle movement group had significantly less occurrence of DVT (p = 0.032).	IB
174	Shimizu, Yukiyo, Kamada, Hiroshi, Sakane, Masataka, et al. A novel exercise device for venous thromboembolism prophylaxis improves venous flow in bed versus ankle movement exercises in healthy volunteers 2017	Quasi-experimental	8 healthy participants	use of novel leg exercise apparatus (LEX) for 1 minute	varying modes of exercise: 1) rapid single motion, 2) slow single motion, 3) slow combined leg motion	venous flow rates	Active ankle movement using the novel LEX may prevent thromboembolism in postoperative and bedridden patients.	IIC
175	Rahemi, Hadi, Chung, Jayar, Hinko, Vanessa, et al. Pilot study evaluating the efficacy of exergaming for the prevention of deep venous thrombosis 2018	Quasi-experimental	15 healthy participants/single institution, Texas	game-based exercises (exergaming)	n/a	femoral blood flow volume; peak and mean systolic velocity	Exergaming increased femoral venous flow volume estimates, peak systolic velocity, and mean systolic velocity by 50%. This effect remained significant 10 minutes after exercise completion. Our pilot data are critical to designing future iterations of exergaming platforms that can use biofeedback so that unsupervised patients can increase femoral venous flow and possibly reduce the risk of VTE, especially in the outpatient setting.	IIC
176	Damle, Aneel, Bauer, Philip S., Atallah, Chady, et al. A Multidisciplinary Ambulation Protocol to Reduce Postoperative Venous Thromboembolism After Colorectal Surgery 2020	Organizational Experience	1762 (pre-intervention) and 253 (post-intervention) patients who underwent colorectal surgery/single center, Missouri	ambulation protocol	pre/post intervention	VTE rate	The implementation of a multidisciplinary ambulation protocol was associated with a decreased rate of VTE in patients undergoing colorectal surgery.	VA
177	Guideline for safe patient handling and movement. In: <i>Guidelines for Perioperative Practice.</i> Denver, CO: AORN, Inc; 2022	Guideline	n/a	n/a	n/a	n/a	Provides guidance for safe patient handling and movement in the perioperative setting.	IVA

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178	Gold, Peter A., Garbarino, Luke J., Heimroth, Jamie C., et al. The Effect of Bladder Catheterization on Ambulation and Venous Thromboembolism Following Total Knee Arthroplasty: An Institutional Analysis 2020	Nonexperimental	9123 patients who underwent primary total knee arthroplasty and had postoperative urinary retention/multi center, NY	n/a	n/a	postoperative ambulation distance, DVT and PE	The use of indwelling catheterization for urinary retention was associated with decreased ambulation distance in postoperative TKA patients. Intermittent catheterization rather than indwelling catheters is recommended to decrease the risk of immobilization.	IIIB
179	Chua, Matthew J., Hart, Andrew J., Mittal, Rajat, Harris, Ian A., Xuan, Wei and Naylor, Justine M. Early mobilisation after total hip or knee arthroplasty: A multicentre prospective observational study 2017	Nonexperimental	1807 adult patients undergoing total hip and total knee arthroplasty/Australia	n/a	n/a	Postoperative mobilization timing	Providers should encourage early mobilization and identify barriers to early mobilization.	IIIB
180	Klaiber, Ulla, Stephan-Paulsen, Lisa, Muller, Gisela, et al. Impact of preoperative patient education on the prevention of postoperative complications after major visceral surgery: The cluster randomized controlled PEDUCAT trial 2018	RCT	111 patients scheduled for elective major visceral surgery/single center, Germany	preoperative education seminar and informational brochure	informational brochure only	30-day postop morbidity and mortality	A preoperative patient education seminar may be beneficial in training both the patients and nursing staff.	IC
181	Nahar, Deepti, Nizam, Aaron, Farrow, Monique, Restifo, Andrea and Nimaroff, Michael. Improving Patient Compliance with Mechanical Venous Thromboembolism Prophylaxis 2018	Quasi-experimental	105 adult women who underwent gynecological surgery via laparotomy incision/single center, NY	preoperative VTE educational pamphlet	no preoperative VTE educational pamphlet	postoperative sequential compression device compliance	Providing a simple preoperative VTE educational pamphlet increases knowledge and compliance with mechanical prophylaxis in the immediate postoperative period after gynecologic surgery.	IIB
182	Serpici, Ayse, Gursoy, Ayla. Nurse-led patient training improves deep vein thrombosis knowledge and self-care practices 2018	Quasi-experimental	40 patients undergoing surgery and DVT prophylaxis/single center, Turkey	nurse-led patient training	pre/post education	Patients' DVT knowledge and self-care practices	The nurse-led DVT prevention training was associated with an increase in the patients' DVT knowledge and self-care practices.	IIB
183	Hajibandeh, Shahab, Hajibandeh, Shahin, Antoniou, George A., Scurr, James R. and Torella, Francesco. Neuromuscular electrical stimulation for the prevention of venous thromboembolism 2017	Systematic Review	n/a	n/a	n/a	n/a	Low-quality evidence shows no clear difference in the risk of DVT between NMES and alternative methods of prophylaxis but suggest that NMES may be associated with lower risk of DVT compared with no prophylaxis (moderate-quality evidence) and higher risk of DVT compared with low-dose heparin (low-quality evidence). The best available evidence about the effectiveness of NMES in the prevention of VTE is not adequately robust to allow definitive conclusions. Adequately powered high-quality randomised controlled trials are required to provide adequately robust evidence.	IIA
184	Horlocker, T. T., Vandermeulen, E., Kopp, S. L., Gogarten, W., Leffert, L. R. and Benzon, H. T. Regional Anesthesia in the Patient Receiving Antithrombotic or Thrombolytic Therapy: American Society of Regional Anesthesia and Pain Medicine Evidence-Based Guidelines (Fourth Edition) 2018	Consensus	n/a	n/a	n/a	n/a	Provides clinical consensus on the management of anticoagulation in the patient receiving regional anesthesia. Clinical decisions should be made on an individual basis.	IVA

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185	Benze, Crissy, Spruce, Lisa and Groah, Linda. Perioperative Nursing: Scope and Standards of Practice 2021	Consensus	n/a	n/a	n/a	n/a	Perioperative nursing standards of practice.	IVB
186	State Operations Manual Appendix L. Guidance for Surveyors: Ambulatory Surgical Centers. 2020	Regulatory	n/a	n/a	n/a	n/a	CMS regulations	n/a
187	State Operations Manual Appendix A. Survey Protocol, Regulations and Interpretive Guidelines for Hospitals 2020	Regulatory	n/a	n/a	n/a	n/a	CMS regulations	n/a
188	Centers for Medicare & Medicaid Services. 42 CFR Part 416: Ambulatory Surgical Services 2006	Regulatory	n/a	n/a	n/a	n/a	CMS regulations	n/a
189	Centers for Medicare & Medicaid Services. 42 CFR Part 482: Medicare and Medicaid Programs; Hospital Conditions of Participation: Requirements for History and Physical Examinations; Authentication of Verbal Orders; Securing Medications; and Postanesthesia Evaluations 2006	Regulatory	n/a	n/a	n/a	n/a	CMS regulations	n/a
Figure 1	Caprini J. Caprini risk score assessment for health professionals. <a href="https://capriniriskscore.org/assessment/">https://capriniriskscore.org/assessment/</a>	Expert Opinion	n/a	n/a	n/a	n/a	Caprini risk score assessment tool.	VA