

Assessing VTE Risk in Ambulatory Surgery Centers

Findings and Recommendations from an Oregon Workgroup

August 2014



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About This Document

In response to requests for resources to reduce the risk of venous thromboembolism (VTE) in ambulatory surgery centers (ASCs), the Oregon Patient Safety Commission convened the *ASC Deep Vein Thrombosis/Venous Thromboembolism (DVT/VTE) Prevention Workgroup*. This short-term workgroup convened in January 2014 and determined that the most critical area in need of support was the risk assessment process, without which, further work on related topics (e.g., prophylaxis, post-operative education) would be challenging. The workgroup developed recommendations to help all Oregon ambulatory surgery centers effectively assess patient risk of VTE.

The workgroup's efforts were guided by the following objectives:

1. Respond to the needs of Oregon ASCs as identified by the Commission's 2013 ASC Impact Survey and by workgroup members
2. Determine the most critical area of opportunity for ASCs related to VTE
3. Review existing literature (including clinical guidelines, toolkits and peer-reviewed publications) to address the identified area of opportunity
4. Recommend an existing guideline or validated tool

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The workgroup identified best practices and opportunities to improve current VTE risk assessment processes related to surgery in Oregon ASCs. The workgroup's review was comprised of four core activities and their subsequent analysis:

1. PubMed literature review
2. Review of three published VTE risk assessment tools
3. Review of specific VTE risk assessment tools and processes currently in use in Oregon
4. Review of VTE-related adverse event data from the Patient Safety Reporting Program

This document captures results from the ASC VTE workgroup and may lead to additional workgroup opportunities to address priority areas such as:

- Work with surgical care providers and staff across healthcare settings to develop VTE prophylaxis recommendations
- Identify and recommend best practices related to patient education that is provided both before and after surgery

Executive Summary

Overview

Venous thromboembolism (VTE) is commonly fatal—an estimated 10-30% of all patients (mostly those with pulmonary embolism) die within 30 days.¹ A patient's quality of life can be adversely affected up to four months after a VTE. "One-third to one-half of lower extremity DVT patients develop post-thrombotic syndrome and chronic venous insufficiency..."²

Estimates for the total annual healthcare cost for VTE range from \$7,594 to \$16,644 per patient.³ A multicenter, prospective study of more than 200,000 outpatient procedures to identify the VTE incidence 30 days after surgery found that the "highest risk" patients "have an almost 20-fold increase in risk of VTE requiring therapy," which is similar to the inpatient surgical population.⁴

Although healthcare professionals are aware of the potential harm from VTE, data from Oregon's Patient Safety Reporting Program indicates that ASCs underestimate the number of potential VTE risk factors in their patients and are not sufficiently assessing the overall level of risk. The Oregon Patient Safety Commission's *ASC DVT/VTE Prevention Workgroup* identified specific challenges to effective VTE risk assessment. Oregon ASCs have several opportunities to standardize and improve VTE assessment.

Key Findings

- ASCs face unique challenges in preventing VTE
- ASCs may not be using validated VTE risk assessment tools or may be invalidating existing tools by changing the included items
- Certain risk factors may change during surgery
- Surveillance methods to identify VTE after surgery yield inconsistent results

- Patient communication impacts VTE
- VTE is not isolated to lower limb surgeries or older patients

Recommendations

After examining the challenges that ASCs face in assessing VTE, the *ASC DVT/VTE Prevention Workgroup* recommends the following steps to improve VTE assessment and patient outcomes:

Evaluate the VTE risk of every patient using a validated risk assessment tool

Use the most recent [Caprini Risk Assessment](#) in its entirety; adding or subtracting items from this assessment will invalidate the tool.

Review and update risk assessment factors that can change during surgery

Identify the factors on the assessment (e.g., length of surgery) that can change and revisit those factors after surgery.

Ensure patients are able to understand the risks associated with VTE and surgery

Explain the purpose of the questions you ask.

Report VTE Incidents to PSRP

Track VTEs using the [Patient Safety Reporting Program's ASC online tool](#).

For more information about the workgroup's research and findings, this document provides:

- Detailed description of findings and recommendations
- Appendix I: Sources including literature review, articles reviewed by the *ASC DVT/VTE Prevention Workgroup*, and references cited in this document
- Appendix II: Review and comparison of VTE risk assessment tools
- Appendix III: National Support for Prevention and Reduction of VTE

¹ Heit, J. A. (2006). The Epidemiology of Venous Thromboembolism in the Community: Implications for Prevention and Management. *Journal of Thrombosis and Thrombolysis*, 21(1), 23-29.

² Beckman, M. G., Hooper, W. C., Critchley, S. E., & Ortel, T. L. (2010). Venous Thromboembolism. *American Journal of Preventive Medicine*, 38(4), S495-S501.

³ Spyropoulos, A. C., & Lin, J. (2007). Direct Medical Costs of Venous Thromboembolism and Subsequent Hospitalization Readmission Rates: An Administrative Claims Analysis. *Journal of Managed Care Pharmacy*, 13(6), 475-86.

⁴ Pannucci, C. J., Shanks, A., Moote, M. J., Bahl, V., Cederna, P. S., Naughton, N. N.,... & Kheterpal, S. (2012). Identifying Patients at High Risk for Venous Thromboembolism Requiring Treatment after Outpatient Surgery. *Annals of Surgery*, 255(6), 1093-1098.

Background

The annual incidence of venous thromboembolism (VTE) in the United States is estimated to be between one and two per 1,000 of the population or 300,000 to 600,000 cases, increasing to about one per 100 people for those over the age of 80.² Venous thromboembolism (VTE) is commonly fatal—an estimated 10-30% of all patients (mostly those with pulmonary embolism) die within 30 days. An estimated 20-25% of all PE cases present as sudden death.¹ Patients' quality of life can be adversely affected up to four months after a DVT. One-third to one-half of lower extremity DVT patients develop post-thrombotic syndrome and chronic venous insufficiency with lifelong conditions characterized by pain, swelling, skin necrosis and ulceration.²

Estimates for the total annual healthcare cost for VTE range from \$7,594 to \$16,644 per patient.³ VTE is not limited to hospitalized patients; about two-thirds of VTE cases occur in outpatients.⁵ A multicenter, prospective study of more than 200,000 outpatient procedures to identify the VTE incidence 30 days after surgery found that out of the 14,559 "high risk" patients identified, "1 of every 250 patients experienced VTE requiring treatment." They observed that the "highest risk" patients "have an almost 20-fold increase in risk of VTE requiring therapy," which is similar to the inpatient surgical population.⁶

VTE risk assessment tools have been developed primarily for use in hospital settings. Assessment tools assign value to patient risk factors with the goal of helping providers make better decisions about appropriate procedural techniques and prophylaxis. Currently, there is not a VTE risk assessment tool designed specifically for the ambulatory surgery center population. Given that the scope of ambulatory surgery continues to expand due to economics and convenience, an increased number of high risk patients are undergoing outpatient surgical procedures that need a VTE risk assessment tool.

VTE is a significant and pressing concern. Federal and national efforts to raise awareness, reduce and prevent incidence have increased. The Center for Disease Control Morbidity and Mortality Weekly Report recently outlined the strategic initiatives being led by the Agency for Health Research and Quality and the Centers for Medicare and Medicaid Services as well as the Joint Commission and the National Quality Forum (a summary of some of this work can be found in Appendix III). Professional organizations such as the Association of periOperative Registered Nurses and the American College of Chest Physicians have also published guidelines for the prevention of VTE.^{7,8}

⁵ Spencer, F. A., Lessard, D., Emery, C., Reed, G., & Goldberg, R. J. (2007). Venous Thromboembolism in the Outpatient Setting. *Archives of Internal Medicine*, 167(14), 1471-1475.

⁶ Pannucci, C. J., Shanks, A., Moote, M. J., Bahl, V., Cederna, P. S., Naughton, N. N.,... & Kheterpal, S. (2012). Identifying Patients at High Risk for Venous Thromboembolism Requiring Treatment after Outpatient Surgery. *Annals of Surgery*, 255(6), 1093-1098.

⁷ Association of periOperative Registered Nurses. (2012). Recommended Practices for Prevention of Deep Vein Thrombosis. In J. Blanchard, B. Burlingame, B. Denholm, S. Giarrizzo-Wilson, M. Ogg, & S. A. Van Wicklin (Eds.), *Perioperative Standards and Recommended Practices for Inpatient and Ambulatory Settings* (pp. 353-363). Denver, CO: AORN, Inc.

⁸ Guyatt, G., Akl, E., Crowther, M., Gutterman, D., Schunemann, H., & Panel, A. C. (2012). Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest*, 141(2), 7S-47S.

VTE in Oregon ASCs

The Oregon Patient Safety Commission has received 52 reports on deep vein thrombosis (DVT) from ambulatory surgery centers between 2007 and April 2014. DVT typically represents 5-10% of the annual ASC adverse event reports submitted to the Commission. The majority (94%) of these reports resulted in serious harm. Serious harm includes permanent harm, any harm requiring a life-saving intervention, or temporary harm requiring a significant intervention. Patient demographics for these reports are unremarkable as compared to the content of the reporting program as a whole, but interesting as compared to known risks for DVT (see Figures 1-3). For example, the majority (81%) of DVTs reported to the Commission were in patients under 60 years of age (see Figure 1), about evenly split male and female (see Figure 2), and who were generally healthy (e.g., ASA class 1; see Figure 3).

Figure 1. Number of DVT Reports by Patient Age Group

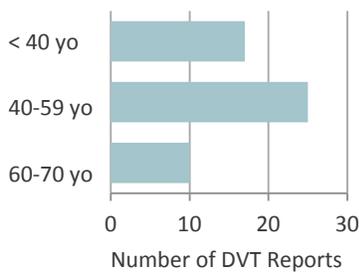


Figure 2. Percent of DVT Reports by Gender

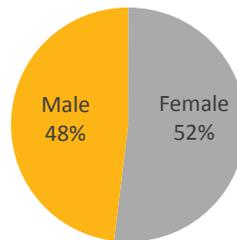
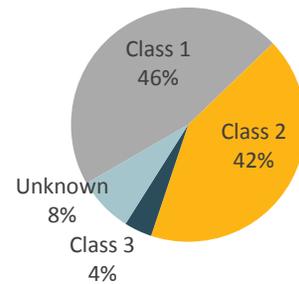


Figure 3. Percent of DVT Reports by ASA Class



DVT reports involved a variety of orthopedic and plastic surgery procedures. Data submitted to the Patient Safety Reporting Program shows a wide variety of patients impacted by DVT—from a healthy, 17 year old

Table 1. DVT Reports by Type of Surgery

Type of surgery	Number	Percent
Orthopedic surgery	41	79%
Lower extremity	31	60%
Upper extremity	10	19%
Plastic surgery	5	10%
Unknown	6	12%
Total	52	

male receiving knee surgery to a 67 year old with severe systemic disease having his rotator cuff repaired. While the Caprini Risk Assessment tool assigns a high risk value to elective hip and knee replacements, those are not the only surgeries where patients are at risk of VTE.⁹ Data from the Patient Safety Reporting Program reported DVTs in other types of procedures (see Table 1).

⁹ Caprini, J. A. (2014). Are You at Risk for DVT? Retrieved from <http://venousdisease.com/dvt-risk-assessment/> on August 20, 2014.

Key Findings

The workgroup's comprehensive review process examined the experience of Oregon ASCs and the available literature on VTE risk assessment. The review was comprised of four core activities:

1. PubMed literature review
2. Review of three published VTE risk assessment tools
3. Review of specific VTE risk assessment tools and processes currently in use in Oregon
4. Review of VTE-related adverse event data from the Patient Safety Reporting Program

The synthesis of these activities with workgroup member experience resulted in key findings that informed the final recommendations.

ASCs Face Unique Challenges in Preventing VTE

ASCs have unique challenges in adapting hospital-based guidelines since the criteria of the type of admissions vary and the skilled level of care they receive before and after surgery are different. ASCs do not perform surgery on high risk patients who require the more intensive care and supervision provided by hospitals, although they are doing more complex surgeries given new technology. ASC patients and their caregivers are in charge of their pre- and post-operative care which makes the need for clear and effective information and instructions for lay people more important.

ASCs May Not Be Using Validated VTE Risk Assessment Tools or May Be Invalidating Existing Tools by Changing the Included Items

Currently available, validated VTE risk assessment tools are designed primarily for use in the hospital setting. Oregon ASCs are adapting these tools for use in the ASC setting, removing items that seem irrelevant to their patient population. For example, ASCs may remove factors from a risk assessment tool that are typically identified in their pre-operative assessment process and which preclude the patient from having surgery at the ASC (e.g., spinal cord injury resulting in paralysis). ASCs may also attempt to reduce a list of risk factors to what the practicing surgeons deem the most essential in an attempt to make the tool quicker to administer. Consequently, adaptations that remove items used in the calculation of a risk score invalidate the tool.

Using Additional Risk Factors

ASCs are considering additional surgical risk factors that are not part of a validated assessment tool. ASCs can and should consider additional factors as needed; however, unless specifically instructed, those factors should not be included in the risk score calculations of validated risk assessment tools. In addition to adapting a validated VTE risk assessment tool by removing items, Oregon ASCs are adding items they consider to be potentially significant risk factors. These additional risk factors include:

- Anticipated post-operative mobility
- Type of anesthesia
- Positioning during surgery
- Tourniquet use
- Tourniquet time
- Dehydration

Some of these items may have been excluded from existing validated assessment tools because they were not found to be independently responsible for additional risk when the tool was created. However, others

may have been excluded due to a lack of evidence for inclusion at the time of validation and publication. The validation process for any kind of assessment tool is limited by the research that was available at the time of validation, which is why tools are often updated and revalidated as new information becomes available. Workgroup members believe the additional potential risk factors identified by Oregon ASCs are important to keep in mind before, during, and after surgery.

Certain Risk Factors May Change During Surgery

Risk scores may be significantly impacted by factors such as length of surgery and method or type of surgery. Scores are often used to determine the kind of prophylaxis the patient will receive postoperatively. The workgroup felt that it was essential to reevaluate risk post-operatively due to these types of changes as they can occur frequently.

Patient Communication Impacts VTE Risk

Patients and their family or friends are responsible for care at home before and after surgery. ASC providers and staff sometimes find communicating about the patient's care and condition to be difficult. Identifying VTE risk before and after surgery and implementing timely prophylaxis becomes highly dependent on how the patient and/or their family communicates with their provider and the ASC before, during, and after surgery.

Surveillance Methods to Identify VTE after Surgery Yield Inconsistent Results

Oregon ASCs struggle to obtain information from the patient and/or provider once they leave the ASC. Many times, patients return to their surgeon's office or primary care physician instead of the ASC for care after surgery. If a patient is diagnosed with VTE after the standard 30-day follow-up period or without the knowledge of the surgeon, information about the adverse event may not be reported back to the ASC.

VTE is Not Isolated to Lower Limb Surgeries or Older Patients

Although patients over 60 years old and those having elective hip or knee joint replacement surgery are at greater risk for VTE, VTE is not isolated to these types of surgeries or patients.⁷ Data from the Commission's Patient Safety Reporting Program reveals that VTE is not isolated to lower limb surgeries or patients over age 60 as commonly assumed. Of the 52 reports of VTE submitted to the Commission by ASCs between 2007 and April 2014, 19% were upper extremity procedures and 90% occurred in patients under 65 years of age. In fact, 33% occurred in patients younger than 40.

Recommendations

Recommendations identify system-level improvements that have the potential to reduce variability and that support evidence-based best practice guidelines to decrease the number of VTE-related adverse events in the ASC setting.

Evaluate the VTE Risk of Every Patient Using a Validated Risk Assessment Tool

Every year, new research expands our understanding of VTE risk. The Centers for Medicare and Medicaid Services' Partnership for Patients recommends that all patients be screened for VTE risk. Implementing a validated risk assessment tool as part of the standard practice for every patient seen reduces dangerous variability between providers and increases the likelihood that high risk patients in ambulatory surgery centers will get the post-operative prophylaxis they need.

The *ASC DVT/VTE Workgroup* recommends that Oregon ASCs use the most recent Caprini Risk Assessment, which can be found online at <http://venousdisease.com/>. This tool covers the best range of risk factors, is regularly updated, widely used, freely available, and easy to administer. For a more detailed discussion of variation among published risk assessment tools, see Appendix II.

ASCs that assess patients for risk factors not included in the Caprini Risk Assessment (e.g., tourniquet time, changes in post-operative mobility) can continue assessing for those factors but should exclude them from the risk score as inclusion invalidates the tool.

A common misconception among physicians is that individual risk assessment takes longer and is more cumbersome than group risk assessment. However, individual assessment can be accomplished with, for example, a simple assessment form that merely captures information from the history and physical examination of the patient.

– J A Caprini, 2010

Implementation Recommendation

ASCs must have leadership support to effectively implement, use, and monitor a standardized assessment tool. This process requires open communication with providers and staff to identify and address perceived barriers to use of the tool. Successful implementation requires that all providers and staff support using the tool to evaluate VTE risk.

Review and Update Risk Assessment Factors that Can Change During Surgery

The *ASC DVT/VTE Workgroup* recommends that ASCs review risk factors that can change during surgery. In particular, after surgery, ASCs should look for any changes such as length of surgery and type of procedure that impact the patient's risk assessment score. This process is particularly critical if the assessment tool is tied to the type of prophylaxis that will be ordered for the patient post-discharge.

Implementation Recommendation

Indicate on the form the fields that may change and should be revisited after surgery. This can reduce the reliance on staff to remember which items may change and will increase the reliability of care.

Ensure Patients Are Able to Understand the Risks Associated with VTE and Surgery

The *ASC DVT/VTE Workgroup* recommends that providers and staff ensure that patients understand what VTE is, what their individual VTE risk factors are, and how following their pre-operative and discharge instructions will help prevent VTE. When interviewing a patient to complete a risk assessment, explain the purpose of the questions you are asking. Patients may provide incomplete information if they do not understand why each question is necessary. For example, a patient awaiting shoulder surgery may not realize that “Family history of blood clots?” also includes family history of stroke. Before a patient leaves the ASC, he or she should be able to “teach back” a basic understanding of what a blood clot is, why it is dangerous, and how following their discharge instructions will help with prevention.¹⁰

Implementation Recommendation

Have patients complete the patient-oriented Caprini Risk Assessment available at www.venousdisease.com prior to their visit and go over the tool with them in the pre-surgical consultation. Doing so will give the patient a chance to look up any terms with which they are unfamiliar and the scoring system will help emphasize which factors carry the highest level of VTE risk.

Report VTE Incidents to the Patient Safety Reporting Program

Staff should use the Oregon Patient Safety Commission’s Patient Safety Reporting Program (PSRP) online tool to track VTE events associated with care received at the ASC (including VTE resulting from known risks or patient noncompliance with discharge instructions). The Patient Safety Reporting Program’s ASC-specific reporting form ensures that the questions asked are appropriate to this unique reporting segment.

Using the online tool provides a confidential, non-discoverable way for PSRP participants to receive individualized feedback from the Commission’s patient safety consultant. In addition, reporting VTE incidence offers organizations a way to share lessons learned, correct underlying system problems, and contribute to a statewide pool of information that can be used to identify themes and facilitate shared learning.

Implementation Recommendation

Contact the Commission to join the [Patient Safety Reporting Program](#) and/or designate a PSRP Manager for your facility.

¹⁰ Agency for Healthcare Research and Quality. (2010). Health Literacy Universal Precautions Toolkit. Retrieved from <http://www.ahrq.gov/professionals/quality-patient-safety/quality-resources/tools/literacy-toolkit/healthliteracytoolkit.pdf> on August 20, 2014.

Appendix I: Annotated Bibliography

Articles and Resources Shared with Workgroup

To support the efforts of the workgroup, Commission staff sought out useful resources through internet searches, a small literature review, and healthcare partners. The resources and articles that were shared with the workgroup are presented in Table 2. Table 3 displays the complete articles reviewed as part of the literature review and is prefaced by a description of the literature review methodology.

Table 2. Articles and Resources Shared with Workgroup

Citation	Annotation	Source
1. Caprini, JA. Thrombotic Risk Assessment: A Hybrid Approach. Modified with permission from CHEST. Chest. 2004;126, 338S-400S.	Review of reasons contributing to underuse of prophylaxis; discusses a “hybrid approach” combining risk assessment scoring with prophylaxis guidelines	Patient Safety Toolkit: Ambulatory Surgery and VTE. Institute for Quality Improvement. (2013) reference list
2. Guyatt, G, Akl, E, Crowther, M, Gutterman, D, Schunemann, H, & Panel, AC. Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest. 2012;141(2 Suppl), 7S-47S.	Emphasis on prophylaxis based on Caprini and Rogers risk assessment scores	Patient Safety Toolkit: Ambulatory Surgery and VTE. Institute for Quality Improvement. (2013) reference list
3. National Quality Forum. (2006). National Voluntary Consensus Standards for Prevention and Care of Venous Thromboembolism: Policy, Preferred Practices, and Initial Performance Measures. Washington, DC: The National Quality Forum.	Framework for the assessment, prevention, diagnosis and treatment of VTE; developed for acute care hospitals, long term care facilities and nursing homes	National Quality Forum website
4. Rogers, S, Kilaru, R, & Hosokawa, P. Multivariable Predictors of Postoperative Venous Thromboembolic Events after General and Vascular Surgery: Results from the Patient Safety in Surgery Study. Journal of the American College of Surgeons. 2007;204(6), 1211–1221.	VTE risk index for surgeons to identify high risk patients pre-operatively and provide timely VTE prophylaxis	American College of Clinical Pharmacy guidelines
5. Patient Safety Toolkit: Ambulatory Surgery and VTE (Venous Thromboembolism) [Internet]. Skokie (IL): AAAHC Institute for Quality Improvement; c2013 [cited 2014 Aug 18]. Available from: http://www.aaahc.org/institute/	Summary of pre-procedure screening, prevention, signs, symptoms and management of VTE in ASCs; includes copy of Caprini Thrombosis Risk Factor Assessment Tool	Google search for ASC and VTE
6. Caprini, JA. Risk assessment as a guide to thrombosis prophylaxis. Current Opinion in Pulmonary Medicine. 2010;16(5), 448-52.	Focus on benefits of individual risk assessment and prophylactic treatments	Literature review

Citation	Annotation	Source
7. Novis, S, Havelka, G, Ostrowski, D, Levin, B, Blum-Eisa, L, Prystowsky, J, & Kibbe, M. Prevention of thromboembolic events in surgical patients through the creation and implementation of a computerized risk assessment program. <i>Journal of Vascular Surgery</i> . 2010;51(3), 648-54.	Describes benefit of using computerized risk assessment program for increased compliance with prophylaxis before surgery	Literature review
8. Pannucci, C, Shanks, A, Moote, M, Bahl, V, Cederna, P, Naughton, N, Kheterpal, S. Identifying patients at high risk for venous thromboembolism requiring treatment after outpatient surgery. <i>Annals of Surgery</i> . 2012;255(6), 1093-9.	Weighted risk index to identify 30-day VTE risk in the outpatient surgery population	Literature review
9. Beckman MG, Hooper WC, Critchley SE, Ortel TL. Venous Thromboembolism – A Public Health Concern. Published by Elsevier Inc. on behalf of American Journal of Preventative Medicine. <i>Am J Prev Med</i> 2010;38 (4S): S495-S501.	Overview of VTE data and statistics	CDC website reference on DVT/PE data and statistics
10. Association of Perioperative Registered Nurses (AORN) 2012 Perioperative Standards and Recommended Practices. <i>Recommended Practices for Prevention of Deep Vein Thrombosis</i> .	Current standards for peri-operative care and prevention of DVT for nurses	Workgroup
11. Venous Thromboembolism Change Package and Checklist [Internet]. Chicago (IL): American Hospital Association, Hospital Engagement Network, Health Research & Educational Trust; c2010 [cited 2014 Aug 18]. Available from: http://hret-hen.org/index.php?option=com_content&view=article&id=9&Itemid=133	Tools for implementation of risk assessment tool and prophylaxis; specific to hospitals but can be adapted to ASC	Oregon Association of Hospitals and Health Systems contact
12. Autar R. (2003). The Management of Deep Venous Thrombosis: the Autar DVT Risk Assessment Scale Re-visited. <i>Journal of Orthopaedic Nursing</i> (2003) 7, 114–124 C 2003	Includes discussion regarding type of anesthesia and thrombosis risk	Workgroup member
13. Anderson FA, Audet AM. Best Practices Preventing Deep Vein Thrombosis and Pulmonary Embolism. A Practical Guide to Evaluation and Improvement. [Internet]. Worcester (MA): Center for Outcomes Research, University of Massachusetts Medical Center; c. 1998 [cited 2014 Aug 20]. Available from: https://www.outcomes-umassmed.org/DVT/PDF/1.pdf	General guidelines for prevention of DVT/PE; may not be completely current	Google search for “best practices for DVT prevention”
14. American Society of Anesthesiologists Committee. Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures: an updated report by the American Society of Anesthesiologists Committee on Standards and Practice Parameters. <i>Anesthesiology</i> [Internet]. 2011 Mar [cited 2014 Aug 21];114(3): 495-511. Available from: https://www.asahq.org/For-Members/Practice-Management/Practice-Parameters.aspx	Current guidelines regarding NPO status from American Society of Anesthesiologists	Workgroup member

Citation	Annotation	Source
15. Caprini, JA. Are You at Risk for DVT? [Internet]. Skokie (IL): Venous Resource Center; c. 2014 [cited 2014 Aug 20]. Available from: https://www.isms.org/uploadedFiles/Main_Site/Content/Resources/Patients/dvt_patient.pdf	Patient-focused version of Caprini risk assessment tool	Dr. Caprini's website – www.venousdisease.com
16. Caprini, JA. Venous Resource Center [Internet]. Skokie (IL): Venous Resource Center; c. 2014 [cited 2014 Aug 20]. Available from: http://venousdisease.com/	Dr. Caprini's website with tools and educational videos for patients and providers	Institute for Quality Improvement's Patient Safety Toolkit: Ambulatory Surgery and VTE handout

Literature Review

In recognition of both time and staffing constraints, Commission staff performed a necessarily limited literature search to identify relevant articles for review. Staff searched PubMed, limiting results to articles published in the last five years, in English, in peer-reviewed journals, and either freely available online, or available through the Oregon State Library. The following search terms were used to generate a list of 4,539 article titles:

- Venous thromboembolism AND prophylaxis
- Venous thromboembolism AND prevention
- Venous thromboembolism AND risk

Staff reviewed each title and identified 213 titles that seemed promising enough to review the abstract. Of those 213 abstracts, 43 articles were fully reviewed (see Table 3). The workgroup agreed that the literature review ought to focus on general surgery guidelines rather than those oriented toward specialty surgery in order to maximize the potential for broad applicability. After review, three articles were selected to share with the workgroup for review and comment (see Table 3). Staff reviewers felt that these articles best met the mission of the workgroup in addressing patient risk assessment in the ambulatory surgery setting.

The literature review identified that there are limited, prospectively validated VTE risk assessment tools available to the healthcare community. Most VTE risk assessment models fell into one of two categories: those that evaluated the individual risks of the patient and those that evaluated risk based on larger groups or categories such as disease or age. The workgroup agreed to review any tools that seemed like good candidates for easy adoption in the ASC setting.

Table 3. Articles Examined in Literature Review

Note: Articles shared with the workgroup appear with an asterisk () before the citation and are repeated in Table 2.*

Citation	Annotation
Assessment	
1. Caprini JA. Identification of patient venous thromboembolism risk across the continuum of care. <i>Clin Appl Thromb Hemost.</i> 2011 Nov-Dec;17(6):590-9.	Suggestions for policies and procedures providers should have in place to prevent VTE
2. Caprini JA. Risk assessment as a guide for the prevention of the many faces of venous thromboembolism. <i>Am J Surg.</i> 2010 Jan;199(1 Suppl):S3-10.	An individualized risk score can be used to determine the type and length of prophylaxis to administer.
3. * Caprini, JA. Risk assessment as a guide to thrombosis prophylaxis. <i>Curr Opin Pulm Med.</i> 2010; 16(5), 448-52.	Focus on benefits of individual risk assessment and prophylactic treatments

Citation	Annotation
4. Iannuzzi JC, Young KC, Kim MJ, Gillespie DL, Monson JR, Fleming FJ. Prediction of post discharge venous thromboembolism using a risk assessment model. <i>J Vasc Surg.</i> 2013 Oct;58(4):1014-20.e1.	Focused on post-discharge risk of VTE, which may be outside the scope of this workgroup
5. Maynard GA, Morris TA, Jenkins IH, Stone S, Lee J, Renvall M, Fink E, Schoenhaus R. Optimizing prevention of hospital-acquired venous thromboembolism (VTE): prospective validation of a VTE risk assessment model. <i>J Hosp Med.</i> 2010 Jan;5(1):10-8.	Development and retrospective validation of a VTE risk assessment tool designed for adult inpatient population
6. * Novis, S, Havelka, G, Ostrowski, D, Levin, B, Blum-Eisa, L, Prystowsky, J, & Kibbe, M. Prevention of thromboembolic events in surgical patients through the creation and implementation of a computerized risk assessment program. <i>J Vasc Surg.</i> 2010;51(3), 648-54.	Describes benefit of using computerized risk assessment program for increased compliance with prophylaxis before surgery
7. Pannucci CJ, Bailey SH, Dreszer G, Fisher Wachtman C, Zumsteg JW, Jaber RM, Hamill JB, Hume KM, Rubin JP, Neligan PC, Kalliainen LK, Hoxworth RE, Pusic AL, Wilkins EG. Validation of the Caprini risk assessment model in plastic and reconstructive surgery patients. <i>J Am Coll Surg.</i> 2011 Jan;212(1):105-12.	Caprini score effectively risk-stratifies plastic and reconstructive surgery patients
8. * Pannucci, C, Shanks, A, Moote, M, Bahl, V, Cederna, P, Naughton, N, Kheterpal, S. Identifying patients at high risk for venous thromboembolism requiring treatment after outpatient surgery. <i>Ann Surg.</i> 2012;255(6), 1093-9.	Weighted risk index to identify 30-day VTE risk in the outpatient surgery population
9. Roberts LN, Porter G, Barker RD, Yorke R, Bonner L, Patel RK, Arya R. Comprehensive VTE prevention program incorporating mandatory risk assessment reduces the incidence of hospital-associated thrombosis. <i>Chest.</i> 2013 Oct;144(4):1276-81. doi: 10.1378/chest.13-0267.	Mandatory VTE risk assessment can significantly reduce preventable hospital-associated thrombosis
10. Schiro TA, Sakowski J, Romanelli RJ, Jukes T, Newman J, Hudnut A, Leonard T. Improving adherence to best-practice guidelines for venous thromboembolism risk assessment and prevention. <i>Am J Health Syst Pharm.</i> 2011 Nov 15;68(22):2184-9.	Combining risk assessment with a nurse case manager trained in anticoagulation improves adherence to VTE guidelines
11. Sepehrvand N, Pakdel FG, Rahimi-Rad MH, Moosavi-Toomatari B, Bazargan-Hejazi S. Practice guidelines and clinical risk assessment models: is it time to reform? <i>BMC Med Inform Decis Mak.</i> 2011 Oct 18;11:63.	Focus on improving guideline adherence – outside the scope of this workgroup
12. Thavarajah D, Wetherill M. Implementing NICE guidelines on risk assessment for venous thromboembolism: failure, success and controversy. <i>Int J Health Care Qual Assur.</i> 2012;25(7):618-24.	Because this study was limited to one facility's orthopedics department, it may not be more broadly applicable
General VTE	
13. Caprini JA. Venous thromboembolism in surgery—a preventable complication. Introduction. <i>Am J Surg.</i> 2010 Jan;199(1 Suppl):S1-2.	Short overview of VTE in surgical patients
Implementation	
14. Maynard G, Stein J. Designing and implementing effective venous thromboembolism prevention protocols: lessons from collaborative efforts. <i>J Thromb Thrombolysis.</i> 2010 Feb;29(2):159-66.	Helpful tips for implementing protocols and monitoring ongoing progress
Prophylaxis - General	
15. Amin AN, Deitelzweig SB. Optimizing the prevention of venous thromboembolism: recent quality initiatives and strategies to drive improvement. <i>Jt Comm J Qual Patient Saf.</i> 2009 Nov;35(11):558-64. Review. PMID:19947332	General focus on prophylaxis, with assessment included as mechanism for improvement

Citation	Annotation
16. Faraj AA. Implementing National Institute of Clinical Excellence guidelines for venous thromboembolism prophylaxis. <i>Am J Med Sci.</i> 2012 Feb;343(2):131-5.	Focused on prophylaxis, but demonstrates a four-fifths reduction in VTE using the NICE guidelines
17. Gaylis FD, Van SJ, Daneshvar MA, Gaylis GM, Gaylis JB, Sheela RB, Stern EJ, Hanson PB, Sur RL. Preprinted standardized orders promote venous thromboembolism prophylaxis compared with traditional handwritten orders: an endorsement of standardized evidence-based practice. <i>Am J Med Qual.</i> 2010 Nov-Dec;25(6):449-56.	Focused on prophylaxis; indicates that standardized orders promote adherence, but also requires more rigorous education
18. Muntz JE, Michota FA. Prevention and management of venous thromboembolism in the surgical patient: options by surgery type and individual patient risk factors. <i>Am J Surg.</i> 2010 Jan;199(1 Suppl):S11-20.	Focused on prophylaxis for specific, individual risk factors
19. Rahman S. Deep vein thrombosis prophylaxis: friend or foe. <i>Am J Ther.</i> 2009 Jul-Aug;16(4):300-3.	Concludes that what is good for the group may not be good for the individual; VTE prophylaxis requires an individualized approach
20. Samama CM, Godier A. Perioperative deep vein thrombosis prevention: what works, what does not work and does it improve outcome? <i>Curr Opin Anaesthesiol.</i> 2011 Apr;24(2):166-70.	Focus on prophylaxis, beyond the scope of this workgroup
Prophylaxis - Mechanical	
21. Caprini JA. Intermittent pneumatic compression and pharmacologic thrombosis prophylaxis. <i>Curr Opin Pulm Med.</i> 2009 Sep;15(5):439-42.	Focus on prophylaxis, beyond the scope of this workgroup
22. Caprini JA. Mechanical methods for thrombosis prophylaxis. <i>Clin Appl Thromb Hemost.</i> 2010 Dec;16(6):668-73.	Focus on prophylaxis, beyond the scope of this workgroup
23. Ryan K, Johnson S. Preventing DVT: a perioperative perspective. <i>J Perioper Pract.</i> 2009 Feb;19(2):55-9. Review.	Focus on prophylaxis, beyond the scope of this workgroup
Prophylaxis - Pharmaceutical	
24. Borris LC. Barriers to the optimal use of anticoagulants after orthopaedic surgery. <i>Arch Orthop Trauma Surg.</i> 2009 Nov;129(11):1441-5.	Focus on prophylaxis, beyond the scope of this workgroup
25. Jaff MR. Chronically anticoagulated patients who need surgery: can low-molecular-weight heparins really be used to bridge" patients instead of intravenous unfractionated heparin?" <i>Catheter Cardiovasc Interv.</i> 2009 Jul 1;74 Suppl 1:S17-21.	Focus on prophylaxis, beyond the scope of this workgroup
26. Squizzato A, Romualdi E, Dentali F, Ageno W. The new oral anticoagulants, do they change the benefit vs. risk for thromboprophylaxis in association to ambulatory surgery? <i>Curr Opin Anaesthesiol.</i> 2010 Dec;23(6):722-5.	Focus on prophylaxis, beyond the scope of this workgroup
Orthopedic Surgery	
27. Eikelboom JW, Karthikeyan G, Fagel N, Hirsh J. American Association of Orthopedic Surgeons and American College of Chest Physicians guidelines for venous thromboembolism prevention in hip and knee arthroplasty differ: what are the implications for clinicians and patients? <i>Chest.</i> 2009 Feb;135(2):513-20.	Recommends the use of American College of Chest Physicians guidelines over the American Association of Orthopedic Surgeons guidelines
28. Maletis GB, Inacio MC, Reynolds S, Funahashi TT. Incidence of symptomatic venous thromboembolism after elective knee arthroscopy. <i>J Bone Joint Surg Am.</i> 2012 Apr 18;94(8):714-20.	Incidence study unrelated to risk assessment

Citation	Annotation
29. Mirkazemi C, Bereznicki LR, Peterson GM. Are the national orthopaedic thromboprophylaxis guidelines appropriate? ANZ J Surg. 2012 Dec;82(12):913-7.	Focus on Australian prophylaxis guidelines puts it outside the scope of this workgroup
Plastic Surgery	
30. Miszkiewicz K, Perreault I, Landes G, Harris PG, Sampalis JS, Dionyssopoulos A, Nikolis A. Venous thromboembolism in plastic surgery: incidence, current practice and recommendations. J Plast Reconstr Aesthet Surg. 2009 May;62(5):580-8.	Focus on plastic surgery is too narrow for the purposes of this group
31. Murphy RX Jr, Alderman A, Gutowski K, Kerrigan C, Rosolowski K, Schechter L, Schmitz D, Wilkins E. Evidence-based practices for thromboembolism prevention: summary of the ASPS Venous Thromboembolism Task Force Report. Plast Reconstr Surg. 2012 Jul;130(1):168e-175e.	Three recommendations for plastic surgery using the 2005 Caprini Risk Assessment Module
32. Pannucci CJ, Barta RJ, Portschy PR, Dreszer G, Hoxworth RE, Kalliainen LK, Wilkins EG. Assessment of postoperative venous thromboembolism risk in plastic surgery patients using the 2005 and 2010 Caprini Risk score. Plast Reconstr Surg. 2012 Aug;130(2):343-53.	Focus on plastic surgery is too narrow for the purposes of this group
Risk Factors	
33. Rott H. Thrombotic risks of oral contraceptives. Curr Opin Obstet Gynecol. 2012 Aug;24(4):235-40.	Certain kinds of oral contraceptives are associated with lower risk for VTE
34. Shapiro S, Dinger J. Risk of venous thromboembolism among users of oral contraceptives: a review of two recently published studies. J Fam Plann Reprod Health Care. 2010 Jan;36(1):33-8.	Oral contraceptives are associated with risk of VTE, but level of risk depends on dose and duration of use
35. Smith R, Wood E. BET 4: quantifying the risk of venous thromboembolism for temporary lower limb immobilisation in ambulatory patients. Emerg Med J. 2012 Sep;29(9):779-80.	Focus on ambulatory patients, but does indicate incidence of VTE in immobilized patients following isolated lower limb trauma of 11%
36. Sweetland S, Green J, Liu B, Berrington de González A, Canonico M, Reeves G, Beral V; Million Women Study collaborators. Duration and magnitude of the postoperative risk of venous thromboembolism in middle aged women: prospective cohort study. BMJ. 2009 Dec 3;339:b4583.	Large prospective study; revealed the risk of DVT/PE increased substantially in first 12 weeks post-op and varies by type of surgery; inpatient surgery associated with higher risk than day surgery
37. Wong P, Baglin T. Epidemiology, risk factors and sequelae of venous thromboembolism. Phlebology. 2012;27 Suppl 2:2-11.	Overview of VTE
38. Zhu T, Martinez I, Emmerich J. Venous thromboembolism: risk factors for recurrence. Arterioscler Thromb Vasc Biol. 2009 Mar;29(3):298-310.	Intrinsic risk factors are associated with higher risk of VTE recurrence than transient risk factors
VTE in Bariatric Patients	
39. Pryor HI 2nd, Singleton A, Lin E, Lin P, Vaziri K. Practice patterns in high-risk bariatric venous thromboembolism prophylaxis. Surg Endosc. 2013 Mar;27(3):843-8.	Variability in practice patterns, especially risk assessment, leads to variability in VTE rates
VTE in Cancer Patients	
40. Connolly GC, Khorana AA. Risk stratification for cancer-associated venous thromboembolism. Best Pract Res Clin Haematol. 2009 Mar;22(1):35-47.	Focus on cancer patients, beyond the scope of this workgroup

Citation	Annotation
41. Farge D, Debourdeau P, Beckers M, Baglin C, Bauersachs RM, Brenner B, Brilhante D, Falanga A, Gerotzafias GT, Haim N, Kakkar AK, Khorana AA, Lecumberri R, Mandala M, Marty M, Monreal M, Mousa SA, Noble S, Pabinger I, Prandoni P, Prins MH, Qari MH, et al. International clinical practice guidelines for the treatment and prophylaxis of venous thromboembolism in patients with cancer. <i>J Thromb Haemost</i> . 2013 Jan;11(1):56-70.	Focus on cancer patients, beyond the scope of this workgroup
42. Khorana AA. Risk assessment and prophylaxis for VTE in cancer patients. <i>J Natl Compr Canc Netw</i> . 2011 Jul 1;9(7):789-97.	Focus on cancer patients, beyond the scope of this workgroup
43. GH, Khorana AA, Kuderer NM, Lee AY, Arcelus JI, Balaban EP, Clarke JM, Flowers CR, Francis CW, Gates LE, Kakkar AK, Key NS, Levine MN, Liebman HA, Tempero MA, Wong SL, Prestrud AA, Falanga A; American Society of Clinical Oncology Clinical Practice. Venous thromboembolism prophylaxis and treatment in patients with cancer: American Society of Clinical Oncology clinical practice guideline update. <i>J Clin Oncol</i> . 2013 Jun 10;31(17):2189-204.	Focus on cancer patients, beyond the scope of this workgroup

** Articles shared with the workgroup appear with an asterisk (*) before the citation and are repeated in Table 2.*

Appendix II: Review of Risk Assessment Tools

We identified several published risk assessment tools through a literature review (see Appendix I). The work group opted to compare the most commonly cited tool—the Caprini DVT Risk Assessment—with two similar tools. All three tools are individual risk assessments focused on general surgery rather than a particular specialty. A crosswalk of the three tools is available in Table 4.

[The Caprini DVT Risk Assessment](#) is designed to provide a systematic assessment of all patients to accurately identify significant individual known risk factors for VTE with a scoring system to assign a level of risk.

The [Venous Thromboembolic Event Complication Risk Index for General and Vascular Surgery Patients](#) (Rogers) is designed for surgeons to use during their preoperative assessment to identify patients at highest risk for post-operative VTE and to institute appropriate perioperative prophylactic measures. This tool was developed using a data source with limited variables known to be associated with VTE.

The **weighted risk index for 30-day VTE events after outpatient surgery** (Pannucci) is designed for physicians to use pre-operatively to identify risk of VTE 30 days post-operatively among outpatient surgery patients, specifically. The authors indicate that the tool is inherently limited because it does not include known risk factors related to personal or family medical history, use of hormone replacement therapy, and inflammatory bowel disease, among others, as they are not tracked as independent variables in their data source.

Table 4. Crosswalk of Published Risk Assessment Tools

Note: Items appear as written in most recently published tool; differences between tools are noted.

Item by category	Caprini, 2014 ¹¹	Pannucci, 2012 ¹²	Rogers, 2007 ¹³
Length or type of surgery, work RVU			
Arthroscopic surgery		✓	
Elective hip or knee joint replacement surgery now or within the past month	✓		
Length of surgery over 2 hours (Pannucci: OR time ≥ 120 min)	✓	✓	
Minor surgery planned (less than 45 minutes) is planned	✓		
Non-GSV venous surgery		✓	
Operation type: aneurysm			✓
Operation type: hernia			✓
Operation type: integument			✓

¹¹ Caprini, J. A. (2014). Are You at Risk for DVT? Retrieved from <http://venousdisease.com/dvt-risk-assessment/> on August 20, 2014. NB: this version recommended for comparison by Dr. Caprini (personal communication).

¹² Pannucci, C. J., Shanks, A., Moote, M. J., Bahl, V., Cederna, P. S., Naughton, N. N.,... & Kheterpal, S. (2012). Identifying Patients at High Risk for Venous Thromboembolism Requiring Treatment after Outpatient Surgery. *Annals of Surgery, 255*(6), 1093-1098.

¹³ Rogers, S., Kilaru, R., & Hosokawa, P. (2007). Multivariable Predictors of Postoperative Venous Thromboembolic Events after General and Vascular Surgery: Results from the Patient Safety in Surgery Study. *Journal of the American College of Surgeons, 204*(6), 1211–1221.

Item by category	Caprini, 2014 ¹¹	Pannucci, 2012 ¹²	Rogers, 2007 ¹³
Operation type: mouth, palate			✓
Operation type: respiratory and hemic			✓
Operation type: stomach, intestines			✓
Operation type: thoracoabdominal aneurysm, embolectomy/thrombectomy, venous reconstruction, and endovascular repair			✓
Planned major surgery lasting longer than 45 minutes (including laparoscopic and arthroscopic)	✓		
Sapheno-femoral junction surgery		✓	
Work RVU >17			✓
Work RVU 10-17			✓
Patient demographics, assessments, vitals			
Age 41-60 years (Pannucci: Age 40-59)	✓	✓	
Age 61-74 years (Pannucci: Age ≥60)	✓	✓	
Age 75 or over (Pannucci: Age ≥60)	✓	✓	
ASA physical status classification 2			✓
ASA physical status classification 3, 4, or 5			✓
BMI above 40 (Pannucci: BMI ≥ 40 kg/m ²)	✓	✓	
Female gender			✓
Overweight or obese (BMI above 25)	✓		
Patient and family medical history			
Blood transfusion now or within the past month (Rogers: Transfusion >4 U packed RBCs in 72 h before operation)	✓		✓
Broken hip, pelvis or leg now or within the past month	✓		
Congestive heart failure now or within the past month	✓		
Experienced a stroke now or within the past month	✓		
Family history of blood clots (thrombosis)	✓		
Heart attack now or within the past month	✓		
History of blood clots, either Deep Vein Thrombosis (DVT) or Pulmonary Embolism (PE)	✓		
History of Inflammatory Bowel Disease (IBD) (for example, Crohn's disease or ulcerative colitis) now or within the past month	✓		
Lung disease (for example emphysema or COPD) now or within the past month	✓		
Past major surgery (more than 45 minutes) within the past month	✓		
Personal or family history of positive blood test indicating an increased risk of blood clotting	✓		
Serious infection (for example, pneumonia) now or within the past month	✓		
Serious trauma (for example, multiple broken bones due to a fall or car accident) now or within the past month	✓		

Item by category	Caprini, 2014 ¹¹	Pannucci, 2012 ¹²	Rogers, 2007 ¹³
Spinal cord injury resulting in paralysis now or within the past month	✓		
Current medical conditions/treatments			
Chemotherapy (Rogers: Chemotherapy for malignancy within 30 d of operation)	✓		✓
Current or past malignancies (excluding skin cancer, but not melanoma) (Pannucci: Active cancer; Rogers: Disseminated cancer)	✓	✓	✓
Diabetes requiring insulin now or within the past month	✓		
Dyspnea			✓
Emergency			✓
Smoking now or within the past month	✓		
Swollen legs (current)	✓		
Tube in blood vessel in neck or chest that delivers blood or medicine directly to heart within the last month (also called central venous access, PICC line, or port)	✓		
Ventilator dependent			✓
Visible varicose veins	✓		
Wound class (clean/contaminated)			✓
For women only			
Current use of birth control or Hormone Replacement Therapy (HRT)	✓		
History of unexplained stillborn infant, recurrent spontaneous abortion (more than 3), premature birth with toxemia of pregnancy or growth restricted infant	✓		
Pregnant or had a baby within the last month (Pannucci: Current pregnancy)	✓	✓	
Lab values			
Albumin \leq 3.5 mg/dL			✓
Preoperative bilirubin $>$ 1.0 mg/dL			✓
Preoperative hematocrit \leq 38%			✓
Preoperative serum sodium $>$ 145 mmol/L			✓
Mobility related			
Confined to bed for 72 hours or more	✓		
Non-removable plaster cast or mold that has kept you from moving your leg within the last month	✓		
On bed rest or restricted mobility, including a removable leg brace for less than 72 hours	✓		

The workgroup found that the Caprini DVT Risk Assessment addressed items pertinent to the ASC setting and patients they served. To get a sense of what risk assessment practices are currently in use locally, the workgroup solicited examples of VTE risk assessment tools from Oregon ASCs. Out of the 58 facilities contacted, the workgroup received four responses, three containing tools and one explaining that they do not use a risk assessment tool at all, favoring the use of VTE prophylaxis for all patients instead. The three facilities that did submit risk assessment tools demonstrated a large amount of variation and were commonly using a modified version of a published tool. Table 5 provides a general comparison of the items on the Caprini Risk Assessment with the items included on the risk assessments submitted to the workgroup.

There were only seven items from the Caprini risk assessment that all three Oregon ASC assessments shared:

- 1) Age
- 2) Malignancies
- 3) Heart attack¹⁴
- 4) Length of surgery
- 5) Personal history of any type of bleeding disorder
- 6) Personal history of thrombosis
- 7) Recent immobility

In addition, all three Oregon ASC assessments included a screening or prophylaxis exclusion for procedures performed under local anesthesia. There were five items on the Caprini risk assessment that were not included on any of the three Oregon ASC assessments:

- 1) Blood transfusions
- 2) Chemotherapy
- 3) Confined to a bed for 72 hours or more
- 4) Diabetes requiring insulin
- 5) History of unexplained stillborn infant, recurrent abortion, (>3) premature birth with toxemia or growth restricted infant

Table 5. Crosswalk of Oregon ASC Risk Assessment Tools

Caprini score item by category	Caprini	ASC 1	ASC 2	ASC 3
Length or type of surgery				
Elective hip or knee joint replacement surgery	✓	✓	✓	
Length of surgery	✓	✓	✓	✓
Patient demographics, assessments, vitals				
Age	✓	✓	✓	✓
BMI	✓	✓	✓	
Patient medical history				
Blood transfusion	✓			
Broken hip, pelvis or leg	✓		✓	
Congestive heart failure	✓	✓	✓	
Family history of thrombosis	✓	✓		
Heart attack	✓			
Inflammatory Bowel Disease	✓	✓	✓	
Lung disease (for example, emphysema or COPD)	✓	✓	✓	
Multiple trauma	✓	✓		
Past major surgery	✓	✓	✓	
Personal history of thrombosis	✓	✓	✓	✓
Personal or family history of positive blood test indicating an increased risk of blood clotting	✓	✓	✓	✓
Serious infection (for example, pneumonia)	✓	✓	✓	

¹⁴ Two of three include atrial fibrillation but not specifically heart attack.

Caprini score item by category	Caprini	ASC 1	ASC 2	ASC 3
Spinal cord injury (paralysis)	✓	✓		
Stroke	✓	✓	✓	
Current medical conditions/treatments				
Central venous access catheter	✓		✓	
Chemotherapy	✓			
Diabetes requiring insulin	✓			
Malignancies	✓	✓	✓	✓
Smoking	✓		✓	
Swollen legs (current)	✓	✓	✓	
Visible varicose veins	✓		✓	
For women only				
History of unexplained stillborn infant, recurrent abortion, (>3) premature birth with toxemia or growth restricted infant	✓			
Oral contraceptive or hormone replacement therapy (HRT)	✓	✓	✓	
Pregnancy or post-partum in last month	✓		✓	
Mobility related				
Confined to a bed for 72 hours or more	✓			
Recent immobility	✓	✓	✓	✓
Additional items not included on Caprini score				
Abdominal or pelvic surgery in patients with malignancy		✓		
Atrial fibrillation		✓	✓	
Scheduled major surgery with additional medical risk factors: myocardial infarction, congestive heart failure, sepsis, or serious lung disease			✓	
Use of beach chair positioner		✓	✓	
Use of stirrups in surgery		✓		
Use of tourniquet		✓	✓	
Exclusion – not considered on Caprini score				
Cataract surgery		From screening		From prophylaxis
Colonoscopy EGD		From screening		From prophylaxis
ESWL (w/o cysto or ureteroscopy)		From screening		
Local anesthesia		From screening	From prophylaxis	From prophylaxis
Pain management case		From screening		From prophylaxis
Patient less than 16 years old			From prophylaxis	
Surgery/procedure time 45 min or less			From prophylaxis	
Ulcers on affected leg		From screening		

The workgroup was interested in the additional risk factors identified in the Oregon ASC risk assessment tools and ultimately felt that there are additional risk factors for surgeries that could be included in an ASC-specific VTE risk assessment tool. Those considered are:

- **Post-op mobility** and factors that affect it. The workgroup recommends consideration of the patient’s pain threshold and whether they have chronic pain issues that may interfere with mobility, as well as the patient’s weight bearing status post-op (NWB, PWB).
- **Type of anesthesia** is of interest to many providers, even though research and work group member experience shows minimal correlation between anesthesia and risk of VTE. Length of surgery may be more relevant than the type of anesthesia used.
- **Positioning** is an important consideration for many ASCs, but the workgroup was unable to identify many peer-reviewed studies tying positioning to VTE incidence or risk. AORN indicates, “Patient positioning for the surgical procedure, such as the reverse Trendelenburg position (i.e., the patient’s head is positioned above heart level) and other positions that cause flexion and internal rotation of the hip and knee, can cause venous stasis.”¹⁵
- **Tourniquet use** can be a major factor in assessing the need for post-op prophylaxis as it can cause venous stasis or congestion by prohibiting venous return (AORN guidelines).
- **Dehydration** is especially a concern when surgeries are delayed and patients have been instructed to refrain from food and drink prior to surgery. According to AORN, “Even in patients with normal coagulation, dehydration reduces fluid volume and concentrates existing clotting factors, leading to a hypercoagulable state.”¹⁵ Current guidelines from the American Society of Anesthesiologists indicate “it is appropriate to fast from intake of clear liquids at least two hours before elective procedures requiring general anesthesia, regional anesthesia or sedation/analgesia (i.e., monitored anesthesia care).”¹⁶ Workgroup member experience suggests that there may be great variation in how long a patient is instructed to fast prior to surgery which may result in dehydration at the time of surgery – especially when surgeries are delayed.

¹⁵ Association of periOperative Registered Nurses. (2012). Recommended Practices for Prevention of Deep Vein Thrombosis. In J. Blanchard, B. Burlingame, B. Denholm, S. Giarrizzo-Wilson, M. Ogg, & S. A. Van Wicklin (Eds.), *Perioperative Standards and Recommended Practices for Inpatient and Ambulatory Settings* (pp. 353-363). Denver, CO: AORN, Inc.

¹⁶ American Society of Anesthesiologist Committee on Standards and Practice Parameters. (2011). Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures. *Anesthesiology*, 114(3), 495-511.

Appendix III: National Support for Prevention and Reduction of VTE

VTE is a significant and pressing concern. Federal and national efforts to raise awareness and reduce or prevent incidence have increased. The Center for Disease Control Morbidity and Mortality Weekly Report recently outlined the strategic initiatives being led by the Agency for Health Research and Quality and the Centers for Medicare and Medicaid Services as well as the Joint Commission and the National Quality Forum.

Partnership for Patients

VTE is one of nine hospital-acquired conditions targeted for an overall 40% reduction in preventable harms by the [Partnership for Patients](#), a collaborative national healthcare quality initiative led by the Centers for Medicare and Medicaid Services. Hospital engagement networks are providing technical assistance to hospitals across the country to achieve the Partnership for Patients goals. Partnership for Patients publishes a variety of useful toolkits, including [Venous Thromboembolism \(VTE\) Change Package: Reducing Harm from VTE-Related Events 2014 Update](#).

Accreditation Organizations

Several accreditation organizations have published protocols or measures related to VTE. VTE-related protocols are freely available from The Joint Commission and the American Association for Accreditation of Ambulatory Surgery Facilities. Other accreditation organizations such as the Accreditation Association for Ambulatory Health Care do not include VTE-related measures or do not make their protocols freely available.

The Joint Commission

In January 2005, six [VTE measures](#) were developed for hospitals as a result of the National Consensus Standards for the Prevention and Care of Deep Vein Thrombosis project between The Joint Commission and the National Quality Form. The six measures are related to prophylaxis use to reduce the incidence of VTE.

In addition, the Joint Commission also has a Surgical Care Improvement Prevention measure: *surgery patients who received appropriate venous thromboembolism prophylaxis within 24 hours prior to surgery to 24 hours after surgery*. While these measures are not specific to ASCs, they provide guidelines for best practice surrounding surgery and discharge.

American Association for Accreditation of Ambulatory Surgery Facilities

In their [Standards and Checklist for Accreditation of Ambulatory Surgery Centers](#), the American Association for Accreditation of Ambulatory Surgery Facilities includes a basic protocol that “There must be a written screening protocol for VTE risk placed in the medical record of each surgical patient. This protocol and assessment tool is to be placed in the facility manual for reference.”

Agency for Healthcare Research and Quality

In March 2013, the Agency for Healthcare Research and Quality published [Patient Safety Indicator v4.5 Benchmark Data Tables](#) that show an increased hospital perioperative rate of VTE with an incidence of 4.51 per 1,000 patients. These rates are based on analysis of 44 state’s inpatient discharges from the 2010 Agency

for Healthcare Research and Quality Healthcare Cost and Utilization Project State Inpatient Databases. While these rates are not specific to ambulatory surgery centers, they indicate that there continues to be a high incidence of VTE potentially related to surgery.

Center for Disease Control

The Centers for Disease Control and Prevention is conducting ongoing research to determine VTE risk factors, identify effective treatments, and provide educational opportunities and materials. [CDC Grand Rounds: Preventing Hospital-Associated Venous Thromboembolism](#), published on the CDC Morbidity and Mortality Weekly Report, provides an overview of the current concern about VTE and why it is considered a healthcare-associated condition, including risk factors associated with surgery and hospitalization.