<table>
<thead>
<tr>
<th>Prevention Strategies</th>
<th>Key Changes for Surgical Care Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Measure Strategies</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Use prophylactic antibiotics appropriately | • Designate responsibility and accountability for preoperative prophylactic antibiotic administration (e.g., preoperative nurse, anesthesia) connected to key point in process.  
• Standardize administration process to occur with commonly performed activity within one hour prior to incision.  
• Develop and maintain a protocol for selection, administration and discontinuance of appropriate prophylactic antibiotic.  
• Administer and discontinue prophylactic antibiotics according to guidelines based on local consensus and antibiotic standing orders specific to surgical site.  
• Make agreed upon antibiotics available in the operating room (OR).  
• Standardize delivery process to ensure timely delivery of preoperative antibiotics to the holding area.  
• Provide a visible reminder or checklist to give antibiotics on each case (e.g., brightly colored sticker).  
• Maintain systematic documentation of antibiotic administration on every patient chart (paper or electronic).  
• Develop a system wherein antibiotic is hanging at head of patient’s bed ready for administration.  
• Develop and follow a protocol to deliver antibiotic to OR with patient.  
• Educate OR staff regarding the importance and reasoning of antibiotic timing.  
• Provide feedback on prophylaxis compliance and infection rate data monthly. |
<table>
<thead>
<tr>
<th>Prevention Strategies</th>
<th>Key Changes for Surgical Care Improvement</th>
</tr>
</thead>
</table>
| Manage beta-blocker therapy appropriately | • Develop and maintain a protocol to provide beta-blocker therapy (to achieve therapeutic blood levels) for non-cardiac vascular surgery patients.  
• Develop and maintain a protocol to provide beta-blocker therapy (to achieve therapeutic blood levels) for surgical patients with CAD or at risk of CAD.  
• Develop and maintain a protocol to provide beta blocker therapy for patients who received a beta blocker during the perioperative period.  
• Maintain documentation of beta-blocker therapy.  
• Establish a cardiac risk assessment. |
| Provide appropriate thromboembolic prophylaxis | • Develop and maintain a VTE risk assessment protocol.  
• Implement VTE prophylaxis based upon risk assessment.  
• Maintain documentation of venous thromboembolism (VTE) prophylaxis. |
| Prevent Ventilator-Associated Pneumonia | • Establish protocol to maintain the head of the bed at 30 degrees if not contraindicated.  
• Establish documentation guidelines to show head of bed elevated 30 degrees. |

**Test Measure Strategies**
<table>
<thead>
<tr>
<th>Prevention Strategies</th>
<th>Key Changes for Surgical Care Improvement</th>
</tr>
</thead>
</table>
| Maintain glucose control for diabetic patients undergoing surgery | - Develop and maintain a standardized protocol for intra-operative and postoperative glucose monitoring in patients having a diagnosis of diabetes and undergoing surgery.  
  - Discourage the use of "Sliding scale" insulin alone.  
  - Use standardized treatment protocol developed by a multidisciplinary team to maintain serum glucose at less than 200 db/mL in patients having a diagnosis of diabetes and undergoing surgery, preferably with an intravenous or subcutaneous continuous infusion.  
  - Utilize a team approach to diabetic management.  
  - Insure appropriate provision of diabetes care, including timely delivery of meal trays. |
| Maintain normothermia intra-operatively                    | - Designate responsibility and accountability for thermoregulation.  
  - Standardize use of warming devices that ensure patient temperature > 36° C on leaving the OR.  
  - Limit heat loss in patients prior to operative procedure.  
  - Assure engineering controls allow surgical staff to control room temperature. |
| Provide appropriate hair removal                           | - Develop and maintain a protocol for when and how to remove hair for surgical site preparation.  
  - Perform hair removal when necessary with clippers and only immediately before surgery.  
  - Remove all razors from operating room. |
| Provide peptic ulcer disease (PUD) prophylaxis             | - Develop and maintain a protocol for PUD prophylaxis for post-operative patients on mechanical ventilation.  
  - Develop guidelines for documentations of PUD prophylaxis. |
<table>
<thead>
<tr>
<th>Prevention Strategies</th>
<th>Key Changes for Surgical Care Improvement</th>
</tr>
</thead>
</table>
| Manage ventilator discontinuance appropriately | • Develop and maintain a protocol for ventilator discontinuance for post-operative patients on mechanical ventilation.  
• Develop guidelines for documentation of ventilator discontinuation for post-operative patients on mechanical ventilation which includes the patient’s response to discontinuation. |
| Maintain glucose control for cardiac surgery patients | • Develop and maintain a standardized protocol for intra-operative and postoperative glucose monitoring in patients undergoing cardiac surgery.  
• Utilize a standardized treatment protocol developed by a multidisciplinary team to maintain serum glucose less than or equal to 200 db/mL in patients undergoing cardiac surgery, preferably with an intravenous or subcutaneous continuous infusion. |
SCIP Surgical Infection Prevention 4:  
Perioperative glucose control in cardiac surgery patients

Description: Percent of major cardiac surgical patients with controlled perioperative serum glucose ($\leq 200\text{mg/dL}$). Perioperative is defined as the 24 hours preceding surgery through 48 hours following surgery.

Type of Measure: Process

Rationale: In order to prevent the incidence of surgical site infections (SSIs), a number of process measures must be implemented for which there is a high level of supporting literature. In a 2001 study by Latham et al\textsuperscript{7}, granulocyte functions, including adherence, chemotaxis, phagocytosis, and bactericidal activity, have been shown to be affected by hyperglycemia. Latham and colleagues prospectively gathered HbA1c values on 1,000 diabetic and non-diabetic cardiac patients prior to planned coronary artery bypass or valve procedures. They confirmed the previously observed increase (almost threefold) in infection rates in diabetics. They also found that 4.2% of the patients had previously undiagnosed diabetes, and the infection rate in these patients was equal to the rate in diagnosed diabetics. More interestingly, they demonstrated that the greatest risk for SSI correlated with postoperative hyperglycemia (blood glucose levels $> 200\text{mg/dL}$) rather than with level of HbA1c or preoperative hyperglycemia (they apparently did not have intraoperative glucose levels available). These authors found a strong association in both diabetic and nondiabetic patients between hyperglycemia at least once during the 48 hours following operation and SSI.

Denominator Statement: Number of patients having major cardiac surgical procedures

   Included Populations: All eligible patients with selected ICD-9-CM procedure codes (see Appendix, Table 1)

Excluded Populations:
   - Patients less than 18 years of age
   - Burn or transplant patients
   - Surgical procedures classified as emergent
   - Patients with preoperative infection

Numerator Statement: Number of patients in the denominator with controlled perioperative serum glucose ($\leq 200\text{mg/dL}$)
Selected References:

### Appendix

#### Table 1: Included Procedure Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Cardiac Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>35.10</td>
<td>Open heart valvuloplasty without replacement, unspecified valve</td>
</tr>
<tr>
<td>35.11</td>
<td>Open heart valvuloplasty of aortic valve without replacement</td>
</tr>
<tr>
<td>35.12</td>
<td>Open heart valvuloplasty of mitral valve without replacement</td>
</tr>
<tr>
<td>35.13</td>
<td>Open heart valvuloplasty of pulmonary valve without replacement</td>
</tr>
<tr>
<td>35.14</td>
<td>Open heart valvuloplasty of tricuspid valve without replacement</td>
</tr>
<tr>
<td>35.20</td>
<td>Replacement of unspecified heart valve</td>
</tr>
<tr>
<td>35.21</td>
<td>Replacement of aortic valve with tissue graft</td>
</tr>
<tr>
<td>35.22</td>
<td>Other replacement of aortic valve</td>
</tr>
<tr>
<td>35.23</td>
<td>Replacement of mitral valve with tissue graft</td>
</tr>
<tr>
<td>35.24</td>
<td>Other replacement of mitral valve</td>
</tr>
<tr>
<td>35.25</td>
<td>Replacement of pulmonary valve with tissue graft</td>
</tr>
<tr>
<td>35.26</td>
<td>Other replacement of pulmonary valve</td>
</tr>
<tr>
<td>35.27</td>
<td>Replacement of tricuspid valve with tissue graft</td>
</tr>
<tr>
<td>35.28</td>
<td>Other replacement of tricuspid valve</td>
</tr>
<tr>
<td>35.31</td>
<td>Operations on papillary muscle</td>
</tr>
<tr>
<td>35.32</td>
<td>Operations on chordae tendineae</td>
</tr>
<tr>
<td>35.33</td>
<td>Annuloplasty</td>
</tr>
<tr>
<td>35.34</td>
<td>Infundibulectomy</td>
</tr>
<tr>
<td>35.35</td>
<td>Operations on trabeculae carneae cordis</td>
</tr>
</tbody>
</table>
35.39 Operations on other structures adjacent to valves of heart
35.42 Creation of septal defect in heart
35.50 Repair of unspecified septal defect of heart with prosthesis
35.51 Repair of atrial septal defect with prosthesis, open technique
35.53 Repair of ventricular septal defect with prosthesis
35.54 Repair of endocardial cushion defect with prosthesis
35.60 Repair of unspecified septal defect of heart with tissue graft
35.61 Repair of atrial septal defect with tissue graft
35.62 Repair of ventricular septal defect with tissue graft
35.63 Repair of endocardial cushion defect with tissue graft
35.70 Other and unspecified repair of unspecified septal defect of heart
35.71 Other and unspecified repair of atrial septal defect
35.72 Other and unspecified repair of ventricular septal defect
35.73 Other and unspecified repair of endocardial cushion defect
35.81 Total repair of tetralogy of Fallot
35.82 Total repair of total anomalous pulmonary venous connection
35.83 Total repair of truncus arteriosus
35.84 Total correction of transposition of great vessels, not elsewhere classified
  35.91 Interatrial transposition of venous return
  35.92 Creation of conduit between right ventricle and pulmonary artery
  35.93 Creation of conduit between left ventricle and aorta
  35.94 Creation of conduit between atrium and pulmonary artery
  35.95 Revision of corrective procedure on heart
  35.96 Percutaneous valvuloplasty
  35.98 Other operations on septa of heart
35.99  Other operations on valves of heart
36.03  Open chest coronary artery angioplasty
36.10  Aortocoronary bypass for heart revascularization, not otherwise specified
36.11  Aortocoronary bypass of one coronary artery
36.12  Aortocoronary bypass of two coronary arteries
36.13  Aortocoronary bypass of three coronary arteries
36.14  Aortocoronary bypass of four or more coronary arteries
36.15  Single internal mammary-coronary artery bypass
36.16  Double internal mammary-coronary artery bypass
36.17  Abdominal - coronary artery bypass
36.19  Other bypass anastomosis for heart revascularization
36.2  Heart revascularization by arterial implant
36.31  Open chest transmyocardial revascularization
36.32  Other transmyocardial revascularization
36.39  Other heart revascularization
36.91  Repair of aneurysm of coronary vessel
36.99  Other operations on vessels of heart
37.10  Incision of heart, not otherwise specified
37.11  Cardiotomy
37.12  Pericardiotomy
37.31  Pericardectomy
37.32  Excision of aneurysm of heart
37.33 Excision or destruction of other lesion or tissue of heart, open approach
37.34 Catheter ablation Excision or destruction of other lesion or tissues of heart, other approach
37.35 Partial ventriculectomy
37.4 Repair of heart and pericardium
37.51 Heart transplantation
37.52 Implantation of total replacement heart system
37.53 Replacement or repair of thoracic unit of total replacement heart system
37.54 Replacement or repair of other implantable component of total replacement heart system
37.62 Implant of other heart assist system
37.63 Replacement and repair of heart assist system
37.64 Removal of heart assist system
37.66 Implant of an implantable, pulsatile heart assist system
37.67 Implantation of cardiomyostimulation system
SCIP Surgical Infection Prevention 5 (Test Measure):
Surgical site hair removal prior to surgery

Description: Percent of major surgical patients with appropriate surgical site hair removal. No hair removal, or hair removal with clippers or depilatory is considered appropriate. Shaving is considered inappropriate.

Type of Measure: Process

Rationale: In a randomized study of 1,980 consecutive adult patients undergoing cardiopulmonary bypass surgeries over a two-year period, Ko W, Lazenby WD, et al. reported that the infection rate was significantly higher in the manually shaven (13/990, 1.3%) than in the electrically clipped patients (4/990, 0.4%). In another randomized study of 200 patients having elective inguinal herniorraphy surgery, Balthazar ER, Colt JD, et al. concluded that “This study indicates that preoperative clipping of hair with electric barber's clippers immediately before operation is a safe, well-tolerated procedure that does not increase the risk of postoperative wound infection.” There was also a systematic literature review by Kjonnikse I, Andersen BM, et al. that states that depilatory or electric clipping, preferably immediately before surgery, should be used and that shaving should be avoided.

Finally, it was determined by Alexander, JW, that if clippers are used on the morning of surgery, a $270,000 savings could be realized on every 1,000 patients treated. He also states that preoperative shaving is deleterious, and the practice should be abandoned.

Denominator Statement: Number of patients having major surgical procedures

Included Populations: All eligible patients having major surgical procedures

Excluded Populations:
- Patients less than 18 years of age
- Burn or transplant patients
- Surgical procedures classified as emergent
- Patients with preoperative infection

Numerator Statement: Number of patients in the denominator with no surgical site hair removal, or hair removal with clippers or depilatory.
Selected References:

SCIP Surgical Infection Prevention 6 (Test Measure):
Colorectal surgical patients with perioperative normothermia.

Description: Percent of major colorectal surgical patients who maintained normothermia (36.0°-38.0°C or 96.8°-100.4°F) during the perioperative period.

Type of Measure: Process

Rationale: According to Clinical Guidelines for the Prevention of Unplanned Perioperative Hypothermia, published research has correlated significant adverse consequences such as impaired wound healing, adverse cardiac event, altered drug metabolism, and coagulopathies with unplanned perioperative hypothermia. With prevention and management of hypothermia, patients will experience a greater level of comfort, and avoid postoperative shivering and the unpleasant sensation of feeling cold. Despite the availability of technology to prevent hypothermia, it remains an ongoing problem in the perioperative period.1

Kurtz A, Sessler DI, et al. further explain that mild perioperative hypothermia may promote surgical-wound infection, and directly impairs immune function. In a study of 200 patients undergoing colorectal surgery, they found surgical wound infections in 18 of 96 patients assigned to hypothermia (19%) and in 6 of 104 patients assigned to normothermia (6%). The sutures were removed one day later and the duration of hospitalization was prolonged by 2.6 days in the hypothermia group.2

In a meta-analysis of outcomes and costs, Mahoney, CB and Odom J. found that a significant increase in the risk of costly complications occurred when patient temperatures dropped a mean of 1.5°C. For example, patients who become mildly hypothermic are much more likely to receive blood transfusions and to develop infections; both these outcomes result in increased costs. Hypothermia averaging only 1.5°C less than normal results in cumulative adverse outcomes adding between $2,500 and $7,000 per surgical patient to hospitalization costs across a variety of surgical procedures. The cost of preventing adverse outcomes that affect patients experiencing intraoperative hypothermia is much less than the cost of treating the adverse outcomes that affect patients experiencing intraoperative hypothermia.3
**Denominator Statement:** Number of patients having selected major colorectal surgical procedures

**Included Populations:** All eligible patients with selected ICD-9-CM procedure codes (see Appendix, Table 1)

**Excluded Populations:**
- Patients less than 18 years of age
- Burn or transplant patients
- Surgical procedures classified as emergent
- Patients with preoperative infection
- Patients having procedures requiring planned hypothermia

**Numerator Statement:** Number of patients in the denominator whose first recorded temperatures in PACU were within the range of 36-38°C or 96.8-100.4°F

**Selected References:**

## Appendix

### Table 1: Included Procedure Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Colon Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>45.03</td>
<td>Incision of large intestine</td>
</tr>
<tr>
<td>45.41</td>
<td>Excision of lesion or tissue of large intestine</td>
</tr>
<tr>
<td>45.49</td>
<td>Other destruction of lesion of large intestine</td>
</tr>
<tr>
<td>45.50</td>
<td>Isolation of intestinal segment, not otherwise specified</td>
</tr>
<tr>
<td>45.52</td>
<td>Isolation of segment of large intestine</td>
</tr>
<tr>
<td>45.71</td>
<td>Multiple segmental resection of large intestine</td>
</tr>
<tr>
<td>45.72</td>
<td>Cecectomy</td>
</tr>
<tr>
<td>45.73</td>
<td>Right hemicolecctomy</td>
</tr>
<tr>
<td>45.74</td>
<td>Resection of transverse colon</td>
</tr>
<tr>
<td>45.75</td>
<td>Left hemicolecctomy</td>
</tr>
<tr>
<td>45.76</td>
<td>Sigmoidectomy</td>
</tr>
<tr>
<td>45.79</td>
<td>Other partial excision of large intestine</td>
</tr>
<tr>
<td>45.8</td>
<td>Total intra-abdominal colectomy</td>
</tr>
<tr>
<td>45.90</td>
<td>Intestinal anastomosis, not otherwise specified</td>
</tr>
<tr>
<td>45.92</td>
<td>Anastomosis of small intestine to rectal stump</td>
</tr>
<tr>
<td>45.93</td>
<td>Other small-to-large intestinal anastomosis</td>
</tr>
<tr>
<td>45.94</td>
<td>Large-to-large intestinal anastomosis</td>
</tr>
<tr>
<td>45.95</td>
<td>Anastomosis to anus</td>
</tr>
<tr>
<td>46.03</td>
<td>Exteriorization of large intestine</td>
</tr>
</tbody>
</table>
46.04 Resection of exteriorized segment of large intestine
46.10 Colostomy, not otherwise specified
46.11 Temporary colostomy
46.13 Permanent colostomy
46.14 Delayed opening of colostomy
46.43 Other revision of stoma of large intestine
46.50 Closure of intestinal stoma, not otherwise specified
46.52 Closure of stoma of large intestine
46.63 Fixation of large intestine to abdominal wall
46.64 Other fixation of large intestine
46.75 Suture of laceration of large intestine
46.76 Closure of fistula of large intestine
46.79 Other repair of intestine
48.0 Proctotomy
48.1 Proctostomy
48.41 Soave submucosal resection of rectum
48.49 Other pull-through resection of rectum
48.5 Abdominoperineal resection of rectum
48.61 Transsacral rectosigmoidectomy
48.62 Anterior resection of rectum with synchronous colostomy
48.63 Other anterior resection of rectum
48.64 Posterior resection of rectum
48.65 Duhamel resection of rectum
48.69 Other
48.71 Suture of laceration of rectum
48.72 Closure of proctostomy
48.73 Closure of other rectal fistula
48.74 Rectorectostomy
48.75 Abdominal proctopexy
48.76 Other proctopexy
48.79 Other repair of rectum
SCIP Surgical Infection Prevention 7 (Test measure):
Non-cardiac surgical patients with diabetes who have perioperative glucose control

Description: Percent of major surgical diabetic patients with controlled perioperative serum glucose (≤ 200mg/dL). Perioperative is defined as the period beginning 24 hours prior to surgery and ending 48 hours after surgery.

Type of Measure: Process

Rationale: In order to prevent the incidence of surgical site infections (SSIs), a number of process measures must be implemented for which there is a high level of supporting literature. In a 2001 study by Latham et al, granulocyte functions, including adherence, chemotaxis, phagocytosis, and bactericidal activity, have been shown to be affected by hyperglycemia. Latham and colleagues prospectively gathered HbA1c values on 1,000 diabetic and non-diabetic cardiac patients prior to planned coronary artery bypass or valve procedures. They confirmed the previously observed increase (almost threefold) in infection rates in diabetics. They also found that 4.2% of the patients had previously undiagnosed diabetes, and the infection rate in these patients was equal to the rate in diagnosed diabetics. More interestingly, they demonstrated that the greatest risk for SSI correlated with postoperative hyperglycemia (blood glucose levels > 200mg/dL) rather than with level of HbA1c or preoperative hyperglycemia (they apparently did not have intraoperative glucose levels available). These authors found a strong association in both diabetic and nondiabetic patients between hyperglycemia at least once during the 48 hours following operation and SSI.

Denominator Statement: Number of diabetic patients having major surgical procedures

Included Populations: All eligible diagnosed diabetic patients having major surgical procedures.

Excluded Populations:
- Patients less than 18 years of age
- Burn or transplant patients
- Surgical procedures classified as emergent
- Non-diabetic patients
- Patients with preoperative infection

Numerator Statement: Number of patients in the denominator with controlled perioperative serum glucose (≤ 200mg/dL)
Selected References:

SCIP Cardiovascular Complication Prevention 1: 
Beta-blocker administration for non-cardiac vascular surgery patients

Description: Percent of major non-cardiac vascular surgery patients, without contraindications to receiving beta blockers, who received beta blockers during the perioperative period. The perioperative period includes 24 hours prior to surgery through 48 hours following surgery.

Type of Measure: Process

Rationale: It has been demonstrated that non-cardiac vascular surgery patients who receive beta blockers to achieve a therapeutic blood level during the perioperative period, experience a reduced risk of cardiovascular complications. Beta blockers may produce similar benefits to patients receiving cardiac surgery and other surgical procedures, but those benefits have not yet been clearly demonstrated.1-4

Denominator Statement: Number of patients having selected major non-cardiac vascular surgical procedures

Included Populations: All eligible patients with selected ICD-9-CM procedure codes (see Appendix, Table 1)

Excluded Populations:
- Patients less than 18 years of age
- Patients transferred to another acute care hospital or discharged to hospice
- Patients who expired
- Patients who left against medical advice
- Patients with one or more of the following beta blocker contraindications/reasons for not prescribing a beta blocker documented in the medical record:
  - Beta blocker allergy;
  - Bradycardia (heart rate less than 60 bpm) on day of discharge or day prior to discharge while not on a beta blocker;
  - Second or third degree heart block on ECG on arrival or during hospital stay and does not have a pacemaker;
  - Systolic blood pressure less than 90 mm Hg on day of discharge or day prior to discharge while not on a beta blocker; or
  - Other reasons documented by a physician, nurse practitioner, or physician assistant for not prescribing a beta blocker at discharge
These conditions are all considered exclusion criteria. Some are controversial. For example, heart failure has been considered an exclusion criterion in the past, but now beta-blockers may be indicated for heart failure. It is an exclusion for purposes of this measure to simplify data consistency.

**Numerator Statement:** Number of patients in the denominator who received beta-blocker therapy during the perioperative period. (see Appendix, Table 2)

**Selected References:**

## Appendix

**Table 1: Included Procedures**

<table>
<thead>
<tr>
<th>Code</th>
<th>Vascular Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>38.10</td>
<td>Endarterectomy, unspecified site</td>
</tr>
<tr>
<td>38.11</td>
<td>Endarterectomy, intracranial vessels, Cerebral (anterior) (middle), Circle of Willis,</td>
</tr>
<tr>
<td></td>
<td>Posterior communicating artery</td>
</tr>
<tr>
<td>38.12</td>
<td>Endarterectomy, other vessels of head and neck, Carotid artery (common) (external)</td>
</tr>
<tr>
<td></td>
<td>(internal), Jugular vein (external) (internal)</td>
</tr>
<tr>
<td>38.13</td>
<td>Endarterectomy, upper limb vessels, Axillary, Brachial, Radial, Ulnar</td>
</tr>
<tr>
<td>38.14</td>
<td>Endarterectomy, aorta</td>
</tr>
<tr>
<td>38.15</td>
<td>Endarterectomy, other thoracic vessels, Innominate, Pulmonary (artery) (vein),</td>
</tr>
<tr>
<td></td>
<td>Subclavian, Vena cava, superior</td>
</tr>
<tr>
<td>38.16</td>
<td>Endarterectomy, abdominal arteries, Celiac, Gastric, Hepatic, Iliac, Mesenteric, Renal, Splenic, Umbilical</td>
</tr>
<tr>
<td>38.18</td>
<td>Endarterectomy, lower limb arteries, Femoral (common) (superficial), Popliteal, Tibial</td>
</tr>
<tr>
<td>38.30</td>
<td>Resection of vessel with anastomosis, unspecified site</td>
</tr>
<tr>
<td>38.31</td>
<td>Resection of vessel with anastomosis, intracranial vessels, Cerebral (anterior) (middle), Circle of Willis, Posterior communicating artery.</td>
</tr>
<tr>
<td>38.32</td>
<td>Resection of vessel with anastomosis, other vessels of head and neck, Carotid artery (common) (external) (internal), Jugular vein (external) (internal)</td>
</tr>
<tr>
<td>38.33</td>
<td>Resection of vessel with anastomosis, upper limb vessels, Axillary, Brachial, Radial, Ulnar</td>
</tr>
<tr>
<td>38.34</td>
<td>Resection of vessel with anastomosis, aorta</td>
</tr>
<tr>
<td>38.35</td>
<td>Resection of vessel with anastomosis, other thoracic vessels, Innominate, Pulmonary (artery) (vein), Subclavian, Vena cava, superior</td>
</tr>
<tr>
<td>38.36</td>
<td>Resection of vessel with anastomosis, abdominal arteries, Celiac, Gastric, Hepatic, Iliac, Mesenteric, Renal, Splenic, Umbilical</td>
</tr>
<tr>
<td>38.38</td>
<td>Resection of vessel with anastomosis, lower limb arteries, Femoral (common) (superficial), Popliteal, Tibial</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>38.40</td>
<td>Resection of vessel with replacement, unspecified site</td>
</tr>
<tr>
<td>38.41</td>
<td>Resection of vessel with replacement, intracranial vessels, Cerebral (anterior) (middle), Circle of Willis, Posterior communicating artery</td>
</tr>
<tr>
<td>38.42</td>
<td>Resection of vessel with replacement, other vessels of head and neck, Carotid artery (common) (external) (internal), Jugular vein (external) (internal)</td>
</tr>
<tr>
<td>38.43</td>
<td>Resection of vessel with replacement, upper limb vessels, Axillary, Brachial, Radial, Ulnar</td>
</tr>
<tr>
<td>38.44</td>
<td>Resection of vessel with replacement, aorta, abdominal, Code also any thoracic vessel involvement (thoracoabdominal procedure) (38.45)</td>
</tr>
<tr>
<td>38.45</td>
<td>Resection of vessel with replacement, thoracic vessels, Aorta (thoracic), Innominate, Pulmonary (artery) (vein), Subclavian, Vena cava, superior, Code also any abdominal aorta involvement (thoracoabdominal procedure) (38.44)</td>
</tr>
<tr>
<td>38.46</td>
<td>Resection of vessel with replacement, abdominal arteries, Celiac, Gastric, Hepatic, Iliac, Mesenteric, Renal, Splenic, Umbilical</td>
</tr>
<tr>
<td>38.48</td>
<td>Resection of vessel with replacement, lower limb arteries, Femoral (common) (superficial), Popliteal, Tibial</td>
</tr>
<tr>
<td>38.80</td>
<td>Other surgical occlusion of vessels, unspecified site</td>
</tr>
<tr>
<td>38.81</td>
<td>Other surgical occlusion of vessels, intracranial vessels, Cerebral (anterior) (middle), circle of Willis, Posterior communicating artery</td>
</tr>
<tr>
<td>38.82</td>
<td>Other surgical occlusion of vessels, other vessels of head and neck, Carotid artery (common) (external) (internal), Jugular vein (external) (internal)</td>
</tr>
<tr>
<td>38.84</td>
<td>Other surgical occlusion of vessels, aorta</td>
</tr>
<tr>
<td>38.85</td>
<td>Other surgical occlusion of vessels, other thoracic vessels, Innominate, Pulmonary (artery) (vein), Subclavian, Vena cava, superior</td>
</tr>
<tr>
<td>38.86</td>
<td>Other surgical occlusion of vessels, abdominal arteries, Celiac, Gastric, Hepatic, Iliac, Mesenteric, Renal, Splenic, Umbilical</td>
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<tr>
<td>38.88</td>
<td>Other surgical occlusion of vessels, lower limb arteries, Femoral (common) (superficial), Popliteal, Tibial</td>
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<td>39.0</td>
<td>Systemic to pulmonary artery shunt</td>
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<tr>
<td>39.22</td>
<td>Aorta-subclavian-carotid bypass</td>
</tr>
</tbody>
</table>
39.23  Other intrathoracic vascular shunt or bypass
39.24  Aorta-renal bypass
39.25  Aorta-iliac-femoral bypass
39.26  Other intra-abdominal vascular shunt or bypass
39.28  Extracranial-intracranial (EC-IC) vascular bypass
39.29  Other (peripheral) vascular shunt or bypass
39.41  Control of hemorrhage following vascular surgery
39.49  Other revision of vascular procedure
39.50  Angioplasty or atherectomy of non-coronary vessel
39.51  Clipping of aneurism
39.52  Other repair of aneurysm
39.54  Re-entry operation (aorta)
39.56  Repair of blood vessel with tissue patch graft
39.57  Repair of blood vessel with synthetic patch graft
39.58  Repair of blood vessel with unspecified type of patch graft
39.59  Other repair of vessel
39.61  Extracorporeal circulation auxiliary to open heart surgery
39.62  Hypothermia (systemic) incidental to open heart surgery
39.71  Endovascular implantation of graft in abdominal aorta
39.72  Endovascular repair or occlusion of head and neck vessels
39.79  Other endovascular repair (of aneurysm) of other vessels
39.99  Other operations on vessels
### Table 2: Common Beta Blockers

<table>
<thead>
<tr>
<th>Acebutolol</th>
<th>Atenolol</th>
<th>Betaxolol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Betapace</td>
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<tr>
<td>Tenormin</td>
<td>Timolide</td>
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<tr>
<td>Toprol</td>
<td>Trandate</td>
<td>Visken</td>
</tr>
<tr>
<td>Zebeta</td>
<td>Ziac</td>
<td></td>
</tr>
</tbody>
</table>

**Terminology:**

**Beta-Blockers:** "These are beta-adrenergic antagonists that exert their antiarrhythmic actions by attenuating the binding of circulating catecholamines to beta-adrenergic receptor sites on myocytes and diminishing increases in automaticity."5
SCIP Cardiovascular Complication Prevention 2:  
**Beta-blocker administration for patients with coronary artery disease (CAD) or other diagnoses of atherosclerotic cardiovascular disease (ASCVD)**

**Description:** Percent of major surgery patients with CAD or other ASCVD diagnoses, without contraindications to beta-blockers, who received beta-blockers during the perioperative period. The perioperative period includes 24 hours prior to surgery through 48 hours following surgery.

**Type of Measure:** Process

**Rationale:** It has been demonstrated that surgery patients with CAD or other ASCVD diagnoses, who receive beta-blockers to achieve a therapeutic blood level during the perioperative period, experience a reduced risk of cardiovascular complications.1-4

**Denominator Statement:** Number of patients having major surgical procedures who have documented CAD or other ASCVD diagnoses

**Included Populations:** All eligible patients having major surgical procedures

**Excluded Populations:**
- Patients less than 18 years of age
- Patients transferred to another acute care hospital or discharged to hospice
- Patients who expired
- Patients who left against medical advice
- Patients with one or more of the following beta blocker contraindications/reasons for not prescribing a beta blocker documented in the medical record:
  - Beta blocker allergy;
  - Bradycardia (heart rate less than 60 bpm) on day of discharge or day prior to discharge while not on a beta blocker;
  - Second or third degree heart block on ECG on arrival or during hospital stay and does not have a pacemaker;
- Systolic blood pressure less than 90 mm Hg on day of discharge or day prior to discharge while not on a beta blocker
- Elevated pre-operative creatinine level
- Other reasons documented by a physician, nurse practitioner, or physician assistant for not prescribing a beta blocker at discharge

These conditions are all considered exclusion criteria. Some are controversial. For example, heart failure has been considered an exclusion criterion in the past, but now beta-blockers may be indicated for heart failure. It is an exclusion for purposes of this measure to simplify data consistency.

**Numerator Statement:** Number of patients in the denominator who received beta-blocker therapy during the perioperative period. (see Appendix, Table 1)
Selected References:


4. Pasternack PF, Imparato AM, Baumann FG, et al. The hemodynamics of beta-blockade in patients undergoing abdominal aortic aneurysm repair. *Circulation*. 1987;76(suppl 3, pt 2):III-1-7. (We are in the process of retrieving this article; it has not yet been reviewed.)

Appendix

Table 1: Common Beta-Blockers

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Drug Name</th>
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</tr>
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<tbody>
<tr>
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Terminology:

**Beta-Blockers:** “These are beta-adrenergic antagonists that exert their antiarrhythmic actions by attenuating the binding of circulating catecholamines to beta-adrenergic receptor sites on myocytes and diminishing increases in automaticity.”5
SCIP Cardiovascular Complication Prevention 3:  
Beta-blocker maintenance

**Description:** Percent of major surgery patients, maintained on a beta-blocker prior to surgery who received a beta-blocker during the perioperative period. The perioperative period includes 24 hours prior to surgery through 48 hours following surgery.

**Type of Measure:** Process

**Rationale:** In patients at risk of cardiovascular complications in a variety of medical conditions, beta-blockers have been shown to reduce that risk. Patients maintained on beta-blockers and without complications that might warrant discontinuation, are good candidates for continuation of beta-blockers through the perioperative period.1-4

**Denominator Statement:** Number of patients on beta-blocker maintenance having major surgical procedures

**Included Populations:** All eligible patients on beta-blocker maintenance having major surgical procedures

**Excluded Populations:**
- Patients less than 18 years of age
- Burn or transplant patients
- Surgical procedures classified as emergent
- Patients previously on a beta-blocker for whom the beta-blocker was discontinued because of undesirable complications or side effects

**Numerator Statement:** Number of patients in the denominator who received beta-blocker therapy during the perioperative period
Selected References:


Appendix

Table 1: Common Beta-Blockers

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Terminology:

**Beta-Blockers:** “These are beta-adrenergic antagonists that exert their antiarrhythmic actions by attenuating the binding of circulating catecholamines to beta-adrenergic receptor sites on myocytes and diminishing increases in automaticity.”\(^5\)
SCIP Respiratory Complication Prevention 1:  
Patient positioning

Description: Percent of major surgical patients on a ventilator whose post-operative orders included elevating the head of the bed (HOB) greater than or equal to 30 degrees.

Type of Measure: Process

Rationale: In order to decrease the incidence of ventilator associated pneumonia (VAP), an integrated and comprehensive strategy, that includes a number of components should be implemented; for example, compliance with hand washing and universal precautions, decrease in the frequency of changing ventilator circuit disposables, suspending enteral feeds during patient transports, etc. Use of the semi-recumbent position is one component of a comprehensive strategy.

In mechanically ventilated patients, the semi-recumbent position reduces the frequency and risk for nosocomial pneumonia compared to the supine position. In a study conducted in 1999 by Drakulovic, the use of semi-recumbent position—elevating the HOB greater than or equal to 30 degrees—was associated with a 26 percent absolute risk reduction of clinically suspected nosocomial pneumonia and an 18 percent absolute risk reduction in microbiologically-confirmed aspiration pneumonia.

Denominator Statement: Number of patients on a ventilator after having major surgical procedures

Included Populations: All eligible patients on a ventilator after having major surgical procedures

Excluded Populations:
- Patients less than 18 years of age
- Burn or transplant patients
- Surgical procedures classified as emergent
- Patients whose medical condition contraindicates raising the HOB greater than or equal to 30 degrees
- Patients cared for in any bed where the HOB bed does not elevate (i.e., Kinair)

Numerator Statement: Number of patients in the denominator whose post-operative orders included elevating the head of the bed (HOB) greater than or equal to 30 degrees.
Selected References:


Appendix

Terminology:

**Endotracheal tube:** A tube, often surrounded by an inflatable cuff, inserted into the trachea for administration of anesthesia, maintenance of an airway, ventilation of the lungs, and/or prevention of entrance of foreign material, such as stomach contents, into the tracheobronchial tree.

**Mechanical Ventilation:** Breathing accomplished by extrinsic means, as with a ventilator for a patient who is intubated.

**Ventilator:** A device designed to assist or control pulmonary ventilation, either intermittently or continuously through a tracheostomy or by endotracheal intubation. Lung-expansion devices such as those that provide intermittent positive pressure breathing, nasal positive end-expiratory pressure, and continuous nasal positive airway pressure are not considered ventilators unless they provide assistance or control through tracheostomy or endotracheal intubation.
SCIP Respiratory Complication Prevention 2 (Test Measure): Peptic ulcer disease (PUD) prophylaxis for ventilator patients

**Description:** Percent of major surgical patients on a ventilator, without contraindications to PUD prophylaxis, who received PUD prophylaxis.

**Type of Measure:** Process

**Rationale:** To decrease the incidence of ventilator associated pneumonia (VAP) in patients, an integrated and comprehensive strategy, which includes a number of components should be implemented; for example, compliance with hand washing and universal precautions, decrease in the frequency of changing ventilator circuit disposables, suspending enteral feeds during patient transports, etc. Use of PUD prophylaxis is one component of a comprehensive strategy. Since aspiration of gastric contents is common in ventilator patients, it is desirable to neutralize the effects of gastric acid. On the other hand, use of antacids and H-2 blockers has been shown in many studies to raise pH and produce bacterial overgrowth. There is some evidence that sucralfate (Carafate) is useful in neutralizing the effects of gastric acid without raising pH, and that it helps prevent VAP. This remains controversial.

**Denominator Statement:** Number of patients on a ventilator after having major surgical procedures

**Included Populations:** All eligible patients on a ventilator after having major surgical procedures

**Excluded Populations:**
- Patients less than 18 years of age
- Burn and transplant patients
- Surgical procedures classified as emergent
- Patients for whom PUD prophylaxis is contraindicated and specifically stated in the chart. As a variety of medications and classes of medications are available for PUD prophylaxis, allergy to a single medication or class should not be considered a contraindication. Only a note in the medical record giving a specific reason not to provide PUD prophylaxis will be considered a valid contraindication.

**Numerator Statement:** Number of patients in the denominator who received any PUD prophylaxis (see Appendix, Table 1)
Selected References:


Appendix

**Table 1: Peptic Ulcer Prophylaxis**

- Any administration of antacid during 48 hours post-op
- Any administration of H₂-receptor antagonist during 48 hours post-op; includes the following:
  - cimetidine (Tagamet)
  - ranitidine (Zantac)
  - famotidine (Pepcid)
- Any administration of proton pump inhibitor during 48 hours post-op; includes the following:
  - esomeprazole (Nexium)
  - lansoprazole (Prevacid)
  - pantoprazole (Protonix)
  - rabeprazole (Acephex)
- Any administration of sucralfate (Carafate)
**Terminology:**

**Endotracheal tube:** A tube, often surrounded by an inflatable cuff, inserted into the trachea for administration of anesthesia, maintenance of an airway, ventilation of the lungs, and/or prevention of entrance of foreign material, such as stomach contents, into the tracheobronchial tree.

**Mechanical Ventilation:** Breathing accomplished by extrinsic means, as with a ventilator for a patient who is intubated.

**Ventilator:** A device designed to assist or control pulmonary ventilation, either intermittently or continuously through a tracheostomy or by endotracheal intubation. Lung-expansion devices such as those that provide intermittent positive pressure breathing, nasal positive end-expiratory pressure, and continuous nasal positive airway pressure are not considered ventilators unless they provide assistance or control through tracheostomy or endotracheal intubation.
**SCIP Respiratory Complication Prevention 3 (Test Measure):**
Ventilator weaning

**Description:** Percent of major surgical patients on a ventilator who are placed on a ventilator-weaning protocol.

**Type of Measure:** Process

**Rationale:** To decrease the incidence of ventilator-associated pneumonia (VAP), an integrated and comprehensive strategy, which includes a number of components, should be implemented. For example, compliance with hand washing and universal precautions, decrease in the frequency of changing ventilator circuit disposables, suspending enteral feedings during patient transports, etc. Use of weaning procedures is one component of a comprehensive strategy.¹⁻³

In mechanically ventilated patients, weaning from the ventilator may reduce risk of VAP if appropriate weaning procedures are followed. Ideally, these procedures are adopted as standard processes of care or critical care pathways for ventilator patients. Procedures may include daily spontaneous breathing tests (SBTs).²

**Denominator Statement:** Number of patients on a ventilator after having major surgical procedures

**Included Populations:** All eligible patients on a ventilator after having major surgical procedures

**Excluded Populations:**
- Patients less than 18 years of age
- Burn and transplant patients
- Surgical procedures classified as emergent
- Patients whose medical conditions contraindicate weaning from the ventilator and have been documented on the medical chart

**Numerator Statement:** Number of patients in the denominator who are placed on a ventilator-weaning protocol
Appendix

Terminology:

**Endotracheal tube:** A tube, often surrounded by an inflatable cuff, inserted into the trachea for administration of anesthesia, maintenance of an airway, ventilation of the lungs, and/or prevention of entrance of foreign material, such as stomach contents, into the tracheobronchial tree.

**Mechanical Ventilation:** Breathing accomplished by extrinsic means, as with a ventilator for a patient who is intubated.

**Ventilator:** A device designed to assist or control pulmonary ventilation, either intermittently or continuously through a tracheostomy or by endotracheal intubation. Lung-expansion devices such as those that provide intermittent positive pressure breathing, nasal positive end-expiratory pressure, and continuous nasal positive airway pressure are not considered ventilators unless they provide assistance or control through tracheostomy or endotracheal intubation.
SCIP Venous Thromboembolism Prevention 1:  
Any venous thromboembolism prophylaxis

Description: Percent of major surgical patients who received any perioperative prophylaxis for venous thromboembolism (VTE).

Type of Measure: Process

Rationale: Over 23 million surgeries are performed in the United States each year. The frequency of deep vein thrombosis (DVT) and pulmonary embolism (PE) varies by type of procedure and specific patient risk factors. DVT is a complication in 20% of major surgical procedures and 50% of major orthopedic procedures when prophylaxis is not used. Without prophylaxis, PE follows 1-2% of major surgical cases and 30% of major orthopedic cases. Despite the frequency with which venous thromboembolism occurs, and the well-established efficacy and safety of preventive measures, prophylaxis is often underused.¹

According to Geerts WH, Heit, JA, et al., a study of 2,000 patients, hospitalized at 16 acute-care hospitals in the US, showed that only one-third received prophylaxis, despite the presence of multiple risk factors for VTE. Clinical risk factors include the following: increasing age, prolonged immobility, stroke, previous VTE, cancer and its treatment, major surgery, trauma, obesity, varicose veins, cardiac dysfunction, indwelling central venous catheter, inflammatory disease, nephritic syndrome, and pregnancy or estrogen use.²

Numerous studies show that both LDUH and LMWH reduce the risk of proximal DVT and PE in patients undergoing general surgery. Results from 46 randomized trials show that prophylaxis of general surgical patients with LDUH compared with placebo reduced the risk of DVT by 68%. LMWH has comparable efficacy to LDUH for prevention of VTE and may be more effective for preventing proximal DVT and PE.¹

Denominator Statement: Number of patients having major surgical procedures

Included Populations: All eligible patients having major surgical procedures

Excluded Populations:
- Patients less than 18 years of age
- Burn or transplant patients
- Surgical procedures classified as emergent

Numerator Statement: Number of patients in the denominator with perioperative VTE prophylaxis
Selected References:


Appendix

Terminology:

VTE Anticoagulation Prophylaxis: For the purposes of this measure, VTE anticoagulation prophylaxis is defined as the use of any of the following drugs. It should be noted that to meet the intent of this measure, the use of drugs listed below is not dose or regimen dependent. Therapeutic anticoagulation would meet (and exceed) the requirements for VTE prophylaxis

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDUH</td>
<td>Heparin 5,000 U SC, given q8–12h starting 1–2 h before operation</td>
</tr>
<tr>
<td></td>
<td>Heparin SC, given q8h starting at approximately 3,500 U SC and adjusted by± 500 U SC per dose, to maintain a midinterval aPTT at high normal values</td>
</tr>
<tr>
<td>ADH</td>
<td>General surgery, moderate risk:</td>
</tr>
<tr>
<td></td>
<td>Dalteparin, 2,500 U SC 1–2 h before surgery and once daily postop</td>
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<tr>
<td></td>
<td>Enoxaparin, 20 mg SC, 1–2 h before surgery and once daily postop</td>
</tr>
<tr>
<td></td>
<td>Nadroparin, 2,850 U SC 2–4 h before surgery and once daily postop</td>
</tr>
<tr>
<td></td>
<td>Tinzaparin, 3,500 U SC 2 h before surgery and once daily postop</td>
</tr>
</tbody>
</table>
General surgery, high risk:
Dalteparin, 5,000 U SC 8–12 h before surgery and once daily postop
Danaparoid, 750 U SC 1–4 h before surgery and q12h postop
Enoxaparin, 40 mg SC, 1–2 h preop and once daily postop
Enoxaparin, 30 mg SC, q12h starting 8–12 h postop

Orthopedic surgery
Dalteparin, 5,000 U SC 8–12 h preop and once daily starting 12–24 h postop
Dalteparin, 2,500 U SC 6–8 h postop; then 5,000 U SC once daily
Danaparoid, 750 U SC 1–4 h preop and q12h postop
Enoxaparin, 30 mg SC q12h starting 12–24 h postop
Enoxaparin, 40 mg SC once daily starting 10–12 h preop
Nadroparin, 38 U/kg SC 12 h preop, 12 h postop, and once daily on postop days 1, 2, and 3; then increase to 57 U/kg SC once daily
Tinzaparin, 75 U/kg SC once daily starting 12–24 h postop
Tinzaparin, 4,500 U SC 12 h preop and once daily postop

Major trauma
Enoxaparin, 30 mg SC q12h starting 12–36 h postinjury if hemostatically stable

Acute spinal cord injury
Enoxaparin, 30 mg SC q12h

Medical conditions
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<table>
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<td>Dalteparin</td>
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<td>Enoxaparin</td>
<td>40 mg SC once daily</td>
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<td>2,850 U SC once daily</td>
</tr>
<tr>
<td>Perioperative</td>
<td>Start daily dose with approximately 5–10 mg the day of or the day after surgery; adjust the dose for a target INR of 2.5 (range 2–3)</td>
</tr>
<tr>
<td>IPC/ES</td>
<td>Start immediately before operation, and continue until fully ambulatory</td>
</tr>
</tbody>
</table>

\[1\] Dosage expressed in anti-Xa units (for enoxaparin, 1 mg = 100 anti-Xa units). Postop = postoperative.
**Intermittent Pneumatic Compression (IPC) Device:** Intermittent pneumatic compression devices have a sleeve, tube, and compression controller. There is one large bladder that fills with air for a period of time and then deflates.

Sequential and intermittent compression counteracts blood flow stasis by increasing peak blood flow velocity. As a result, less blood is allowed to pool in veins thus decreasing chances for thrombus formation. In addition, compression has an anticlotting effect by increasing fibrolytic activity, which in turn stimulates the release of plasminogen activator. These two physiological effects, in combination with the mechanical movement of fluid in a proximal direction make the sequential devices effective in preventing and treating VTE.

**Elastic Stockings (ES):** Stockings worn to apply pressure to the extremity, aiding the return of blood from the extremity to the heart through the deep veins

**Inferior Vena Cava (IVC) Filter:** Umbrella filter placed in the IVC to prevent emboli from reaching the lungs.

**Early Ambulation:** Increasing the level of activity in the lower extremities as soon as possible following surgery or other debilitating event.
SCIP Venous Thromboembolism Prevention:
Appropriate venous thromboembolism prophylaxis.

**Description:** Percent of major surgical patients who received appropriate perioperative prophylaxis based on the surgical level of risk for venous thromboembolism (VTE).

**Type of Measure:** Process

**Rationale:** Over 23 million surgeries are performed in the United States each year. The frequency of deep vein thrombosis (DVT) and pulmonary embolism (PE) varies by type of procedure and specific patient risk factors. DVT is a complication in 20% of major surgical procedures and 50% of major orthopedic procedures when prophylaxis is not used. Without prophylaxis, PE follows 1-2% of major surgical cases and 30% of major orthopedic cases. Despite the frequency with which venous thromboembolism occurs, and the well-established efficacy and safety of preventive measures, prophylaxis is often underused.¹

According to Geerts WH, Heit, JA, et al., a study of 2,000 patients, hospitalized at 16 acute care hospitals in the US, showed that only one-third received prophylaxis, despite the presence of multiple risk factors for VTE. Clinical risk factors include the following: increasing age, prolonged immobility, stroke, previous VTE, cancer and its treatment, major surgery, trauma, obesity, varicose veins, cardiac dysfunction, indwelling central venous catheter, inflammatory disease, nephritic syndrome, and pregnancy or estrogen use.²

Numerous studies show that both LDUH and LMWH reduce the risk of proximal DVT and PE in patients undergoing general surgery. Results from 46 randomized trials show that prophylaxis of general surgical patients with LDUH compared with placebo reduced the risk of DVT by 68%. LMWH has comparable efficacy to LDUH for prevention of VTE and may be more effective for preventing proximal DVT and PE.¹
**Denominator Statement:** Number of patients having major surgical procedures

**Included Populations:** All eligible patients having major surgical procedures

**Excluded Populations:**
- Patients less than 18 years of age
- Burn or transplant patients
- Surgical procedures classified as emergent

**Numerator Statement:** Number of patients in the denominator with appropriate perioperative VTE prophylaxis. See Appendix, Table 1, for appropriate prophylaxis based on surgical risk.
Selected References:


Appendix

**Measure Analysis Suggestions:**
This core measure as constructed, does not address appropriate dosage for VTE prophylaxis. Reference to dosage information can be found in the publication in *Chest* from the Sixth Consensus Conference on Antithrombotic Therapy published in 2001. Therapeutic anticoagulation would meet and exceed the requirements for VTE prophylaxis. Hospitals may want to analyze measure rates relative to appropriate dosages and the rate of subsequent VTEs.
**Terminology:**

**VTE Anticoagulation Prophylaxis:** For the purposes of this measure VTE anticoagulation prophylaxis is defined as the use of any of the following drugs. It should be noted that to meet the intent of this measure, the use of drugs listed below is not dose or regimen dependent. Therapeutic anticoagulation would meet (and exceed) the requirements for VTE prophylaxis.

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<td></td>
<td>Dalteparin, 2,500 U SC 1–2 h before surgery and once daily postop</td>
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<tr>
<td></td>
<td>Enoxaparin, 20 mg SC, 1–2 h before surgery and once daily postop</td>
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<td></td>
<td>Nadroparin, 2,850 U SC 2–4 h before surgery and once daily postop</td>
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<tr>
<td></td>
<td>Tinzaparin, 3,500 U SC 2 h before surgery and once daily postop</td>
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<tr>
<td><strong>LMWH and heparinoids</strong></td>
<td><strong>General surgery, high risk:</strong></td>
</tr>
<tr>
<td></td>
<td>Dalteparin, 5,000 U SC 8–12 h before surgery and once daily postop</td>
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<tr>
<td></td>
<td>Danaparoid, 750 U SC 1–4 h before surgery and q12h postop</td>
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<tr>
<td></td>
<td>Enoxaparin, 40 mg SC, 1–2 h preop and once daily postop</td>
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<tr>
<td></td>
<td>Enoxaparin, 30 mg SC, q12h starting 8–12 h postop</td>
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</tbody>
</table>
Orthopedic surgery:
Dalteparin, 5,000 U SC 8–12 h preop and once daily starting 12–24 h postop
Dalteparin, 2,500 U SC 6–8 h postop; then 5,000 U SC once daily
Danaparoid, 750 U SC 1–4 h preop and q12h postop
Enoxaparin, 30 mg SC q12h starting 12–24 h postop
Enoxaparin, 40 mg SC once daily starting 10–12 h preop
Nadroparin, 38 U/kg SC 12 h preop, 12 h postop, and once daily on postop days 1, 2, and 3; then increase to 57 U/kg SC once daily
Tinzaparin, 75 U/kg SC once daily starting 12–24 h postop
Tinzaparin, 4,500 U SC 12 h preop and once daily postop

Major trauma:
Enoxaparin, 30 mg SC q12h starting 12–36 h postinjury if hemostatically stable
Acute spinal cord injury
Enoxaparin, 30 mg SC q12h

Medical conditions:
Dalteparin, 2,500 U SC once daily
Danaparoid, 750 U SC q12h
Enoxaparin, 40 mg SC once daily
Nadroparin, 2,850 U SC once daily
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<tbody>
<tr>
<td><strong>Perioperative warfarin</strong></td>
<td>Start daily dose with approximately 5–10 mg the day of or the day after surgery; adjust the dose for a target INR of 2.5 (range 2–3)</td>
</tr>
<tr>
<td><strong>IPC/ES</strong></td>
<td>Start immediately before operation, and continue until fully ambulatory</td>
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</tbody>
</table>

`Dosage expressed in anti-Xa units (for enoxaparin, 1 mg = 100 anti-Xa units). Postop = postoperative. 1`

**Intermittent Pneumatic Compression (IPC) Device:** Intermittent pneumatic compression devices have a sleeve, tube, and compression controller. There is one large bladder that fills with air for a period of time and then deflates.

Sequential and intermittent compression counteracts blood flow stasis by increasing peak blood flow velocity. As a result, less blood is allowed to pool in veins thus decreasing chances for thrombus formation. In addition, compression has an anticlotting effect by increasing fibrolytic activity, which in turn stimulates the release of plasminogen activator. These two physiological effects, in combination with the mechanical movement of fluid in a proximal direction make the sequential devices effective in preventing and treating VTE.

**Elastic Stockings (ES):** Stockings worn to apply pressure to the extremity, aiding the return of blood from the extremity to the heart through the deep veins.

**Inferior Vena Cava (IVC) Filter:** Umbrella filter placed in the IVC to prevent emboli from reaching the lungs.

**Early Ambulation:** Increasing the level of activity in the lower extremities as soon as possible following surgery or other debilitating event.
<table>
<thead>
<tr>
<th>Surgery, Level of Risk</th>
<th>Recommended Prophylaxis</th>
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<tbody>
<tr>
<td>General surgery, moderate risk (Minor procedure, with</td>
<td>Elastic stockings (ES), low-dose unfractionated heparin (LDUH), low molecular weight heparin* (LMWH), or intermittent pneumatic compression device (IPC) (grade 1A)</td>
</tr>
<tr>
<td>additional risk factors for thrombosis; non-major</td>
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<tr>
<td>surgery in patients 40 to 60 yr, with no additional risk</td>
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<tr>
<td>factors; major surgery in patients &lt; 40 yr, with no</td>
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<tr>
<td>additional risk factors†)</td>
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<tr>
<td>General surgery, higher risk (Non-major surgery in</td>
<td>LDUH, LMWH*, or IPC (grade 1A)</td>
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<tr>
<td>patients &gt; 60 yr, or with additional risk factors; major</td>
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<tr>
<td>surgery in patients &gt; 40 yr, or with additional risk</td>
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<tr>
<td>factors†)</td>
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<tr>
<td>General surgery, higher risk, with greater-than-usual risk</td>
<td>Mechanical prophylaxis with elastic stockings (ES) or IPC device, at least initially (grade 1C)</td>
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<td>for bleeding</td>
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<tr>
<td>General surgery, very high risk (Multiple risk factors)</td>
<td>Effective pharmacologic methods (LDUH or LMWH*), combined with mechanical method (ES or IPC) (grade 1C)</td>
</tr>
<tr>
<td>Gynecologic surgery, brief procedure for benign</td>
<td>Early mobilization (grade 1C)</td>
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<tr>
<td>disease</td>
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<tr>
<td>Major gynecologic surgery, benign disease; no additional</td>
<td>LDUH every 12 hours (grade 1A); alternatively, LMWH or IPC device started just before surgery and continued at least several days postoperatively (grade 1C+)</td>
</tr>
<tr>
<td>risk factors</td>
<td></td>
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<tr>
<td>Extensive gynecologic surgery for malignancy</td>
<td>LDUH every 8 hours (grade 1A). For possible additional protection, LDUH plus mechanical prophylaxis with ES or IPC device; or higher doses of LMWH (grade 1C)</td>
</tr>
<tr>
<td>Urologic surgery – Transurethral or other low-risk</td>
<td>Prompt mobilization (grade 1C)</td>
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<tr>
<td>procedure</td>
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<tr>
<td>Urologic surgery – major open procedure</td>
<td>LDUH, ES, IPC device, or LMWH (grade 1B)</td>
</tr>
<tr>
<td>Urologic surgery – Highest-risk patients</td>
<td>ES with or without IPC device added to LDUH or LMWH (grade 1C)</td>
</tr>
<tr>
<td>Elective total hip replacement</td>
<td>LMWH (started 12 h before surgery, or 12 to 24 h after surgery; or half the usual high-risk dose 4 to 6 h after surgery, followed by the usual high-risk dose the following day)* or adjusted-dose warfarin (INR 2.0-3.0) started preoperatively or immediately postoperatively (grade 1A) or [adjusted-dose heparin (grade 2A)]: Adding ES or IPC may improve efficacy (grade 2C)</td>
</tr>
<tr>
<td>Elective total knee replacement</td>
<td>LMWH* or adjusted-dose warfarin (INR 2.0-3.0) (grade 1A); or “optimal” use of IPC device (grade 1B)</td>
</tr>
<tr>
<td>Hip fracture surgery</td>
<td>LMWH* or adjusted-dose warfarin (INR 2.0-3.0) (grade 1B); possible alternative: LDUH (grade 2B)</td>
</tr>
<tr>
<td>Intracranial neurosurgery</td>
<td>IPC + ES (grade 1A). LDUH or postoperative LMWH may be acceptable alternative (grade 2A) [ES or IPC with LDUH or LMWH may be more effective than either alone.]</td>
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<tr>
<td>Trauma, with identifiable risk factor for thromboembolism</td>
<td>LMWH as soon as considered safe (grade 1A); if delayed or contraindicated because of bleeding concerns, initial use of ES or IPC device or both (grade 1C) [IVC filter is recommended only if proximal DVT documented and anticoagulation is contraindicated.]</td>
</tr>
<tr>
<td>Acute spinal cord injury</td>
<td>LMWH recommended (grade 1B). (Note that LDUH, ES, and IPC as sole prophylaxis is not recommended – grade 1C). ES or IPC may be offered in combination with LMWH or LDUH, or if early use of anticoagulants is contraindicated (grade 2B)</td>
</tr>
</tbody>
</table>

† Clinical risk factors include advanced age (greater than 70 years); prolonged immobility or paralysis; obesity; varicose veins; congestive heart failure; myocardial infarction; fractures of the pelvis, hip or leg; and estrogen use. In addition, congenital and acquired aberrations in hemostatic mechanisms including antithrombin III deficiency, protein C deficiency, protein S deficiency, dysfibrinogenemia, disorders of plasminogen and plasminogen activation, antiphospholipid antibodies and lupus anticoagulant, heparin-induced thrombocytopenia, myeloproliferative disorders such as polycythemia vera and hyperviscosity syndromes.

* Note: The FDA has issued a clinical alert (FDA Public Health Advisory, 15 December 1997) regarding the use of low molecular weight heparin in patients who have had a spinal puncture or neuraxial anesthesia (epidural/spinal anesthesia). There is the possibility of the development of epidural or spinal hematoma in these patients. The risk of these complications is increased by the use of indwelling epidural catheters or by the concomitant use of drugs affecting hemostasis (NSAIDs, platelet inhibitors, or other anticoagulants) and appears to be increased by traumatic or repeated epidural or spinal puncture. The majority of reported cases have occurred in elderly women undergoing orthopedic surgery. The incidence of this complication is unknown.
Outcome Measures

Outcome measures are critical for the monitoring and improving of quality of healthcare. Various factors affect surgical outcomes, including:

- Patient related factors (risk factors)
- Provider related factors (level of training, expertise, experience, and qualifications of the surgical team)
- Facility related factors (adequate equipment, instrumentation, lab coverage, etc)

The following outcome measures have been identified by the Steering Committee for SCIP:

- Proportion of post-operative wound infection diagnosed during index hospitalization.
- Proportion of intra- or post-operative AMI diagnosed during index hospitalization.
- Proportion of intra- or post-operative cardiac arrest diagnosed during index hospitalization.
- Proportion of intra- or post-operative PE diagnosed during index hospitalization.
- Proportion of intra- or post-operative DVT diagnosed during index hospitalization.
- Proportion of post-operative VAP diagnosed during index hospitalization.
- 30-day admission/readmission.
- Mortality within 30 days of surgery.