

# Surgical Site Infections

## Change Package

2016 UPDATE

PREVENTING SURGICAL SITE INFECTIONS

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## ACKNOWLEDGEMENTS

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### How to Use this Change Package

This change package is intended for hospitals participating in the Hospital Engagement Network (HEN) 2.0 project led by the Centers for Medicare & Medicaid Services (CMS) Partnership for Patients (PFP); it is meant to be a tool to help you make patient care safer and improve care transitions. This change package is a summary of themes from the successful practices of high performing health organizations across the country. It was developed through clinical practice sharing, organization site visits and subject matter expert contributions. This change package includes a menu of strategies, change concepts and specific actionable items that any hospital can choose to implement based on need or for purposes of improving patient quality of life and care. This change package is intended to be complementary to literature reviews and other evidence-based tools and resources.

## PART 1: ADVERSE EVENT AREA (AEA) DEFINITION AND SCOPE

A surgical-site infection (SSI) is an infection that occurs after surgery in the part of the body where the surgery took place.<sup>1</sup> SSIs can be superficial infections involving just the skin or more serious and involve tissues under the skin, organs or implanted material.

### Magnitude of the Problem - Why This Matters

More than 15 million surgeries are performed in the United States annually.<sup>2</sup> Between two and five percent of these patients will develop an SSI, totaling anywhere from 160,000 to 300,000 SSIs nationwide every year. SSIs are now the most common and expensive health care associated infection in the U.S.<sup>3,4,5</sup> Fortunately, 60 percent of SSIs are potentially preventable if evidence-based practices are adopted.<sup>6</sup>

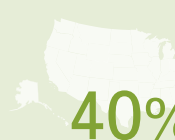
### HEN 1.0 Progress

From 2011 to 2014, the AHA/HRET HEN prevented an estimated 4,860 SSIs, with an estimated cost savings of over \$102 million.

What does that mean?

 **4,860**  
SSIs  
PREVENTED

 **\$102,060,000**  
TOTAL PROJECT  
ESTIMATED COST SAVINGS

 **17 of 31**  
PARTICIPATING HEN  
STATES MEETING THE  
REDUCTION GOAL  
**40%**

### HEN 2.0 Reduction Goals

Reduce the incidence of harm due to Surgical Site Infections (SSI) by 40 percent by September 23, 2016.

## PART 2: MEASUREMENT

A key component to making patient care safer in your hospital is to track your progress toward improvement. This section outlines the nationally recognized process and outcome measures that you will be collecting and submitting data as part of the AHA/HRET HEN 2.0. Collecting these monthly data points at your hospital will guide your quality improvement efforts as part of the Plan-Do-Study-Act (PDSA) process. Tracking your data in this manner will provide valuable information needed to study your data across time and help determine the effect your improvement strategies are having in your hospital at reducing patient harm. Furthermore, collecting these standardized metrics will allow the AHA/HRET HEN to aggregate, analyze and report its progress toward reaching the project's 40/20 goals across all AEAs by September 2016.

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## Nationally Recognized Measures: Process and Outcome

Please download and reference the encyclopedia of measures (EOM) on the AHA/HRET HEN website for additional measure specifications and for any updates after publication at: <http://www.hret-hen.org/audience/data-informatics-teams/EOM.pdf>

### HEN 2.0 EVALUATION MEASURE

Surgical Site Infection Standardized Infection Ratio (SIR) - (NQF 0753) - NHSN submitting facilities only

- Separately for each procedure: Colon surgeries, abdominal hysterectomies, total knee replacements, total hip replacements

Surgical Site Infection Rate

- Separately for each procedure: Colon surgeries, abdominal hysterectomies, total knee replacements, total hip replacements

### SUGGESTED PROCESS MEASURES

- Prophylactic Antibiotic Received within One Hour Prior to Surgical Incision – (NQF 0527 and SCIP-Inf-1a)
- Prophylactic Antibiotic Selection for Surgical Patients – (NQF 0528 and SCIP-Inf-2a)
- Prophylactic Antibiotics Discontinued within 24 Hours after Surgery End Time – (NQF 0529 and SCIP-INF-3a)

## PART 3: APPROACHING YOUR AEA

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### Suggested Bundles and Toolkits

- Society for Infection Epidemiology of America (SHEA) Compendium of Strategies to Prevent Healthcare-Associated Infection in Acute Care Hospitals: 2014 Update: <http://www.shea-online.org/View/smid/428/ArticleID/289.aspx>
- Association of Perioperative Registered Nurses (AORN) Guidelines for Perioperative Practice, 2015 Edition: <http://www.aornstandards.org/>
- Institute for Healthcare Improvement Project Joints Bundle: <http://www.ihl.org/Engage/Initiatives/Completed/ProjectJOINTS/Pages/default.aspx>
- BMJ Quality & Safety: Online First: Project JOINTS: What factors affect bundle adoption in a voluntary quality improvement campaign?: <http://qualitysafety.bmj.com/content/early/2014/11/09/bmjqs-2014-003169.full>
- For key tools and resources related to preventing and reducing surgical site infections, visit [www.hret-hen.org](http://www.hret-hen.org).

## Investigate Your Problem and Implement Best Practices

Driver diagrams: A driver diagram visually demonstrates the causal relationship between your change ideas, secondary drivers, primary drivers and your overall aim. A description of each of these components is outlined in the table below. This change package reviews the components of the driver diagram to first, help you and your care team identify potential change ideas to implement at your facility and second, to show how this quality improvement tool can be used by your team to tackle new process problems.

Aim	Primary Driver	Secondary Driver	Change Idea
		Secondary Driver	Change Idea
	Primary Driver	Secondary Driver	Change Idea

**AIM:** A clearly articulated goal or objective describing the desired outcome. It should be specific, measurable and time-bound.

**PRIMARY DRIVER:** System components or factors which contribute directly to achieving the aim.

**SECONDARY DRIVER:** Action, interventions or lower-level components necessary to achieve the primary driver.

**CHANGE IDEAS:** Specific change ideas which will support/achieve the secondary driver.

## Drivers in This Change Package

Prevent SSI	Antimicrobial Prophylaxis	Choose appropriate prophylactic antibiotics	Change Idea
	Preoperative Skin Antisepsis	Ensure preoperative skin cleansing	Change Idea
	Perioperative Skin Antisepsis	Select perioperative skin antiseptic	Change Idea
		Administer the skin antiseptic correctly	Change Idea
	Normothermia	Prevent hypothermia during all surgical phases	Change Idea
	Perioperative Safety Checklist	Utilize perioperative safety checklist	Change Idea
	Glucose Control	Monitor hyperglycemia preoperatively, perioperatively and postoperatively	Change Idea
	Supplemental Oxygen	Administer supplemental oxygen during and after surgery	Change Idea
	Additional Strategies To Prevent SSI	Adhere to established guidelines to prevent SSI	Change Idea
		Identify staphylococcus aureus-colonized patients and decolonize preoperatively	Change Idea
		Develop guidelines for surgical wound management intraoperatively and postoperatively	Change Idea

## OVERALL AIMS: PREVENT SSI

### Primary Driver > Antimicrobial prophylaxis

Ideally, an antimicrobial agent for surgical prophylaxis should: prevent SSIs, prevent SSI-related morbidity and mortality, reduce the cost of health care (given the subsequent costs associated with treating SSIs), produce no adverse effects and have no adverse consequences for the microbial flora of the patient or the health care setting.<sup>7</sup>

### Secondary Driver > Choose appropriate prophylactic antibiotics

Select the appropriate prophylactic antibiotic for a specific surgical procedure based on current clinical guidelines and ensure the antibiotic is administered at the proper time, in the correct dose and for the recommended duration.<sup>8</sup>

### Change Ideas

- + Educate surgeons on the appropriate use and administration of prophylactic antibiotics for specific surgeries.
- + Develop pharmacist- and nurse-driven protocols and/or order sets to facilitate the correct antibiotic selection and use based on the type of surgery and specific patient characteristics (e.g., age, weight).
- + Create a process to review all exceptions to the developed protocols.
- + Ensure that antibiotics are dosed in a timely manner, one hour prior to incision or two hours are allowed for the administration of vancomycin and fluoroquinolones and re-dosed appropriately in surgeries lasting longer than three hours.<sup>9</sup>
- + Determine who on the surgical team is responsible for timely antibiotic administration. Consider assigning to anesthesia staff.
- + Verify when the antibiotic was administered during a “timeout” or pre-procedural briefing so that action can be taken if the prophylaxis has not been administered.
- + Stock operating-room medications according to national guidelines to only include specific medications in standard-dose packages.

### Suggested Process Measures for Your Test of Change

- Percentage of patients who received the appropriate antimicrobial dose in a timely manner prior to incision
- Percentage of patients who received the appropriate weight-based antimicrobial preoperative dose
- Percentage of patients who received an additional antimicrobial agent when appropriate because of an extended duration of a surgical procedure

### Hardwire the Process

Ongoing monitoring of compliance to prophylaxis guidelines is vital to sustaining recommended practices. Develop standardized order sets for each surgical procedure that include the name of the designated antibiotic, the appropriate dose, the timing of its administration and the recommendations for its discontinuation. Establish a protocol whereby the anesthesiologist is prompted to re-dose the patient (e.g., using a timer or clock). Audit compliance monthly, and provide feedback to providers regarding the audit results. Report results regularly in quality or infection-prevention committees. If compliance to antibiotic guidelines decreases, engage practitioners and nurses to examine contributing factors and potential changes.

### Primary Driver > Preoperative skin antisepsis

The purpose of preoperative skin antisepsis is to reduce surgical infection risk by decreasing the bacterial count on the patient’s skin. Preoperative bathing with soap or an antiseptic agent by the patient prior to surgery helps to reduce the bacterial load.<sup>10,11</sup>

### Secondary Driver > Ensure preoperative skin cleansing

Develop a preoperative skin antisepsis protocol for surgical patients that includes patient bathing or showering with soap or antiseptic agent(s) prior to surgery.

### Change Ideas

- + Choose a preoperative skin agent and method based upon review of current research literature by a multidisciplinary team.
- + Develop a strategy to distribute skin antiseptic agent(s) to patients prior to surgery.

- > Develop a process to educate hip- and knee-replacement patients and their families about the importance of bathing or showering with CHG soap for three days preoperatively. See Appendix III for a joint-patient-bathing-instructions tool.
- > Consider the use of Chlorhexidine Gluconate (CHG) wipes instead of soap. Better compliance may be achieved with CHG cloths rather than with liquid soap.
- + Educate patients on how to appropriately apply the skin antiseptic agents using the teach-back method, in which patients explain back in their own words what they understood the clinicians' instructions to be.
- + Reinforce the need for preoperative bathing along with instruction reinforcement in the preoperative call.
- + Ask patients to complete a standard form after they perform skin cleansing, documenting the cleansing dates and times. Ask patients to also affix the bottle label/package sticker to the form to confirm pre-surgical skin cleansing prior to surgery.
- + Educate patients and families about the risks of applying lotions/deodorants after cleansing, as these agents will reduce the benefits of the antiseptic residue.
- + Establish a process for staff to inquire if the patient had any difficulty following the bathing procedure to identify gaps and provide supplemental cleansing measures to prevent infection.

### **Suggested Process Measures for Your Test of Change**

- Percentage of patients eligible for preoperative skin cleansing who received the cleansing product
- Percentage of patients who experienced a rash or other skin reaction possibly related to the preoperative skin cleansing

### **Hardwire the Process**

Standardizing processes is a key hardwiring strategy. Standardizing preoperative skin antisepsis may include the following:

- + Develop standardized order sets for preoperative skin cleansing to reduce protocol variation.
- + Preoperative checklists that include reminders about skin antisepsis and method, patient teaching points using teach-back method, opportunities for return demonstration (in which patients demonstrate what has just been taught to them) and opportunities for patients to ask questions and express concerns and requests.
- + Skin-antisepsis product and educational materials readily available to give to patients whether at physician's office or during a preoperative appointment at the hospital.
- + Include the topic of preoperative bathing using skin antisepsis in preoperative call.

## **Primary Driver > Perioperative skin antisepsis**

Perioperative skin antisepsis using an antiseptic agent is a vital step in preventing SSIs.<sup>12</sup> Alcohol-containing preoperative skin antiseptic agents may be more effective than those without, but the most effective antiseptic to combine with alcohol has not been determined.<sup>12,13</sup> There are clearly differences in mechanisms of action between povidone-iodine and CHG that may favor the selection of one product over the other in certain patients. And, when combined with either CHG or an iodophor, alcohol plays a synergistic role in enhancing skin preparation.<sup>12,13</sup>

## **Secondary Driver > Select the perioperative skin antiseptic**

Choose the appropriate antiseptic for a specific surgical procedure based on current clinical guidelines. Understand the differences in the mechanisms of action between povidone-iodine and CHG as skin antiseptic agents. The most effective antiseptic to combine with alcohol has not been determined. CHG may have advantages over povidone-iodine, including the fact that increased amount of CHG on the skin leads to enhanced antiseptic activity, longer residual activity and activity in the presence of blood or serum.<sup>12,14,15</sup> A growing body of literature shows that two percent CHG impregnated cloths are the preferred agent and method, and povidone-iodine is an alternative when CHG is contraindicated.<sup>16</sup>

### **Change Ideas**

- + Use evidence-based results from the literature and educate all perioperative personnel on the benefits of skin antisepsis to reduce the microbial burden on the skin prior to surgery.
- + Select skin antiseptic and an alternative antiseptic for those patients with sensitivities and make these readily available.

### Secondary Driver > Administer the preoperative skin antiseptic correctly

Incorrect application that leads to incomplete coverage of the surgical site may result in decreases in both antiseptic effectiveness and residual effect.<sup>12</sup>

#### Change Ideas

- + Educate perioperative personnel on the safe application and use of selected skin antiseptic agents.
- + Validate perioperative personnel's use of proper technique using return demonstration (in which they demonstrate their technique) in the application of skin antiseptics.
- + Review package instructions to determine the amount of skin surface each unit-dose container of skin antiseptics is able to cover and maintain a therapeutic dose, particularly when preparing a patient scheduled for bariatric surgery.

#### Suggested Process Measures for Your Test of Change

- Percentage of patients whose skin was prepared with the standardized skin-preparation protocol
- Observational studies of the implementation of perioperative skin antiseptics with a sampling of surgical specialties
- Percentage of bariatric patients who were prepped with the appropriate dose of a skin cleansing agent as calculated based on skin-surface measurements

### Hardwire the Process

To ensure correct application each and every time, standardize the process using the product insert of the selected skin-antiseptic agent as a guide. This protocol should include the appropriate agent for each procedure and an alternative agent in case of patient sensitivity, the amount to be applied and the method of application.

### Primary Driver > Perioperative safety checklist

Use of a checklist supports compliance with standards, guidelines and evidence-based practices to improve surgical patient safety and SSI-prevention measures.<sup>12</sup>

### Secondary Driver > Utilize a perioperative checklist

A checklist (e.g., the WHO Surgical Safety Checklist) supports communication, guides timeouts and promotes a safe culture (e.g., speaking up). See Appendix IV for a sample checklist.

#### Change Ideas

- + Adopt a surgical-safety checklist based on the WHO Surgical Safety Checklist.
- + Test the surgical-safety checklist prior to implementation to determine workflow.
- + Assign responsibility for initiating the checklist to a specific role.
- + Promote effective interprofessional communication utilizing TeamSTEPPS™ structured communication processes.<sup>17</sup> Allow teams the time to practice and role play different scenarios to increase comfort levels in speaking up.

#### Suggested Process Measures for Your Test of Change

- The rate perioperative checklist use
- Percentage of surgical cases with a completed surgical checklist in the medical record

### Hardwire the Process

Involve surgeons, nurses, technicians and anesthesiologists in the design or redesign of a surgical checklist to promote adoption. Develop a process to report results from observational studies and chart audits to the quality or infection prevention committee.

## Primary Driver > Normothermia

Maintaining normothermia during the perioperative period reduces the risk of SSI.<sup>12</sup> Hypothermia adversely affects circulation, coagulation, medication metabolism and wound healing and increases risk of infection by impairing immune function and circulation.<sup>18</sup> Numerous factors, such as room temperature, anesthesia, intravenous and irrigation fluids, anxiety and skin exposure can cause patients to become clinically hypothermic during surgery.<sup>17</sup> Studies have demonstrated that both preoperative and intraoperative warming reduce SSI rates and other complications.<sup>19,20,21,22</sup>

## Secondary Driver > Prevent hypothermia during all surgical phases

Pre-warm and actively warm in the operating room. Patients should be warmed for a minimum of 15 minutes prior to the induction of anesthesia.

### Change Ideas

- + Pre-warm using forced air warming system in the preoperative area.
- + Keep patient normothermic during the intraoperative period by using forced air warming, circulating water garments or energy transfer pads.<sup>23</sup>
- + Use warmed intravenous (IV) fluids if large volumes are given and warmed irrigation fluid for inside the abdomen, pelvis or thorax.
- + Measure body temperature at appropriate intervals.
- + Teach patients and their families in the preoperative period about the value of pre-warming and warming to improve healing and reduce infection risk post-surgery.
- + Adjust engineering controls so that operating rooms and patient areas are not permitted to become excessively cold overnight, when many rooms are empty.
- + Educate the surgical team that normothermia results in less blood loss, reducing the need for blood transfusions.
- + Monitor and record operating room ambient temperature. Establish a partnership with the engineering department in maintaining targeted room temperature.
- + Utilize a low-tech warming system wherein a warmed blanket is covered by a sheet.

### Suggested Process Measures for Your Test of Change

- Percentage of patients whose temperature remained within the normal range perioperatively
- Percentage of patients who received warmed IV fluids and irrigation fluids

## Hardwire the Process

Measures should be taken for every patient to prevent inadvertent hypothermia to reduce the risk of SSI. Standardization of practice will support reliability of hypothermia prevention. Develop standardized procedures for pre-warming in preoperative area that include assessing patient risk of hypothermia. Report ambient temperature logs to quality or infection prevention committee.

## Primary Driver > Glucose control

Perioperative hyperglycemia has been associated with adverse outcomes in general surgery patients with and without diabetes.<sup>24,25,26,27,28,29</sup> Studies have also shown that the degree of hyperglycemia in the postoperative period correlates with the rate of SSI in patients undergoing major cardiac surgery.<sup>30,31</sup> Recommendations are to maintain postoperative blood glucose of 180 mg/dL or lower in both general and cardiac-surgery patients.<sup>12</sup>

## Secondary Driver > Monitor hyperglycemia preoperatively, intraoperatively and postoperatively

Opportunities for hyperglycemia exist during each surgical phase and therefore must be monitored at each phase. Maintenance of blood sugars within the range of 140 or 150 to 180 or less is a reasonable goal.<sup>32</sup> Intensive postoperative glucose control (targeting levels less than 110mg/dL) has not been shown to reduce the risk of SSI and may actually lead to higher rates of adverse outcomes, including stroke and death.<sup>33,34</sup> Establish protocols to monitor perioperative glucose levels.

### Change Ideas

- + Obtain glucometers for every anesthesia station.
- + Identify patients at risk for hyperglycemia in the perioperative period; the list should not be limited to diabetic patients.

- + Require glucose testing for every surgical patient upon arrival in the operating room; perform glucose testing when blood pressure, heart rate, temperature and oxygen saturation are being recorded.
- + Develop a perioperative glycemic control team that includes surgeons, anesthesiologists, endocrinologists and nurses who are assigned the responsibility for blood-glucose monitoring and control.
- + Minimize extreme glucose spikes and drops during perioperative care.
- + Establish guidelines on holding sulfonurea agents and metformin for 24 hours prior to elective surgeries and for adjusting the patient's insulin dose on the morning of surgery. Patients with an insulin pump may need a continual basal insulin rate the morning of surgery.<sup>35</sup>
- + Develop the guidelines to perioperative glucose control in collaboration with your medical staff and clinical pharmacist.

### **Suggested Process Measures for Your Test of Change**

- Percentage of patients who had their blood sugar checked intraoperatively
- Percentage of anesthesia stations that have a functioning glucometer present

### **Hardwire the Process**

Surgeons, anesthesiologists, intensivists and nursing staff must be included in the education, design and testing of efforts to control blood glucose levels. This will promote adoption of practice and facilitate success of supporting processes. Examples of supporting the hardwiring of processes include:

- + Implementing a glucose-control protocol for all surgical patients.
- + Periodically auditing operating room blood-sugar values to assess for signs of practice drift.
- + In the protocol, including an algorithm for the appropriate administration of intravenous insulin to patients with intraoperative and postoperative hyperglycemia.
- + Including diabetic-medication adjustments for the morning of surgery in the preoperative call the night before surgery.

## **Primary Driver > Supplemental oxygen**

Administering supplemental oxygen preoperatively, intraoperatively and postoperatively optimizes tissue oxygenation and reduces SSI risk.<sup>12,36,37,38</sup>

### **Secondary Driver > Administer supplemental oxygen during and after surgery**

Perioperative oxygen administration is a simple, low-cost SSI prevention strategy. A meta-analysis concluded that perioperative supplemental oxygen led to a relative risk reduction of 25 percent.<sup>39,40</sup> Through a standardized protocol, provide guidance on the appropriate and timely use of supplemental oxygen through the surgical perioperative period for all patients.<sup>41</sup>

### **Change Ideas**

- + Include supplemental oxygen on preoperative and postoperative orders.
- + Educate surgical staff on the benefits of high oxygen levels in preventing wound and tissue hypoxia postoperatively.
- + Educate surgical staff that oxygenation is a low-cost intervention with benefits and minimal risks.

### **Suggested Process Measures for Your Test of Change**

- Percentage of patients who received supplemental oxygen therapy perioperatively.
- Percentage of patients who received supplemental oxygen therapy immediately after surgery.

### **Hardwire the Process**

Develop and test protocols with a multidisciplinary team, including perioperative nurses, anesthesiologists and surgeons. Include supplemental oxygen administration on perioperative checklists, order sets and nurse-driven protocols. Periodically audit operating room records for documentation of supplemental oxygen to assess for practice drift.

## Primary Driver > Additional strategies to prevent SSI

A focus on adherence to the basics is imperative when focusing on prevention of SSIs. Many of these strategies are related to the team's culture of safety, which supports intolerance for deviance from established practices. This strategy encompasses patient and family engagement, the environment and personnel practices.

## Secondary Driver > Adhere to established guidelines to prevent SSIs

Utilize the guidelines provided by professional organizations, such as the Association of Perioperative Registered Nurses (AORN), to ensure recommended standards and practices are followed.<sup>42</sup>

### Change Ideas

- + Conduct direct observational studies of a sampling of surgical procedures to evaluate adherence to aseptic practices.
- + Evaluate traffic-control patterns to establish the rate of entry and exit in the surgical suite.
- + Develop a surgical-attire policy that adheres to recommend practices for surgical attire, hair-covering, shoes, masks and jackets.
- + Evaluate practices related to hair-covering (e.g., using bouffant caps instead of skull caps as the latter do not contain all hair and ears).
- + Establish room- and equipment-cleaning procedures and frequencies by a multidisciplinary team according to perioperative standards and recommendations.
- + Educate patients and their families about appropriate, personal hair removal practices (e.g., instruct patients not to shave their legs in the week prior to hip or knee surgery, and advise female patients not to shave their perineal area prior to a scheduled C-section).
- + Establish and monitor pre-surgical hair-removal processes. Avoid hair removal unless necessary for the procedure. Remove hair close to the time of surgery, outside of the operating room to prevent contamination of the environment. Do not allow use of razors.
- + Determine the method used to clean/sterilize clipper hand pieces between patients.
- + Utilize double gloving and glove changes.
- + Provide positive-pressure ventilation in the operating room, with at least 15 air exchanges an hour.

### Suggested Process Measures for Your Test of Change

- Number of hair-removal documentations; including rationale for removal, device used, time and physical location
- Number of times the door in an operative suite opens during a surgical procedure per week
- Number of staff who have their hair and ears 100 percent covered while in the surgical suite per week

## Secondary Driver > Identify *Staphylococcus aureus*-colonized patients and decolonize preoperatively

Patients who carry *Staphylococcus aureus* (SA) – both methicillin sensitive and methicillin resistant – in their nares or on their skin are more likely to develop SA surgical-site infections.<sup>43,44,45</sup> Depending on the surgical procedure, such as joint and cardiac surgeries, baseline SSI rates, and available resources, implement a pre-screening program to identify and decolonize SA carriers prior to surgery.<sup>46,47,48</sup>

### Change Ideas

- + Educate the surgical staff to be aware that patients who carry SA in their nares/skin are more likely to develop SA surgical-site infections.
- + Recognize that decolonization efforts are not a “cure”, but a temporary reduction of SA from the nares and skin, the natural reservoirs where SA is most often carried.
- + Establish a pre-screening/decolonization program for designated elective surgeries (e.g., hip or knee replacements or coronary artery bypass surgery).
- + Integrate CHG bathing and either intranasal mupirocin or povidone-iodine nasal antiseptic into the decolonization protocol.
- + Establish clear pre-admission testing protocols for the screening, detection and reporting of SA. Clearly state who performs the diagnostic swab, who processes the swab to determine if SA is present, who receives the notification of SA presence, and who coordinates and implements follow-up treatment.

### Suggested Process Measures for Your Test of Change

- Percentage of eligible patients who have a preoperative nasal-SA screening performed
- Percentage of patients with a positive SA screen who also receive mupirocin, povidone-iodine cleaning and CHG decolonization interventions

## Secondary Driver > Develop guidelines for surgical wound management intraoperatively and postoperatively

Guidelines, developed by a multidisciplinary team, should adhere to recommended evidence-based practices within the literature.

### Change Ideas

- + Consider standardizing irrigation protocols for cases in which irrigation is indicated (e.g., ophthalmologic or prolonged abdominal surgeries).
- + Evaluate protocols for the timely removal of drains.
- + Consider utilizing antiseptic dressings around drains that remain in place.
- + Use impervious plastic wound protectors for gastrointestinal and biliary tract surgery.
- + Explore the benefits of dressings impregnated with an antimicrobial agent in select cases.
- + Develop a closure guide for surgical procedures that carry a higher risk for SSI (e.g., hernia repair).
- + Establish protocols designed to identify and minimize unnecessary entries and exits in the surgical suite.
- + Open a new sterile instrument set to close the patient if contamination is suspected in an instrument set being used (e.g., in colon surgery).
- + Establish a process to address intraoperative replacement of gloves and gowns of those directly involved in closing a case that is considered contaminated.
- + Evaluate where hair removal is actually taking place. If it is occurring in the operating room, question why this is necessary. If there is no other option, consider utilizing a device that removes and also contains the hair.
- + Evaluate traffic-control patterns to establish the rate of entry and exit in the surgical suite.
- + Irrigate wounds prior to closure.
- + Consider utilizing antimicrobial-impregnated sutures for some surgeries (e.g., colorectal surgeries).<sup>12,49,50</sup>
- + Apply sterile dressing for 24 – 48 hours.

### Suggested Process Measures for Your Test of Change

- Percentage of patients for whom wound-management guidelines were followed
- Observational studies of antiseptic practices in operating room to assess glove replacement and irrigation practices at wound closure

### Hardwire the Process

Ongoing monitoring of compliance to supporting processes is vital to sustaining recommended practices.

- + Audit practices and provide feedback to providers regarding results and recommendations for improvement. Report results regularly in quality or infection prevention committees. If compliance to wound-management guidelines decreases, engage surgeons, anesthesiologists, nurses and other team members to examine contributing factors and potential changes. See Appendix II for an audit tool: Surgical Procedures Observation Checklist for Assessment of Infection-Prevention Efforts.
- + Include special wound protectors and recommended enhanced dressings in surgical-case pick lists
- + Establish traffic-control guidelines to restrict access into the operating rooms during open cases.

## PDSA IN ACTION | TIPS ON HOW TO USE THE MODEL FOR IMPROVEMENT

There are many potentially effective interventions to reduce the risks of SSI. Improvement teams should begin their efforts by asking: “What is the greatest need at our facility? Where can we have the greatest impact?”

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### Choice of Tests and Interventions for SSI Reduction:

- Focus on pre-surgical skin cleansing;
  - Enhance antimicrobial therapy practices;
  - Improve traffic control during your joint procedures; or
  - Keep your patients warm during and after surgery?
- 

### Implement Small Tests of Change

Test adherence to protocols of antibiotic administration by anesthesiologists, including documentation.

## PLAN

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Select a volunteer anesthesiologist to administer and document one antibiotic dose for the first case of the day. *For Example:*

- The operating room nurse will record the observation of administration and document any secondary issues that arise.
- The anesthesiologist will document the time and dose of antibiotic administration on the preoperative checklist.
- The process will be reviewed with the anesthesiologist and the nurse in a debriefing after the surgery is complete.

## DO

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Carry out the change and test. Collect information and data about the test, and begin your analysis. *For Example:*

- A test was conducted on the first surgery case on Tuesday morning.
- The anesthesiologist was not happy; he/she did not have the preoperative checklist in his/her hands at the scheduled time of antibiotic administration because the circulating nurse was carrying it.

## STUDY

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Debrief and conduct an analysis of the findings. How did or didn't the results of this cycle agree with your initial predictions? Summarize the new knowledge that was gained from this PDSA cycle. *For Example:*

- The checklist currently in use was not ideal for use by anesthesiologists who need to record dose administration.
- Discuss whether the time of antibiotic administration record could be documented on the anesthesia record instead of on the checklist.
- Revise the checklist and anesthesia record as needed to ensure that the documentation of administration time is consistent.

## ACT

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List new actions that will be implemented as a result of the analysis of this cycle. *For Example:*

- The anesthesiologist is willing to try the test again.
- Repeat this test the next day after drafting a revision to the anesthesia record.

## NEXT STEPS

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Begin a new PDSA cycle by analyzing the results from your last test to help inform your plan for the next test. The next day perform the test for two or three scheduled surgeries, analyze and review based on the results.

---

### Potential Barriers

Many of these change ideas will require surgeons, nurses and other clinical staff to modify their daily routines. Resistance to change is common, particularly when proposing modifications in surgical procedures, such as perioperative skin preparation. Therefore, provide the evidence for the suggested changes; the research and literature can speak to the benefits of practice changes. Additionally, enlist champions to advocate for these changes. A champion may be a surgeon, a surgical nurse, an anesthesiologist, a perfusionist or a preoperative nurse. An effective champion supports quality-improvement initiatives and is open to change ideas that attempt to improve services. Leaders and champions can help an organization adopt advances in knowledge and practice that positively impact patient outcomes.

### Enlist Administrative Leadership as Sponsors to Help Remove or Mitigate Barriers

- Enlist an executive sponsor who recognizes the value of preventing SSIs for patients and your organization. The sponsor can help engage key stakeholders, the board and staff in seeing the big picture of the importance of eliminating harm caused by SSIs.
- The sponsor must have the authority and ability to provide solutions in overcoming barriers and resources needed to facilitate implementation.
- Utilize respected and willing surgeons and anesthesiologists as “opinion leaders” who can trial these changes in their cases, and then advocate for organization wide adoption of successful best practices.

### Change not only “The Practice,” but also “The Culture”

- Implementing SSI-prevention measures will require a change in culture, particularly among surgeons, who will be asked to evolve their practice to a more standardized, multidisciplinary approach. Engaging individual surgeons and anesthesiologists in the process of making changes from the onset is crucial. Surgeons and anesthesiologists need to maintain their authority and leadership in the operating room while leading or supporting new or improved safety practices. Therefore, it is critical that concerns voiced about changes are heard and responded to in an inter-professional, collaborative manner. If necessary, engage medical leadership in mentoring resistant, outlier physicians.
- Many physicians prefer to learn from peers rather than by following theoretical expert advice. Use lead surgeons and anesthesiologists as peer educators to advocate for the adoption of improvements, such as time outs and safety checklists, and to model the new practices.
- Begin the trial with a small test of change with one willing surgeon and other perioperative staff. Actively gather and respond to feedback with each small test of change until an effective process is achieved. Then spread the new process to more surgical teams, and eventually disseminate successful results more widely across the department and other invasive procedural areas. The ideal outcome is the development of team-based care wherein each member of the team (surgeon, anesthesiologists, physician assistants, nurses, technicians) contributes to improved quality of patient care.

## PART 4: CONCLUSION & YOUR NEXT STEPS

SSI prevention is multifaceted and attainable by following evidence-based strategies and recommended guidelines. This effort requires a multidisciplinary approach that includes surgeons, anesthesiologists, leaders, perioperative staff, infection preventionists, pharmacists, engineers and environmental services. Ongoing monitoring of compliance with using bundles for data-driven decision making; data drives practice and process changes. Communications of supporting processes and SSI rates to physicians and perioperative staff are also keys to success.

- Multidisciplinary approach – assemble a team with physician champions (surgeon and anesthesiologist), front-line staff leaders and key leadership persons. Determine and define roles, and ensure that the leader has the energy to lead a dynamic process-improvement project. Assess the composition of the team and the support from key strategic partners, such as the quality leader, chief medical officer, nursing director, infection preventionist, etc. Create strategies and/or allocate resources to engage front-line staff in designing new care processes.
- Ongoing monitoring - use the data to drive decision making for determining practice and process changes. Use the Top Ten Checklist (Appendix I) to assess current efforts in SSI prevention. Ask “Do we have this element in place? If so, how well are we doing it? Is practice drift present?” Enlist physician and nursing champions on the team to assist in data analysis, determine potential interventions and conduct small tests of change (see Appendix V).
- Communication – establish clear lines of communication with physicians, staff, other stakeholders and supporting leadership. Communication should include guidelines, supporting-processes compliance and SSI rates and it should be annotated with interventions to show effects of improvement efforts.

## PART 5: APPENDICES

### APPENDIX I: SURGICAL SITE INFECTIONS (SSI) TOP TEN CHECKLIST

**Associated Hospital/Organization:** AHA/HRET HEN 2.0

**Purpose of Tool:** A checklist to review current SSI interventions or initiate prevention in your facility.

**Reference:** [www.hret-hen.org](http://www.hret-hen.org)

2016 SSI Top Ten Checklist				
Process Change	In Place	Not Done	Will Adopt	Notes (Responsible and By When?)
Develop and follow standardized order sets for each surgical procedure to include antibiotic name, timing of administration, weight-based dose, re-dosing (for longer procedures) and discontinuation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Ensure preoperative skin antisepsis (basic soap and water shower); antiseptic agent (e.g., chlorhexidine gluconate (CHG) cloths).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Develop standardized perioperative skin-antiseptic practices utilizing the most appropriate skin antiseptic for the type of surgery performed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Develop a standardized procedure to assure normothermia by warming ALL surgical patients.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Develop and implement protocol to optimize glucose control in ALL surgical patients.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Administer supplemental oxygen during the preoperative, intraoperative and postoperative periods.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Develop protocol to screen and/or decolonize selected patients with <i>Staphylococcus aureus</i> .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Adhere to established guidelines (e.g., HICPAC, AORN) to assure basic aseptic techniques (e.g., traffic control, attire) are adhered to uniformly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Utilize a Safe Surgery Checklist to drive development of a culture of safety that provides an environment of open and safe communication among the surgical team.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Establish a system where surgical site infection data are analyzed and shared.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

## APPENDIX II: OPERATING ROOM OBSERVATION CHECKLIST

**Associated Hospital/Organization:** Infection Prevention and Control Quality and Safety Department, Program Office  
Kaiser Permanente

**Purpose of Tool:** Audit of surgical procedure compliance of guidelines and protocols

**Reference:** Developed by Kaiser National Infection Prevention and Periop; based on a tool shared by Gwen Felizardo, RN, BSN, CIC, Group Health Cooperative, Tacoma, Washington - Revised Kaiser National Infection Prevention and Control 2015

### Surgical Procedures (surgical = procedures involving an incision) Observation Checklist for Assessment of Infection Prevention Efforts

**Date of Observation:** \_\_\_\_\_ **Observer:** \_\_\_\_\_

**Procedure(s):** \_\_\_\_\_ **Surgeon/MD:** \_\_\_\_\_

Standards	Yes	No	N/A	Description/ Comments
<b>Environment:</b>				
Room appears clean, dust free, uncluttered, no holes in walls, floors or ceiling				
Interim (between case) environmental cleaning performed – horizontal surfaces in patient zone (note: floor and walls not implicated in infection transmission)				
Single-use items disposed between cases including O2 tubing, suction canisters				
Reusable patient equipment cleaned/disinfected between cases				
Doors closed, traffic in and out of room kept to minimum during case				
Clean, sterile, and soiled items are kept separate.				
Supplies stored behind closed doors				
<b>Patient Care:</b>				
If indicated: pre-op antibiotic administered within 60 minutes prior to incision				
Hair removal: if needed, ensure clipped hair is contained e.g. with ClipVac <a href="http://www.carefusion.com/medical-products/infection-prevention/surgical-clippers/clipvac.aspx">http://www.carefusion.com/medical-products/infection-prevention/surgical-clippers/clipvac.aspx</a>				
Skin prep: Dual agent prep used (e.g. Chloraprep or Duraprep) and applied correctly – back and forth for 30 seconds for Chloraprep/concentric circles for Duraprep) and appropriate dry time 30 seconds). CHG, Betadine or Technicare for mucous membranes (e.g. genitalia) per regional policy				
<b>Staff Attire:</b>				
Non scrubbed staff: Hand hygiene prior to applying gloves and after glove removal				
Properly donned surgical masks				
All head hair covered				
Chest and beard hair fully covered				
For all staff, no artificial nails, natural nails short				
All non-scrubbed OR staff should wear long sleeve jackets buttoned up				
Keep jewelry to a minimum and contained within the scrub				
No lanyard badge holders				

## APPENDIX II: OPERATING ROOM OBSERVATION CHECKLIST (CONTINUED)

Standards	Yes	No	N/A	Description/ Comments
<b>Sterile Field:</b>				
In OR: Once opened sterile items are supervised to prevent contamination. In other venues: Once sterile items opened environment is controlled to prevent contamination.				
Items introduced onto sterile field are opened, dispensed, transferred by methods to maintain sterility/integrity.				
All personnel moving in/around sterile field do so in manner to maintain sterility – e.g. + Staff do not turn back to sterile field + Hands above waist + Separation of sterile team from non-sterile team maintained				
Non sterile equipment covered by a clean barrier such as C-Arm; sterile handles for microscope, lights or other equipment touched by scrubbed team members				
<b>Anesthesia:</b>				
IV injection ports swabbed prior to access or port disinfectant cap used				
Skin prep prior to local anesthetic (alcohol)				
Drainage bags (e.g. Foley) kept off the floor				
Aseptic practice used for accessing IV tubing, administering fluids and medications				
IV solution/tubing is assembled <b>immediately</b> prior to use				
Aseptic practice used for all invasive procedures: (epidurals, blocks, IV insertion)				
Anesthesia cart (if applicable) appears clean – hand sanitizer readily available & used routinely- cart wiped down between cases				
Re-usable personal equipment (e.g. stethoscope) cleaned between cases				
If MDV are used they are dated when opened, and with 28 day expiration date; single dose vials are not used for more than one patient; medications are stored according to manufacturer recommendations				
<b>Surgical Hand Scrub</b>				
Surgical team cleans fingernails and washes hands with soap and water if using alcohol based brushless product.				
Surgical team performs a pre-surgical hand scrub per protocol using antimicrobial solution OR brushless alcohol based scrub product per manufacturer's recommendations.				

### Additional procedure specific items:

Standards	Yes	No	N/A	Description/ Comments
<b>Mohs procedure</b>				
Mask and sterile gloves should be worn by provider – gloves should be changed after skin prep if gloves contact sponge/prep solution (not sterile)				
Sterile instruments should be used for second and subsequent skin layer(s) removal (sterile scalpel, scissors and tweezers).				
Consider pre-op patient nasal decolonization with Mupirocin, Nozin alcohol or 3M PVI nasal antiseptic <sup>1</sup>				
Consider antiseptic dressing and/or surgical glue for incision over suture to provide a closed aseptic wound during healing <sup>3</sup> .				

## APPENDIX II: OPERATING ROOM OBSERVATION CHECKLIST (CONTINUED)

Standards	Yes	No	N/A	Description/ Comments
<b>PEG tube placement</b>				
Long sleeves should be worn by surgeon AND endoscopic MD (two providers — one doing the endoscopy, one doing the insertion of the PEG tube via incision).				
Mask should be worn by both physicians.				
There should be no contact between non-scrubbed (endoscopic) physician and sterile field.				
Consider Biopatch or other antiseptic dressing over tube insertion site at the end of the procedure <sup>4</sup> .				
<b>Cataract procedure<sup>5-9</sup></b>				
Sterile single packaged ophthalmic betadine ocular prep				
Use only lint free surgical drapes.				
Use preservative and stabilizer free epinephrine.				
Eye drops used for one patient only.				
Elimination of enzymatic detergent for cataract instruments and substituting pH neutral detergent (prevention of TASS)				
Staff checks expiration date of the implantable device (lens).				
Staff checks all indicators on and in sterile trays.				
Use deionized water for final instrument rinse prior to sterilization.				
Instruments that cannot be cleaned with confidence should be disposable if at all possible e.g. small cannulas, lens enfolder.				
For non-disposable instruments with a lumen, Quick Rinse can be used to force fluid through small channels.				
Inspection of cataract instruments under magnification in SPD prior to sterilization.				
No IUSS for cataract instrument.				
<b>Vasectomy</b>				
Razor use for scrotal hair removal is permitted – surgeon choice.				

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## APPENDIX III: JOINT SURGERY PATIENT BATHING INSTRUCTIONS

**Associated Hospital/Organization:** Cynosure Health

**Purpose of Tool:** Patient education on preoperative skin antisepsis for patients undergoing hip or knee surgery

**Reference:** Not applicable

### Joint Surgery Patient Bathing Instructions

You play an important role in your own health. Because skin is not sterile, we need to be sure that your skin is as free of germs as possible before your surgery. You can reduce the number of germs on your skin by using the antiseptic soap we have given you and by following the directions below.

<b>Date:</b>	Two days before surgery	<input type="checkbox"/> Shower or bathe with antiseptic soap as described below. (Check when done)
<b>Date:</b>	One day before surgery	<input type="checkbox"/> Shower or bathe with antiseptic soap as described below. Do <b>NOT</b> shave area where surgery will take place. (Check when done)
<b>Date:</b>	Morning of surgery	<input type="checkbox"/> Shower or bathe with antiseptic soap as described below. Do <b>NOT</b> shave area where surgery will take place. Do <b>NOT</b> put on any lotions, perfumes, powders or deodorant. (Check when done)

### Shower/Bathing Instructions:

1. Get completely wet
2. Turn off water if using shower/step out of tub if using bath
3. Gently apply antiseptic soap to neck and move down your body using a clean washcloth
4. Pay special attention to surgical area
5. Do NOT apply to face or genitals (use regular soap for these areas)
6. Keep soap on your skin for five minutes; the soap will not make a rich lather
7. Turn water back on and rinse off soap; the soap might feel 'sticky' until completely dry
8. Dry with a freshly washed towel
9. Put on freshly washed clothes

### CAUTION/REMINDER:

Do **NOT** use antiseptic soap if you are allergic to chlorhexidine.

Once you have started using the antiseptic soap, avoid using regular soap other than on your face and genitals.

**Please complete this checklist and bring it with you to the hospital on the day of your surgery.**

## APPENDIX IV: SAFE SURGERY TOOLKIT

**Associated Hospital/Organization:** Harvard School of Public Health, Massachusetts

**Purpose of Tool:** The Safe Surgery 2015 Initiative was developed to reduce surgical infections, major complications and death through effective population-wide implementation of the WHO Surgical Safety Checklist Program.

**Reference:** To learn more about the Safe Surgery 2015 Initiative, please visit [www.safesurgery2015.org](http://www.safesurgery2015.org).

### Safe Surgery 2015 Checklist Template

#### Before Induction of Anesthesia

##### Nurse and Anesthesia Provider Verify:

- ☐ Patient identification (name and DOB)
- ☐ Surgical site
- ☐ Surgical Procedure to be performed matches the consent
- ☐ Site marked
- ☐ Known allergies
- ☐ Patient Positioning
- ☐ The anesthesia safety check has been completed

##### Anesthesia Provider Shares Patient Specific Information with the Team:

- ☐ Anticipated airway or aspiration risk
- ☐ Risk of significant blood loss
  - Two IVs/central access and fluids planned
  - Type and crossmatch/screen
  - Blood availability
- ☐ Risk of hypothermia - operation >1h
  - Warmer in place
- ☐ Risk of venous thromboembolism
  - Boots and/or anticoagulants in place

#### Before Skin Incision

##### Entire Surgical Team:

- ☐ Is everyone ready to perform the time out?
- ☐ Please state your name and role
- ☐ Patient's name
- ☐ Surgical procedure to be performed
- ☐ Surgical site
- ☐ Essential imaging available
- ☐ Has antibiotic prophylaxis been given within the last 60 minutes?
  - Plan for redosing discussed

#### Briefing

##### Surgeon Shares:

- ☐ Operative Plan
- ☐ Possible difficulties
- ☐ Expected duration
- ☐ Anticipated blood loss
- ☐ Implants or special equipment needed

##### Anesthesia Provider Shares:

- ☐ Anesthetic plan
- ☐ Airway concerns
- ☐ Other concerns

##### Circulating Nurse and Scrub Tech Share:

- ☐ Sterility, including indicator results
- ☐ Equipment issues
- ☐ Other concerns

##### Surgeon says:

"Does anybody have any concerns? If you see something that concerns you during this case, please speak up."

#### Before Patient Leaves Room

##### Nurse reviews with Team:

- ☐ Instrument, sponge and needle counts are correct
- ☐ Name of the procedure performed
- ☐ Specimen labeling
  - Read back specimen labeling including patient's name

#### Debriefing

##### Entire Surgical Team Discusses:

- ☐ Equipment problems that need to be addressed.
- ☐ Key concerns for patient recovery and management
- ☐ What could have been done to make this case safer or more efficient



*This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged.* Based on the WHO Surgical Safety Checklist, URL <http://www.who.int/patientsafety/safesurgery/en>, © World Health Organization 2008 All rights reserved.

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## APPENDIX V: IDENTIFYING AND CLOSING THE GAPS – GAP ANALYSIS TOOL

**Associated Hospital/Organization:** Developed by Cynosure Health for Beyond SCIP Collaborative

**Purpose of Tool:** Developed to support the identification of process opportunities in preventing SSI

**Reference:** Available upon request from Cynosure Health

### Surgical Site Infection – Gap Analysis

Checklist	Process Questions			
<b>Surgical Safety</b>	<b>Policies &amp; Procedures</b> <i>List and review all associated policies and procedures.</i> <i>Any changes needed?</i>	<b>Training Materials</b> <i>List and review all associated training materials.</i> <i>Any changes needed?</i>	<b>Actual Practice</b> <i>Observe through chart review, staff interview or unit observation. Does practice match policy?</i>	<b>Monitoring</b> <i>List measures collected and frequency. Who collects/aggregates data? Where do findings go?</i>
<input type="checkbox"/> Y Is there a customized Surgical Safety Checklist that includes: <input type="checkbox"/> N + Before induction of anesthesia + Before skin incision + Before patient leaves OR  <input type="checkbox"/> Y Does the team verbally confirm all items on the surgical checklist at each pause with appropriate team members? <input type="checkbox"/> N  <input type="checkbox"/> Y Is a debrief incorporated into the checklist to include: <input type="checkbox"/> N + Equipment problems that need to be addressed + Key concerns for patient recovery and management + If anything could have been done to make the case safer or more efficient  <input type="checkbox"/> Y Is clarification and documentation of surgical-wound class included in debrief? <input type="checkbox"/> N				
<b>Antimicrobial Prophylaxis</b>				
<input type="checkbox"/> Y Is there a standardized order set for each surgical procedure that includes antibiotic, timing, dose, repetition if indicated and discontinuation? <input type="checkbox"/> N  <input type="checkbox"/> Y Are there pharmacist- and nurse-driven protocols that ensure correct antibiotic selection and dose based on type of surgery and patient (age, weight, BMI)? <input type="checkbox"/> N  <input type="checkbox"/> Y Is actual 'antibiotic-in to cut-time' measured with regards to the precise time the pre-op antibiotic is started and the timing of the incision or application of tourniquet? <input type="checkbox"/> N				

## APPENDIX V: IDENTIFYING AND CLOSING THE GAPS – GAP ANALYSIS TOOL (CONTINUED)

Checklist	Process Questions			
<b>Perioperative Skin Antisepsis</b>  <input type="checkbox"/> Y Are there standardized practices for choice and application of skin antiseptic agents? <input type="checkbox"/> N  <input type="checkbox"/> Y Are the perioperative staff educated on the safe application of selected skin antiseptic agents? <input type="checkbox"/> N	<b>Policies &amp; Procedures</b> <i>List and review all associated policies and procedures.</i> <i>Any changes needed?</i>	<b>Training Materials</b> <i>List and review all associated training materials.</i> <i>Any changes needed?</i>	<b>Actual Practice</b> <i>Observe through chart review, staff interview or unit observation. Does practice match policy?</i>	<b>Monitoring</b> <i>List measures collected and frequency. Who collects/aggregates data? Where do findings go?</i>
<b>Preoperative Skin Cleansing</b>  <input type="checkbox"/> Y Are there standardized order sets for pre-admission skin cleansing? <input type="checkbox"/> N  <input type="checkbox"/> Y Is there a standardized protocol for frequency of preoperative skin cleansing (e.g., 3-5 days prior)? <input type="checkbox"/> N  <input type="checkbox"/> Y Is there a strategy for distribution of skin antiseptic agents/products to patients? <input type="checkbox"/> N  <input type="checkbox"/> Y Are patients/families educated on how to apply the skin antiseptic agent prior to admission? <input type="checkbox"/> N  <input type="checkbox"/> Y Is there a system in place to verify that the patient applied the antiseptic appropriately? <input type="checkbox"/> N				
<b>S. aureus/MRSA screening</b>  <input type="checkbox"/> Y Is there a protocol in place to conduct nasal S. aureus/MRSA screening? <input type="checkbox"/> N  <input type="checkbox"/> Y Is there a protocol in place to manage colonized patients (Mupirocin and CHG wash, Povidone-Iodine nasal antiseptic and CHG wash)? <input type="checkbox"/> N				

## APPENDIX V: IDENTIFYING AND CLOSING THE GAPS – GAP ANALYSIS TOOL (CONTINUED)

Checklist	Process Questions			
<b>Perioperative Temperature Management</b>  <input type="checkbox"/> Y    Is there a standardized procedure for pre-warming every surgical patient without a contraindication?  <input type="checkbox"/> N  <input type="checkbox"/> Y    Is there a standardized practice in place to provide active warming to patients during the surgical procedure?  <input type="checkbox"/> N	<b>Policies &amp; Procedures</b> <i>List and review all associated policies and procedures.</i> <i>Any changes needed?</i>	<b>Training Materials</b> <i>List and review all associated training materials.</i> <i>Any changes needed?</i>	<b>Actual Practice</b> <i>Observe through chart review, staff interview or unit observation. Does practice match policy?</i>	<b>Monitoring</b> <i>List measures collected and frequency. Who collects/aggregates data? Where do findings go?</i>
<b>Glucose Control</b>  <input type="checkbox"/> Y    Is there a perioperative glycemic control team to ensure that responsibility and accountability are assigned for blood-glucose monitoring and control?  <input type="checkbox"/> N  <input type="checkbox"/> Y    Are there glucometers located at every anesthesia station?  <input type="checkbox"/> N  <input type="checkbox"/> Y    Is there a system in place to assure glucose is not too high and not too low in order to minimize extremes?  <input type="checkbox"/> N				
<b>Oxygen Supplementation</b>  <input type="checkbox"/> Y    Is there a protocol in place to guide the use of supplemental oxygen at a FiO <sub>2</sub> of 80% intraoperatively and immediately after surgery for all or specific surgeries?  <input type="checkbox"/> N				
<b>Minimizing Blood Transfusions</b>  <input type="checkbox"/> Y    Have steps been taken to study blood-transfusion practices in the surgical setting?  <input type="checkbox"/> N  <input type="checkbox"/> Y    Is your facility tracking and trending packed red blood cell (PRBC) transfusion rates in surgical patients?  <input type="checkbox"/> N				

## APPENDIX V: IDENTIFYING AND CLOSING THE GAPS – GAP ANALYSIS TOOL (CONTINUED)

Checklist	Process Questions			
<b>Minimizing Blood Transfusions (continued)</b>  <input type="checkbox"/> Y Have you implemented a ‘hard stop’ or ‘best practice alert’ for PRBC transfusion orders?  <input type="checkbox"/> N Do you include ‘history of PRBC transfusion’ in the root-cause analysis of SSI investigations?	<b>Policies &amp; Procedures</b> <i>List and review all associated policies and procedures.</i> <i>Any changes needed?</i>	<b>Training Materials</b> <i>List and review all associated training materials.</i> <i>Any changes needed?</i>	<b>Actual Practice</b> <i>Observe through chart review, staff interview or unit observation. Does practice match policy?</i>	<b>Monitoring</b> <i>List measures collected and frequency. Who collects/aggregates data? Where do findings go?</i>
<b>Wound Irrigation</b>  <input type="checkbox"/> Y Is there a protocol in place to address the utilization of wound irrigation in specific surgeries such as: + Ortho/spine/colon: Chlorhexidine 0.5% sterile irrigation solution for cases currently using Neomycin/Bacitracin + Colon: Pulsatile lavage irrigation after prolonged intra-abdominal procedures + Regardless of type: normal saline copious irrigation >2000ml/hour of saline + Eye: sterile PVI 0.25% irrigation <input type="checkbox"/> N				
<b>Skin Closure</b>  <input type="checkbox"/> Y Have you considered products other than sutures, such as: + Clean procedures: skin glue instead of or in addition to tape or suture for high-risk cases to provide a sterile wound until skin starts to heal + Contaminated procedures: staples instead of sutures <input type="checkbox"/> N				

## APPENDIX V: IDENTIFYING AND CLOSING THE GAPS – GAP ANALYSIS TOOL (CONTINUED)

Checklist	Process Questions			
<b>Skin Closure (continued)</b> <ul style="list-style-type: none"> <li>+ Skin sealant prior to incision after skin prep (e.g., integuseal)</li> <li>+ Cases requiring suture: use of antimicrobial-impregnated suture</li> <li>+ Are sterile gloves and instruments replaced before closing?</li> </ul>	<b>Policies &amp; Procedures</b> <i>List and review all associated policies and procedures.</i> <i>Any changes needed?</i>	<b>Training Materials</b> <i>List and review all associated training materials.</i> <i>Any changes needed?</i>	<b>Actual Practice</b> <i>Observe through chart review, staff interview or unit observation. Does practice match policy?</i>	<b>Monitoring</b> <i>List measures collected and frequency. Who collects/aggregates data? Where do findings go?</i>
<b>Drains, Drapes and Dressings</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Y <input type="checkbox"/> N Are there protocols in place to guide the early removal of drains and the use of antiseptic dressings around drains when in place?</li> <li><input type="checkbox"/> Y <input type="checkbox"/> N Are antimicrobial-impregnated surgical drapes being used for selected cases?</li> <li><input type="checkbox"/> Y <input type="checkbox"/> N Are antiseptic dressings (e.g., PHMB, a derivative of chlorhexidine) being used in selected cases?</li> </ul>				
<b>Traffic Control</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Y <input type="checkbox"/> N Do you have systems in place to monitor traffic control in surgical settings?</li> <li><input type="checkbox"/> Y <input type="checkbox"/> N Do you correlate this measure with SSI, and if so, how do you report this to the surgical team?</li> </ul>				
<b>Hair Removal</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Y <input type="checkbox"/> N Is hair removal done with clippers rather than razors?</li> <li><input type="checkbox"/> Y <input type="checkbox"/> N Is hair removal done in a contained manner and in a non-sterile environment?</li> </ul>				

## APPENDIX V: IDENTIFYING AND CLOSING THE GAPS – GAP ANALYSIS TOOL (CONTINUED)

Checklist	Process Questions			
<b>Team Training and Teamwork</b>  <input type="checkbox"/> Y Have you utilized a validated safety-attitudes questionnaire to better understand behavior in the surgical setting? <input type="checkbox"/> N  <input type="checkbox"/> Y If yes, how have you used the results to direct change and improve teamwork? <input type="checkbox"/> N  <input type="checkbox"/> Y Have you launched a Team Training program designed to improve teamwork in the perioperative setting? <input type="checkbox"/> N	<b>Policies &amp; Procedures</b> <i>List and review all associated policies and procedures.</i> <i>Any changes needed?</i>	<b>Training Materials</b> <i>List and review all associated training materials.</i> <i>Any changes needed?</i>	<b>Actual Practice</b> <i>Observe through chart review, staff interview or unit observation. Does practice match policy?</i>	<b>Monitoring</b> <i>List measures collected and frequency. Who collects/aggregates data? Where do findings go?</i>
<b>Improving Accuracy of Surgical-Wound Classification</b>  <input type="checkbox"/> Y Have you validated the accuracy of surgical-wound classification? If so, what have you put in place to improve the accuracy? <input type="checkbox"/> N  <input type="checkbox"/> Y Is 'surgical-wound classification' a component of the surgical-safety checklist? <input type="checkbox"/> N				

## PART 6: REFERENCES

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