HRET
HEALTH RESEARCH & EDUCATIONAL TRUST

2017 UPDATE

PREVENTING SURGICAL SITE INFECTIONS

>>>

SURGICAL SITE INFECTIONS *CHANGE PACKAGE*

ACKNOWLEDGEMENTS

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Accessible at: http://www.hret-hiin.org/

Contact: hiin@aha.org

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How to Use this Change Package

This change package is intended for hospitals participating in the Hospital Improvement Innovation Network (HIIN) project led by the Centers for Medicare & Medicaid Services (CMS) and 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 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: AEA DEFINITION AND SCOPE

CURRENT DEFINITION OF HARM TOPIC: A surgical site infection (SSI) is an infection that occurs after surgery in the part of the body where the surgery took place.[1] SSIs can be superficial infections involving just the skin, or they can be more serious and can involve tissues under the skin, organs or implanted material.

Magnitude of the Problem and Why this Matters

More than 15 million surgeries are performed in the United States annually.[2] Between two and five percent of these patients will develop an SSI, equating to between 160,000 and 300,000 SSIs nationwide each year. SSIs are now the most common and most expensive health care-associated infection in the U.S.[3,4,5] Fortunately, through the adoption of evidence based practices, 60 percent of SSIs are potentially preventable.[6]

> HEN 1.0 Progress:

- From 2011 to 2014, the over 1,400 AHA/HRET HEN hospitals prevented an estimated 4,860 SSIs with an estimated cost savings of over $102 million.

WHAT DOES THAT MEAN?

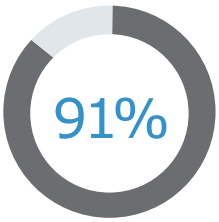
4,860 SSIs PREVENTED

$102,060,000 TOTAL PROJECT ESTIMATED COST SAVING

40% 17 of 31 MEETING THE REDUCTION GOAL

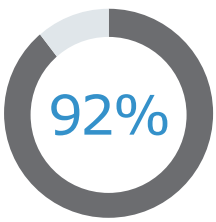
> HEN 2.0 Results:

- Through the work of the AHA/HRET Hospital Engagement Network 2.0, from September 2015 through September 2016, over 1,500 hospitals worked to prevent SSIs. Under this initiative, hospitals prevented 792 SSIs and saved an estimated $16,631,000.



of Eligible Acute/CAH/ Children's Hospital Reporting Data

18% Reduction in SSI Measures



Percent of participants that stated information provided will promote higher quality work

WHAT DOES THAT MEAN?

792 SSIs PREVENTED

$16,631,000 TOTAL PROJECT ESTIMATED COST SAVINGS

16 states MEETING THE **40%** REDUCTION IN PREVENTABLE HARM GOAL

> HIIN Reduction Goals:

- Reduce the incidence of harm due to surgical site infections (SSI) by 20 percent by September 27, 2018.

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 for as part of the HRET HIIN. 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 impact of your improvement initiatives on reducing patient harm. Furthermore, collecting data for these standardized metrics will allow the HRET HIIN to aggregate, analyze and report progress toward reaching the project's 20/12 reduction goals across all Adverse Event Areas (AEAs) by September 27, 2018.

Nationally Recognized Measures: Process and Outcome

Please download and reference the encyclopedia of measures (EOM) on the HRET HIIN website for additional measure specifications and for any updates after publication at: http://www.hret-hiin.org/data/hiin_eom_core_eval_and_add_req_topics.pdf

HIIN 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)

> 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: www.shea-online.org/View/smid/428/ArticleID/289.aspx
- Association of Perioperative Registered Nurses (AORN) Guidelines for Perioperative Practice, 2016 Edition: www.aornstandards.org/
- Institute for Healthcare Improvement Project Joints Bundle: www.ihi.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 http://www.hret-hiin.org/topics/surgical-site-infection.shtml
- 2016 UP Campaign Start Up Tool. Retrieved at www.hret-hiin.org/Resources/up_campaign/16/hrethiin_upcampaign_startuptool.pdf.

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 help you and your care team identify potential change ideas to implement at your facility and 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 that 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 or achieve the secondary driver.*

Drivers in This Change Package

PREVENT SSI	ANTIMICROBIAL PROPHYLAXIS	USE CLINICAL PRACTICE GUIDELINES TO CHOOSE APPROPRIATE PROPHYLACTIC ANTIBIOTICS	**Change Idea**
	PRE-OPERATIVE SKIN ANTISEPSIS	ENSURE PRE-OPERATIVE SKIN CLEANSING	**Change Idea**
	PERI-OPERATIVE SKIN ANTISEPSIS	SELECT THE APPROPRIATE PERI-OPERATIVE SKIN ANTISEPTIC	**Change Idea**
	PERI-OPERATIVE SAFETY CHECKLIST	UTILIZE A PERI-OPERATIVE CHECKLIST	**Change Idea**
	NORMOTHERMIA	PREVENT HYPOTHERMIA DURING ALL SURGICAL PHASES	**Change Idea**
	SUPPLEMENTAL OXYGEN	ESTABLISH PROTOCOL TO GUIDE USE OF SUPPLEMENTAL OXYGEN DURING AND AFTER SURGERY	**Change Idea**
	GLUCOSE CONTROL	MONITOR FOR HYPERGLYCEMIA PRE-OPERATIVELY, INTRA-OPERATIVELY AND POST-OPERATIVELY	**Change Idea**
	ADDITIONAL STRATEGIES TO PREVENT SSI	ADHERE TO ESTABLISHED GUIDELINES TO PREVENT SSI	**Change Idea**
		STAPHYLOCOCCUS AUREUS (SA) SCREENING AND DECOLONIZATION	**Change Idea**
		DEVELOP GUIDELINES FOR SURGICAL WOUND MANAGEMENT INTRA- AND POST-OPERATIVELY	**Change Idea**

PREVENT SURGICAL SITE INFECTIONS (SSI)

Primary Driver:

ANTIMICROBIAL PROPHYLAXIS.

Ideally, an antimicrobial agent for surgical prophylaxis should: prevent SSI; 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.[7]

Secondary Driver > USE CLINICAL PRACTICE GUIDELINES TO CHOOSE APPROPRIATE PROPHYLACTIC ANTIBIOTICS

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

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 patient characteristics (e.g., age, weight).

> Create a process to review all exceptions to the developed protocols.

> Ensure that antibiotics are dosed (within one hour) prior to incision (or within two hours if administering vancomycin or fluoroquinolones) and re-dosed appropriately in surgeries lasting longer than three hours.

> Ensure antibiotic dosages are weight-based and adjusted for patients with BMIs out of the normal range.

> Determine who on the surgical team is responsible for timely antibiotic administration. Consider assigning this responsibility to anesthesia staff.

> Verify the antibiotic administration time during a time-out or pre-procedural briefing so action can be taken if the prophylaxis has not been administered.

> Stock operating room medications according to national guidelines so they 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 timely prior to incision
- Percentage of patients who received the appropriate weight-based antimicrobial pre-operative 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 sustain 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. See Appendix II for an audit tool: Surgical Procedures Observation Checklist for Assessment of Infection Prevention Efforts.

Primary Driver:

PRE-OPERATIVE SKIN ANTISEPSIS

Purpose of pre-operative skin antisepsis is to reduce surgical infection risk by decreasing the bacterial count on the patient's skin. Pre-operative bathing with soap or an antiseptic agent prior to surgery, by the patient, helps to reduce the bacterial load.[10,11]

Secondary Driver > ENSURE PRE-OPERATIVE SKIN CLEANSING

Develop a pre-operative skin antisepsis protocol for surgical patients that includes patient bathing or showering with soap or antiseptic agent prior to surgery.

Change Ideas

> Choose a pre-operative skin agent and method based upon review 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 engage the patient and family of joint replacements such as hip, knee or shoulder to bathe or shower with Chlorhexidine Gluconate (CHG) soap for three days pre-operatively. See Appendix III for 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 liquid soap.

> Educate patients on how to appropriately apply the skin antiseptic agents using teach-back method.

> Include pre-operative bathing instruction reinforcement in the pre-operative 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 in discussion about the risks of applying lotions and 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 pre-operative skin cleansing who received the cleansing product
- Percent of patients who experienced a rash or other skin reaction possibly related to the pre-operative skin cleansing

Hardwire the Process

Standardizing processes is a key hardwiring strategy. Standardizing pre-operative skin antisepsis may include:

> Develop standardized order sets for pre-operative skin cleansing to reduce protocol variation.

> Pre-operative checklists that include reminders on skin antisepsis and method, patient teaching points using teach-back method, opportunities for patient questions and return demonstration, and opportunities for patients to express concerns and requests.

> Skin antisepsis product and education readily available to give to patients whether given at physician's office or during a pre-operative appointment at the hospital.

> Include pre-operative bathing and skin antisepsis in pre-operative call.

Primary Driver:

PRE-OPERATIVE SKIN ANTISEPSIS

Peri-operative skin antisepsis using an antiseptic agent is a vital step in preventing SSI.[12] Alcohol-containing preoperative skin antiseptic agents maybe more effective but the most effective antiseptic to combine with alcohol has not been determined.[12,13] 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.[12,13]

Secondary Driver > SELECT THE APPROPRIATE PERI-OPERATIVE 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 activity, longer residual activity and activity in the presence of blood or serum.[12,14,15] A growing body of literature shows 2% CHG impregnated cloths to be the preferred agent and method, and povidone iodine as alternative when CHG is contraindicated.[14]

Change Ideas

> Use evidence-based results from the literature to educate all peri-operative 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.

Secondary Driver > CORRECTLY ADMINISTER THE APPROPRIATE PRE-OPERATIVE SKIN ANTISEPTIC

Incorrect application may decrease antiseptic effectiveness and cause a residual effect from incomplete coverage of surgical site.[12]

Change Ideas

> Educate peri-operative personnel on the safe application and use of selected skin antiseptic agents.

> Validate peri-operative personnel's use of proper technique using return demonstration in the application of skin antisepsis.

> Review package instructions to determine the amount of skin surface each unit-dose container of skin antisepsis 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 antisepsis with a sampling of surgical specialties
- Percentage of bariatric patients who were prepared for surgery with the appropriate dose of a skin cleansing agent as calculated based upon skin surface measurements

Hardwire the Process

To ensure correct application each 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,an alternative agent in case of patient sensitivity, the amount to be applied and the method of application.

Primary Driver:

PERI-OPERATIVE SAFETY CHECKLIST

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

Secondary Driver > UTILIZE A PERI-OPERATIVE CHECKLIST

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

Change Ideas

> Adopt a surgical safety checklist based upon the WHO Surgical Safety Checklist.

> Test the surgical safety checklist prior to implementation to determine workflow.

> Assign responsibility to a specific role to initiate the checklist.

> Promote effective inter-professional communication utilizing TeamSTEPPS® structured communication processes.Allow team 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 of 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.[12] Hypothermia adversely affects circulation, coagulation, medication metabolism, wound healing and increases risk of infection by impairing immune function and circulation.[16]

Numerous factors such as room temperature, anesthesia, intravenous and irrigation fluids, anxiety and skin exposure can cause patients to become clinically hypothermic during surgery.[17] Studies have demonstrated that both pre-operative and intra-operative warming reduces SSI rates and other complications.[17,18,19,20]

Secondary Driver > PREVENT HYPOTHERMIA DURING ALL SURGICAL PHASES

Pre-warm and actively warm in the operating room. Patient 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.

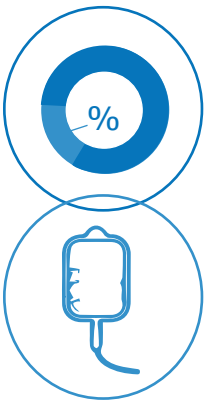
> Keep patient normothermic during the intraoperative period by using forced air warming, circulating water garments or energy transfer pads.

> Use warmed intravenous (IV) fluids if large volumes are given and warmed irrigation fluid for inside abdomen, pelvis or thorax.

> Measure body temperature at appropriate intervals.

> Teach patients and families in the pre-operative 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 engineering department in maintaining targeted room temperature.

> Utilize a low technology 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 peri-operatively
- 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 pre-operative area that includes 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.[22,23,24,25,26,27] Studies have also shown that the degree of hyperglycemia in the post-operative period correlates with the rate of SSI in patients undergoing major cardiac surgery.[28,29] Recommendations are to maintain post-operative blood glucose of 180 mg/dL or lower in general and cardiac surgery patients.[12]

Secondary Driver > MONITOR FOR HYPERGLYCEMIA PRE-OPERATIVELY, INTRA-OPERATIVELY AND POST-OPERATIVELY

Opportunities for hyperglycemia exist during each surgical phase and therefore must be monitored at each phase. Maintenance of blood glucose between 140-180 mg/dL is recommended.[30] Intensive post-operative 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.[31,32] Establish protocol to monitor peri-operative glucose levels.

Change Ideas

> Obtain glucometers for every anesthesia station.

> Identify patients at risk for hyperglycemia in the peri-operative period; 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 BP, heart rate, temperature and oxygen saturation are being recorded.

> Develop a peri-operative 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 peri-operative 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 continual basal insulin rate the morning of surgery.

> Develop the guidelines to peri-operative 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 intra-operatively
- 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 hardwiring processes include:

> Implementing a glucose control protocol for all surgical patients.

> Periodically audit operating room blood sugar values to assess for signs of practice drift.

> In the protocol, include an algorithm for the appropriate administration of intravenous insulin to patients with intra-operative and post-operative hyperglycemia.

> Include diabetic medication adjustments the morning of surgery in the pre-op call the night before surgery.

Primary Driver:

SUPPLEMENTAL OXYGEN

Administering supplemental oxygen pre-operative, intra-operative, and post-operative optimizes tissue oxygenation and reduces SSI risk.[12,34,35,36]

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%.[37,38] Through a standardized protocol, provide guidance on the appropriate and timely use of supplemental oxygen through the surgical perioperative period for all patients.

Change Ideas

> Include supplemental oxygen on pre-operative and post-operative orders.

> Educate surgical staff on the benefits of high oxygen levels combined with other strategies such as normothermia in preventing wound and tissue hypoxia post operatively.

> Educate surgical staff that oxygenation is a low-cost intervention with minimal risks and possible benefits.

Suggested Process Measures for Your Test of Change

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

Hardwire the Process

Develop and test protocols with a multidisciplinary team, including peri-operative nurses, anesthesiologists, and surgeons. Include supplemental oxygen administration on peri-operative 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 SSI

Utilize the guidelines provided by professional organizations such as the Association of Perioperative Registered Nurses (AORN) to ensure recommended peri-operative standards and recommended practices are followed.[40]

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 peri-operative standards and recommendations.

> Educate patients and 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 Caesarean 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 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.

> Evaluate Immediate Use Sterilization patterns to identify opportunities for improvement

> Provide staff with cross-cutting education related to hand hygiene by referring to the HRET HIIN UP Campaign Start Up Tool.[41]

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.
- Track reasons for doors opening during a surgical case (e.g., medical necessity, staff relief, curiosity)
- 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 PRE-OPERATIVELY

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.[42,43,44] 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.[45,46,47]

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" per se, but a temporary reduction of SA from the nares and skin, the natural reservoirs where SA is most often carried.

> Establish pre-screening/decolonization program for designated elective surgeries (e.g., hip or knee replacement or coronary artery bypass surgery).

> Integrate CHG bathing and intranasal decolonization with mupirocin, povidone iodine nasal antiseptic, or alcohol-based nasal therapy 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 pre-operative nasal SA screening performed
- Percentage of patients with a positive SA screen who also receive nasal decolonization and CHG decolonization interventions

Secondary Driver > DEVELOP GUIDELINES FOR SURGICAL WOUND MANAGEMENT INTRA- AND POST-OPERATIVELY

Guidelines, developed by a multidisciplinary team, should adhere to recommended evidenced 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 at 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 if contamination is suspected (e.g., colon surgery).

> Establish a process to address intra-operative 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 contains the hair.

> Evaluate traffic control patterns to establish the rate of entry and exit in the surgical suite.

> Irrigate selected wounds prior to closure.

> Consider utilizing antimicrobial-impregnated sutures for some surgeries, e.g., colorectal surgeries.[12,49,50]

> Apply sterile dressing for 24 to 48 hours.

Suggested Process Measures for Your Test of Change

- Percentage of patients for which 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 sustain 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 decrease, 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?"

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

> Keep your patients warm during and after surgery

IMPLEMENT SMALL TESTS OF CHANGE

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

PLAN

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

> The OR 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 pre-operative checklist.

> The process will be reviewed with the anesthesiologist and the nurse in a debriefing after the surgery is complete.

DO

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 did not have the pre-operative checklist in his hands at the scheduled time of antibiotic administration because the circulating nurse was carrying it.

STUDY

Debrief and conduct and 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

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.

> Plan for the next cycle (implement change, perform another test, analyze and revise).

> Run a second PDSA cycle the next day for two or three scheduled surgeries.

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 peri-operative 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 pre-operative nurse. An effective champion supports quality improvement initiatives and is open to change ideas which 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 SSI to the organization and your patients.The sponsor can help engage key stakeholders, the board, and staff in seeing the big picture of the importance of eliminating harm caused by SSI.

> 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 during 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, multi-disciplinary 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 a timeout and safety checklist 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 (i.e., surgeon, anesthesiologists, physician assistants, nurses, technicians) contributes to improved quality of patient care.

PART 4: CONCLUSION AND ACTION PLANNING

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, engineering and environmental services. Ongoing monitoring of compliance to bundles for data-driven decision-making, using data to drive practice and process changes, and communication of supporting processes performance and SSI rates to physicians and perioperative staff, and are also key for success.

- Assemble a multidisciplinary team. Determine and define roles and confirm 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 prevention lead, etc. Create strategies and/or allocate resources to engage front-line staff in designing new care processes.
- Use data to monitor and 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).
- Establish clear lines of communication with physicians, staff, other stakeholders and supporting leadership. Communication should include updates on: guidelines, compliance with supporting processes and SSI rates. Display charts of SSI rates annotated with interventions to show the effect of improvement efforts.

PART 5: APPENDICES

APPENDIX I: SURGICAL SITE INFECTION (SSI) TOP TEN CHECKLIST

Associated Hospital/Organization: HRET HIIN

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

Reference: www.hret-hiin.org

Surgical Site Infections (SSI) Top Ten Checklist

- 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.
- Ensure pre-operative skin antisepsis (e.g., basic soap and water shower; antiseptic agent).
- Develop standardized peri-operative skin antiseptic practices utilizing the most appropriate skin antiseptic for the type of surgery performed.
- Develop a standardized procedure to ensure normothermia by warming all surgical patients.
- Develop and implement protocols to optimize glucose control in all surgical patients.
- Administer supplemental oxygen during the pre-operative, intra-operative and post-operative periods.
- Develop a protocol to screen and/or decolonize selected patients with *Staphylococcus aureus*.
- Adhere to established guidelines (e.g., HICPAC, AORN) to ensure basic aseptic techniques (e.g., traffic control, attire) are adhered to uniformly.
- 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.
- Establish a system where surgical site infection data is analyzed and shared.

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

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
Environment:				
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				
Patient Care:				
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 http://www.carefusion.com/medical-products/infection-prevention/surgical-clippers/clipvac.aspx				
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				
Staff Attire:				
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 stuff should wear long sleeve jackets buttoned up				

STANDARDS	YES	NO	N/A	DESCRIPTION/ COMMENTS
Keep jewelry to a minimum and contained within the scrub				
No lanyard badge holders				
Sterile Field:				
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				
Anesthesia:				
IV injection ports swabbed prior to access or port disinfector 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 *immediately* 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				
Surgical Hand Scrub				
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:

Mohs procedure				
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[1]				
Consider antiseptic dressing and/or surgical glue for incision over suture to provide a closed aseptic wound during healing[3].				

STANDARDS	YES	NO	N/A	DESCRIPTION/ COMMENTS
PEG tube placement				
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[4].				
Cataract procedure[5-9]				
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 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.				
Vasectomy				
Razor use for scrotal hair removal is permitted — surgeon choice.				

References

1. Cherian P, Gunson T, Borchard K, Tai Y, Smith H, Vinciullo C. Oral antibiotics versus topical decolonization to prevent surgical site infection after Mohs micrographic surgery—a randomized, controlled trial. Dermatol Surg. 2013 Oct;39(10):1486-93.
2. Edmiston CE Jr, Bruden B, Rucinski MC, Henen C, Graham MB, Lewis BL. Reducing the risk of surgical site infections: does chlorhexidine gluconate provide a risk reduction benefit? Am J Infect Control. 2013 May;41(5 Suppl):S49-55.
3. Bowler PG, Welsby S, Hogarth A, Towers V.Topical antimicrobial protection of postoperative surgical sites at risk of infection with Propionibacterium acnes: an in-vitro study.J Hosp Infect. 2013 Mar;83(3):232-7.
4. Ogbemudia AO, Bafor A, Ogbemudia EJ, Edomwonyi E. Efficacy of 1 % silver sulphadiazine dressings in preventing infection of external fixation pin-tracks: a randomized study. Strategies Trauma Limb Reconstr. 2015 Aug 15.
5. Helinger WC, et al. Recommended Practices for Cleaning and Sterilizing Intraocular Surgical Instruments. Special ReportPrepared February 16, 2007, by the American Society of Cataract and Refractive Surgery Ad Hoc Task Force on Cleaning and Sterilization of Intraocular Instruments.
6. Leyngold IM, et al. Perioperative antibiotics for prevent prevention of acute endophthalmitis after cataract surgery (Protocol).The Cochrane Collaboration, 2007.
7. Mangram AJ, Horan TC. Silver LC, Jarvis WR. Center for Disease Control and Prevention (CDC), Hospital Infection Control Practices Advisory Committee; American Journal of Infection Control1999;27(2):97-132.
8. West ES, et al. The Incidence of Endophthalmitis after Cataract Surgery among the U.S. Medicare Population increased between 1994 and 2001. American Academy of Ophthalmology 2005;112:1388-1394.
9. Mehran T, et al. Acute Endophthalmitis Following Cataract Surgery, A Systematic Review of the Literature. Arch Ophthalmol 2005;123:613-620.

APPENDIX III: JOINT SURGERY PATIENT BATHING INSTRUCTIONS

Associated Hospital/Organization: Cynosure Health

Purpose of Tool: Patient education on pre-operative skin antisepsis for patients undergoing hip or knee surgery.

Reference: Developed by Cynosure Health

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.

DATE:	**2 days before surgery**	Shower or bathe with Antiseptic Soap as described below *(Check when done)*	☐
DATE:	**1 day before surgery**	Shower or bathe with Antiseptic Soap as described below/do NOT shave area where surgery will take place *(Check when done)*	☐
DATE:	**Morning of surgery**	Shower or bathe with Antiseptic Soap as described below/do NOT shave area where surgery will take place/do NOT 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 5 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

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: This checklist template was developed for learning more about the Safe Surgery 2015 Initiative please visit www.safesurgery2015.org.

Safe Surgery Checklist template

Hospital Name

Before Induction of Anesthesia

Nurse and **Anesthesia Professional** verify:

- ☐ Patient identification (name and DOB)
- ☐ Surgical site
- ☐ Surgical procedure to be performed matches the consent
- ☐ Site marked
- ☐ Known allergies
- ☐ Patient positioning
- ☐ Essential imaging available
- ☐ Risk of hypothermia (if operation >1 hour)
  - Warmer in place
- ☐ Risk of venous thromboembolism
  - Boots in place and/or anticoagulants
- ☐ Anesthesia safety check completed

ANESTHESIA BRIEFING

Anesthesia Professional shares:

- ☐ Anticipated airway or aspiration risk
- ☐ Risk of significant blood loss
  - Two IVs/central access and fluids planned
  - Type and crossmatch/screen
  - Blood availability

Before Skin Incision

TIME OUT

Circulating Nurse asks:

"Is everyone ready to perform the time out? Please state your name and role."

Entire Surgical Team confirms:

- ☐ Patient name
- ☐ Surgical procedure to be performed
- ☐ Surgical site
- ☐ Essential imaging available
- ☐ Antibiotic prophylaxis given within the last 60 minutes
  - Antibiotic redosing plan discussed

TEAM BRIEFING

Surgeon shares:

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

Anesthesia Professional shares:

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

Circulating Nurse and **Scrub Tech** share:

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

Surgeon asks:

"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
- ☐ Name of the procedure performed

Nurse reads aloud to team:

- ☐ Specimen labeling, including patient's name

TEAM DEBRIEFING

Entire Surgical Team discusses:

- ☐ Key concerns for patient recovery and management
- ☐ Equipment problems that need to be addressed
- ☐ Other opportunities for improvement

This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged. Based on the WHO Surgical Safety Checklist (http://www.who.int/patientsafety/safesurgery/en)

 SSC-Master template Revised: 7 August 2015

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

Process Questions	**Policies & Procedures** List and review all associated policies and procedures. Any changes needed?	**Training Materials** List and review all associated training materials. Any changes needed?	**Actual Practice** Observe through chart review, staff interview, or unit observation. Does practice match policy?	**Monitoring** List measures collected and frequency. Who collects/aggregates data? Where do findings go?
SURGICAL SAFETY CHECKLIST				
Is there a customized Surgical Safety Checklist that includes: > Before induction of anesthesia > Before skin incision > Before patient leaves OR				
Does the team verbally confirm all items on the surgical checklist at each pause with appropriate team members?				
Is a debrief incorporated into the checklist to include: > Equipment problems the 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				
Is clarification and documentation of surgical wound class included in debrief?				

Surgical Site Infection Gap Analysis

Process Questions	**Policies & Procedures** List and review all associated policies and procedures. Any changes needed?	**Training Materials** List and review all associated training materials. Any changes needed?	**Actual Practice** Observe through chart review, staff interview, or unit observation. Does practice match policy?	**Monitoring** List measures collected and frequency. Who collects/aggregates data? Where do findings go?
ANTIMICROBIAL PROPHYLAXIS				
Is there a standardized order set for each surgical procedure that includes antibiotic, timing, dose, repeat if indicated and discontinuation?				
Are there pharmacist- and nurse-driven protocols that ensure correct antibiotic selection and dose based on type of surgery and patient (age, weight, BMI)?				
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?				
PERI-OPERATIVE SKIN ANTISEPSIS				
Are there standardized practices for choice and application of skin antiseptic agents?				
Are the peri-operative staff educated on the safe application of selected skin antiseptic agents?				
PRE-OPERATIVE SKIN CLEANSING				
Are there standardized order sets for preadmission skin cleansing?				
Is there a standardized protocol for frequency of pre-operative skin cleansing (e.g., 3-5 days prior)?				
Is there a strategy for distribution of skin antiseptic agents/products to patients?				
Are patients/families educated as to how to apply the skin antiseptic agent prior to admission?				
Is there a system in place to verify that the patient applied the antiseptic appropriately?				

Surgical Site Infection Gap Analysis

Process Questions	**Policies & Procedures** List and review all associated policies and procedures. Any changes needed?	**Training Materials** List and review all associated training materials. Any changes needed?	**Actual Practice** Observe through chart review, staff interview, or unit observation. Does practice match policy?	**Monitoring** List measures collected and frequency. Who collects/aggregates data? Where do findings go?
S. AUREUS/MRSA SCREENING				
Is there a protocol in place to conduct nasal S. aureus/MRSA screening?				
Is there a protocol in place to manage colonized patients (Mupirocin and CHG wash, Povidone Iodine nasal antiseptic and CHG wash)?				
PERI-OPERATIVE TEMPERATURE MANAGEMENT				
Is there a standardized procedure for pre-warming every surgical patient without a contraindication?				
Is there a standardized practice in place to provide active warming to patients during the surgical procedure?				
GLUCOSE CONTROL				
Is there a peri-operative glycemic control team to ensure that responsibility and accountability is assigned for blood glucose monitoring and control?				
Are there glucometers located at every anesthesia station?				
Is there a system in place to assure glucose is not too high and not too low to minimize extremes?				
OXYGEN SUPPLEMENTATION				
Is there a protocol in place to guide the use of supplemental oxygen at a FiO_2 of 80% intra-operatively and immediately after surgery for all or specific surgeries?				

Surgical Site Infection Gap Analysis

Process Questions	**Policies & Procedures** List and review all associated policies and procedures. Any changes needed?	**Training Materials** List and review all associated training materials. Any changes needed?	**Actual Practice** Observe through chart review, staff interview, or unit observation. Does practice match policy?	**Monitoring** List measures collected and frequency. Who collects/aggregates data? Where do findings go?
MINIMIZING BLOOD TRANSFUSIONS				
Have steps been taken to study blood transfusion practices in the surgical setting?				
Is your facility tracking and trending PRBC transfusion rates in surgical patients?				
Have you implemented a 'hard stop' or 'best practice alert' for PRBC transfusion orders?				
Do you include 'history of PRBC transfusion' in the root-cause analysis of SSI investigations?				
WOUND IRRIGATION				
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				
SKIN CLOSURE				
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 > Skin sealant prior to incision after skin prep (e.g., integuseal) > Cases requiring suture: use of antimicrobial impregnated suture > Are sterile gloves and instruments replaced before closing?				

Surgical Site Infection Gap Analysis

Process Questions	**Policies & Procedures** List and review all associated policies and procedures. Any changes needed?	**Training Materials** List and review all associated training materials. Any changes needed?	**Actual Practice** Observe through chart review, staff interview, or unit observation. Does practice match policy?	**Monitoring** List measures collected and frequency. Who collects/aggregates data? Where do findings go?
DRAINS, DRAPES, DRESSINGS				
Are there protocols in place to guide the early removal of drains and the use of antiseptic dressings around drains when in place?				
Are antimicrobial impregnated surgical drapes being used for selected cases?				
Are antiseptic dressings (e.g., PHMB, a derivative of chlorhexidine) being used in selected cases?				
TRAFFIC CONTROL				
Do you have systems in place to monitor traffic control in surgical settings?				
Do you correlate this measure with SSI and if so how do you report this to the surgical team?				
HAIR REMOVAL				
Is hair removal done with clippers rather than razors?				
Is hair removal done in a contained manner and in a non-sterile environment?				
TEAM TRAINING AND TEAMWORK				
Have you utilized a validated safety attitudes questionnaire to better understand behavior in the surgical setting?				
If yes, how have you used the results to direct change and improve teamwork?				
Have you launched a team training program designed to improve teamwork in the peri-operative setting?				

Surgical Site Infection Gap Analysis

Process Questions	**Policies & Procedures** List and review all associated policies and procedures. Any changes needed?	**Training Materials** List and review all associated training materials. Any changes needed?	**Actual Practice** Observe through chart review, staff interview, or unit observation. Does practice match policy?	**Monitoring** List measures collected and frequency. Who collects/aggregates data? Where do findings go?
IMPROVING ACCURACY OF SURGICAL WOUND CLASSIFICATION				
Have you validated the accuracy of surgical wound classification?				
If so, what have you put in place to improve the accuracy?				
Is 'surgical wound classification' a component of the surgical safety checklist?				

PART 6: REFERENCES

1. Healthcare-associated Infections (HAIs): Surgical Site Infection (SSI). (2012, May 17). Centers for Disease Control & Prevention. Retrieved from www.cdc.gov/HAI/ssi/ssi.html
2. Anderson, D.J. et al. (2014). Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update. *Infection Control and Hospital Epidemiology*, 35(6), 605-627.
3. Anderson, D.J. et al. (2013). Statewide costs of health care–associated infections: estimates for acute care hospitals in North Carolina. *American Journal of Infection Control*, 41(9), 764–768.
4. Lewis, S.S., et al. (2013). Assessing the relative burden of hospital-acquired infections in a network of community hospitals. *Infection Control and Hospital Epidemiology,* 34(11), 1229–1230.
5. Zimlichman, E. et al. (2013). Health care–associated infections: a meta-analysis of costs and financial impact on the U.S. health care system. *JAMA Internal Medicine*, 173(22), 2039–2046.
6. Umscheid CA, Mitchell MD, Doshi JA, Agrawal R, Williams K, Brennan PJ. (2011). Estimating the proportion of healthcare-associated infections that are reasonable preventable and the related mortality and costs. *Infect Control Hosp Epidemiol,* 32(2):101-114.
7. Bratzler, D.W., Dellinger, E.P., Olsen, K.M. et al. (2013). Clinical practice guidelines for antimicrobial prophylaxis in surgery. *American Journal of Health-System Pharmacists,* 70, 195–283.
8. Bratzler DW, Dellinger EP, Olsen KM, Per TM, Auwater PG, Bolon MK, et al. (2013). Clinical practice guidelines for antimicrobial prophylaxis in surgery. AJHP 70(3)195-283.
9. Anderson, D.J. et al. (2014). Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update. *Infection Control and Hospital Epidemiology,* 35(6), 605-627.
10. Wood A, Conner R. (2015) Guideline for Preoperative Patient Skin Antisepsis. In 2015 Guidelines for Perioperative Practice (pp 45-66). Denver: AORN.
11. Anderson, D.J. et al. (2014). Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update. *Infection Control and Hospital Epidemiology*, 35(6), 605-627.
12. Anderson, D.J. et al. (2014). Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update. *Infection Control and Hospital Epidemiology*, 35(6), 605-627.
13. Wood A, Conner R. (2015) Guideline for Preoperative Patient Skin Antisepsis. In 2015 Guidelines for Perioperative Practice (pp 45-66). Denver: AORN.
14. Dumville JC, Mc Farlene E, Edwards P, Lipp A, Homes A, Liu Z. (2015). Cochrane Database Syst Rev. 21(4).
15. TeamSTEPPS®: Strategies and Tools to Enhance Performance and Patient Safety. September 2015. Agency for Healthcare Research and Quality, Rockville, MD. Retrieved from www.ahrq.gov/professionals/education/curriculum-tools/teamstepps/index.html
16. Hart SR, Bordes B, Hart J, Corsino D, Harmon D. (2011). Unintended perioperative hypothermia. Oschner J. 11(3): 259-270.
17. Sessler, D.I. (2001). Complications and treatment of mild hypothermia. *Anesthesiology*, 95(2), 531–543.
18. Melling, A.C., Ali, B., Scott, E.M. and Leaper, D.J. (2001). Effects of preoperative warming on the incidence of wound infection after clean surgery: a randomised controlled trial. *Lancet*, 358(9285), 876-80.
19. Kurz, A., Sessler, D.I. and Lenhardt, R. (1996). Study of Wound Infection and Temperature Group. Perioperative normothermia to reduce the incidence of surgical-wound infection and shorten hospitalization. *New England Journal of Medicine,* 334(19), 1209–1215.
20. Mahoney, C.B. and Odom, J. (1999). Maintaining intraoperative normothermia: A meta-analysis of outcomes with costs. *AANA Journal,* 67(2), 155-64.
21. Wood A, Conner R. (2015) Guideline for Prevention of Unplanned Perioperative Hypothermia. In 2015 Guidelines for Perioperative Practice (pp 479-490). Denver: AORN.
22. Kwon, S., Thompson, R., Dellinger, P. et al. (2013). Importance of perioperative glycemic control in general surgery: a report from the surgical care and outcomes assessment program. *Annals of Surgery,* 257, 8–14.

23. Martin ET, Kaye KS, Knott C, Nguyen H, Santorossa M, Evans R, et al. (2015). Diabetes and risk of surgical site infection: a systemic review and met-analysis. Infect Control Hosp Epidemiol, 00()):1-12.
24. Kwon S, Thompson R, Dellinger P, Yanez D, Farrohki E, Flum D. (2013). Importance of perioperative glycemic control in general surgery: a report from the Surgical Care and Outcomes Assessment Program. Ann Surg, 257(1):8-14.
25. Rutan L, Sommers K. (2012). Hyperglycemia as a risk factor in the perioperative patient. ARON, 95(8):352-361.
26. Richards JE, Kaufmann RM, Zuckerman SL, Obremsky WT, May AK. (2012). Relationship of hyperglycemia and surgical-site infection in orthopedic surgery. J Bone Joint Surg Am, 94(13):1181-1186.
27. Mohan S, Kaoutzanis C, Welch KB, Vanderwarker JF, Winer S, Krapohl G, et al. (2015). Postoperative hyperglycemic and adverse outcomes in patients undergoing colorectal surgery: results from the Michigan surgical quality collaborative database. Int J Collorectal Dis, 30(11):1515-1523.
28. Latham, R., Lancaster, A.D., Covington, J.F., et al. (2001). The association of diabetes and glucose control with surgical-site infections among cardiothoracic surgery patients. *Infection Control and Hospital Epidemiology,* 22, 607–612
29. Dellinger, E.P. (2001). Preventing surgical-site infections: the importance of timing and glucose control. *Infection Control and Hospital Epidemiology,* 22, 604–606.
30. Duncan, A. E. (2012). Hyperglycemia and Perioperative Glucose Management. Current Pharmaceutical Design, 18(38), 6195–6203.
31. Gandhi GY, Nuttall GA, Abel MD, et al. (2007). Intensive intraoperative insulin therapy versus conventional glucose management during cardiac surgery: a randomized trial. Ann Intern Med, 146(4), 233-243.
32. Anderson, D.J. et al. (2014). Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update. Infection Control and Hospital Epidemiology, 35(6), 605-627.
33. Duncan, A. E. (2012). Hyperglycemia and Perioperative Glucose Management. Current Pharmaceutical Design, 18(38), 6195–6203.
34. Togioka, B., Galvagno, S., Sumida, S., Murphy, J., Ouanes, J.P., and Wu, C. (2012). The role of perioperative high inspired oxygen therapy in reducing surgical site infection: a meta-analysis. *Anesthesia & Analgesia*, 114, 334-42.
35. Stall A, Paryan E, Gupta R, Zadnik M, O'Tool RV. (2013). Perioperative supplemental oxygen to reduce surgical site infections after open fixation of high-risk fractures: a randomized controlled pilt tiral. J Trauma Acute Care Surg, 75(4):657-663.
36. Qadan M, Akca O, Mahid SS, Hornung CA, Polk HC Jr. (2013). Perioperative supplemental oxygen therapy and surgical site infrections: a meta-anaysis of random controlled trials. Arch Surg, 144(4):359-366.
37. Anderson, D.J. et al. (2014). Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update. *Infection Control and Hospital Epidemiology*, 35(6), 605-627.
38. Qadan M, Akca O, Mahid SS, Hornung CA, Polk HC Jr. (2009). Peri-operative supplemental oxygen therapy and surgical site infection: a met-analysis of randomized controlled trials. Arch Surg, 144(4):359-366.
39. Spruce L. (2014). Back to basics: prevention surgical site infections. ARON J, 99(5):600-608.
40. Wood A, Conner R. (2015) *Guidelines for Perioperative Practice* 2016. Denver: AORN.
41. Health Research & Educational Trust (2016, November). Up Campaign: Set UP Tool.Chicago, IL: Health Research & Educational Trust. Accessed at: http://www.hret-hiin.org/Resources/up_campaign/16/hrethiin_upcampaign_startuptool.pdf
42. Kluytmans, J.A., Mouton, J.W., Ijzerman, E.P., Vandenbroucke-Grauls, C.M., Maat, A.W., Wagenvoort, J.H., et al. (1995). Nasalcarriage of Staphylococcusaureus as a major risk factor for wound infections after cardiac surgery. *Journal of Infectious Diseases*, 171, 216-9.
43. Huang, S.S. and Platt, R. (2003). Risk of methicillin-resistant Staphylococcus aureus infection after previous infection or colonization. *Clinical Infectious Diseases,* 36, 281–285
44. Rao, N., Cannella, B.A., Crossett, L.S., Yates, A.J., McGough, R.L. and Hamilton, C.W. (2011). Preoperative Screening/Decolonizationfor Staphylococcus aureus to Prevent Orthopedic Surgical Site Infection. *Journal of Arthroplasty,* 25(8), 1501-1507.

45. van Rijen, M.M., Bonten, M., Wenzel, R.P. and Kluytmans, J.A. (2008). Intranasal mupirocin for reduction of Staphylococcus aureus infections in surgical patients with nasal carriage: a systematic review. *Journal of Antimicrobial Chemotherapy*, 61, 254-261

46. Anderson, D.J. et al. (2014). Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update. *Infection Control and Hospital Epidemiology*, 35(6), 605-627.

47. Anderson, D.J. et al. (2014). Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update. *Infection Control and Hospital Epidemiology*, 35(6), 605-627.

48. Barnes S. Nasal Decolonization and HAI Prevention: Applications and Evidence. ICT December 2016.

49. Daoud FC, Edmiston CE,Jr., Leaper D. (2014). Meta-analysis of prevention of surgical site infections following closure with triclosan-coated sutures: robustness to new evidence. Surg Infect (Larchmt), 15(3):165-181.

50. Baracs J, Huszar O, Horvath OP. (2011). Surgical site infection after abdominal closure in colorectal surgery using triclosan-coated absorbable suter (PDS Plus) vs. uncoated sutures (PDS II) a randomized multicenter study. Surg Infect (Larchmt), 12(6):483-489.