

Surgical Site Infections (SSI)

How To Use This Guide

This AEBP provides evidence-based actions and resources for executives, leaders, clinicians, and performance improvement specialists. This document is intended to be used as a guide for healthcare organizations to examine their own workflows, identify practice gaps, and implement improvements. In it, you'll find: Best Practice Summary: A high level summary of evidence-based, clinical best practices.

Executive Summary: Executives should understand the breadth of the problem and its clinical and financial implications.

Leadership Checklist: This section is for senior leaders to understand common patient safety problems and their implications related to Surgical Site Infections (SSI). Most preventable medical harm occurs due to system defects rather than individual mistakes. Leaders can use this checklist to assess whether best practices are being followed and whether action is needed in their organization around SSI.

Clinical Workflow: This section includes more specific information about SSI across the continuum of care. Leaders should include the people doing the work in improving the work. This section outlines what should be happening on the frontline. Clinicians can use this section to inform leaders whether there are gaps and variations in current processes. This is presented as an infographic that can be used for display in a clinical area.

Education for Patients and Family Members: This section outlines what frontline healthcare professionals should be teaching patients and family members about SSI. Clinicians can inform leaders whether there are gaps and variations in the current educational processes.

Performance Improvement Plan: If it has been determined that there are gaps in current practice, this section can be used by organizational teams to guide them through an improvement project.

What We Know about SSI: This section provides additional detailed information about SSI. Resources: This section includes helpful links to free resources from other groups working to improve patient safety.

Endnotes: This section includes the conflict of interest statement, workgroup member list, and references.

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Best Practice Summary

Pre-operative measures

- Consider all minimally invasive measures to determine if surgery is necessary.
- Conduct MRSA screening.
- Assess the patient for any allergies or sensitivities to skin antiseptics that may be used during the surgery.
- Provide clear and understandable instructions of the procedure to the patient and their family prior to surgery.
- Confirm identity, incision site, and procedure type.
- Conduct a fire risk assessment.
- Remove patient jewelry or any clothing that may be an obstruction during the surgery.
- Isolate highly contaminated areas near the surgical site (e.g., anus).
- Utilize precautions to avoid ingestion of antiseptic for surgical sites near the mouth of the patient.
- Administer antibiotics within one hour prior to any surgical incisions and re-dose as needed per specific surgical procedure and patient.

Intra-operative measures

- Closely monitor the patient's vital signs during the procedure.
- When needed, utilize antibiotic-impregnated implants.
- Minimize blood transfusions.
- Minimize traffic inside the operating room and maintain room humidity of 20-60%. Keep the interior of the room as a positive pressure.
- Adhere to sterile precautions by enforcing strict hand scrub compliance and maintaining PPE the entire procedure. Note the PPE is not to be taken or worn outside of the operating room.
- Maintain protection and cleanliness of the site during the entire operation and perform topical irrigation of the incision site.
- Maintain tight glucose and temperature control.

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Post-operative measures

- Ensure that all sponges, instruments, and needles used during the procedure are counted.
- Check blood glucose levels, temperature, and vital signs.
- Document wound care and maintain infection vigilance during the entire stay of the patient at the hospital.
- Communicate key concerns for patient recovery with the full care team, including the patient and family. See Education for Patients and Family Members section.

Executive Summary

The Problem

Nearly half of all adverse events in industrialized hospital care settings are attributable to surgical procedures, with surgical site infections (SSIs) occurring in between 2-11% of patients undergoing surgical procedures (AHRQ, 2019; WHO, 2018).

The Cost

SSI is the most expensive type of healthcare-associated infection, costing \$3.3 billion annually with over one million preventable patient days (CDC, 2021). Because more than 10 million patients undergo an invasive procedure annually, the risk for SSI is significant.

The Solution

Reduce deaths as a result of SSI throughout healthcare organizations and provide clear directives to reduce deaths associated with SSI complications after discharge. This document provides a blueprint that outlines the actionable steps organizations should take to successfully improve surgical safety and summarizes the available evidence-based practice protocols. This document is revised annually and is always available free of charge on our website.

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Leadership Checklist

Use this checklist as a guide to determine whether current evidence-based guidelines are being followed in your organization:

Obtain buy-in for use of a surgical safety checklist.

- Ask team members to think about how the checklist intervention is connected to their values.
- Involve surgeons and all other clinicians in building these safety mechanisms to emphasize the “why”.
- Hold staff accountable for providing the standard of care and reward success.
- Debrief on a regular basis to solicit team feedback about barriers to sustained compliance. Adjust the plan quickly and nimbly as needed.
- Use patient stories to help teach and inspire change in your staff (PSMF, 2018).

Invest in team building.

- Designate an individual responsible for the use of the surgical checklist and make sure their role is known among other team members.
- Activate all team members in efforts to build and improve the standardized protocol and share the responsibility.
- Minimize hierarchy and consider implementing elements of TeamSteps (Clapper & Kong, 2012; King et al., 2008).

Standardize expectations.

- Standardize a standardized surgical site infection prevention checklist for all surgical procedures (Haynes et al., 2009; Prates et al., 2018).
- Incorporate hard stop reminders to complete the checklist during routine preoperative processes.
- Standardize SSI definitions and criteria for institutional reporting (CDC, 2018).
- Ensure that surgical safety protocols are embedded into clinical workflows, whether electronic or paper.

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Use metrics to inform needed process changes.

- Measure and report SSIs and compliance monthly (colon surgical site infections based on CDC NHSN definitions/total number of colon operative procedures based on CDC NHSN definitions). Note trends in areas with low compliance and high SSI incidence. Routinely reassess outcomes.
- Track root causes of failure to use/complete the pre-op checklist and for procedure delays.
- Consider calling patients post-operatively to assess for signs of infection.
- Ensure that leaders have a simple process to oversee surgical safety improvement work while also considering how it aligns with other initiatives across the organization.

Clinical Workflow

1. FOLLOW PRE-OPERATIVE MEASURES

(Bratzler et al., 2013; Berrios-Torres et al., 2017; Ban et al., 2017).

- Consider minimally-invasive alternatives.
- Conduct MRSA screening.
- Encourage chlorhexidine shower (Hranjec et al., 2010).
- Assess for patient allergies and sensitivities to skin antiseptics.
- Provide the patient and patient care provider clear verbal and written instructions for preoperative bathing that accounts for manufacturer's instructions for safe use of the antiseptic and individual directives for patient based on their personal care instructions such as hair placement, use of nail adhesives, or body lotions or deodorants.
- Confirm patient identity, incision site, and procedure.
- Perform fire risk assessment.
- Isolate highly contaminated areas (e.g., anus) near the surgical site.
- Use precautions to avoid ingestion/inhalation of the antiseptic for surgical sites near the mouth.
- Document surgical site preparation.

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- Administer antibiotics within 1 hour prior to incision (2 hours for vancomycin and fluoroquinolones) and re-dose when scheduled as different antibiotics are re-dosed at different times (Anderson et al., n.d.).
- Defer to institution-specific guidelines to choose appropriate antimicrobial agents based on:
 - Surgical procedure
 - Most common SSI pathogens for the planned procedure
 - Known allergies or drug reactions of each specific patient.



2. FOLLOW INTRA-OPERATIVE MEASURES.

- **Monitor patient vital signs and adjust as needed** (Redose antibiotics based on agent half-life)
- **Optimize the environment** (Minimize traffic, use laminar air flow, maintain room humidity of 20-60% (ISID, 2018))
- **Adhere to sterile precautions** (Maintain appropriate PPE and enforce strict hand scrub compliance: no jewelry)
- **Maintain sterilization and protection of the site during operation** (Example: utilize an impermeable plastic wound protector, perform topical irrigation of the incision site, and or perform intraoperative skin preparation with an alcohol-based antiseptic agent unless contraindicated).
- **Maintain tight glucose and temperature control intraoperatively.**



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3. FOLLOW POST-OPERATIVE MEASURES (Berríos-Torres et al., 2017)

- Count sponges, instruments, and needles.
- Check blood glucose level and temperature.
- Perform chlorhexidine shower two hours after the procedure.
- Protect primary closure incisions with sterile dressing for 24-48 hours post-op.
- Document wound care and communicate key concerns for patient recovery with the full care team, including the patient and family. See Education for Patients and Family Members section.
- Stop using antibiotics within 24 hours after the surgery end time—48 hours for cardiac patients—unless signs of infection are present.
- Maintain infection vigilance throughout full hospital stay.
- If an infection is identified, the care team should also be actively engaged in sepsis prevention (See Sepsis AEBP).

Education For Patients And Family Members

The outline below illustrates all of the information that should be conveyed to the patient and family members by someone on the care team in a consistent and understandable manner. Patients and family members should understand

- The definition of a surgical site infection
- Their specific risk factors for a surgical site infection
- Things the organization is doing to prevent a surgical site infection
- Things they can be doing to prevent a surgical site infection, such as
 - Telling their provider about previous medical problems or previous SSIs
 - Telling their provider about health problems that could impact treatment (e.g., allergies, etc)
 - Quitting smoking

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- Not applying powders, makeup, or lotions before the procedure
- Avoiding shaving where they will have surgery
- Showering just before the procedure
- Asking about the antibiotics before the surgery
- Ensuring all providers practice hand hygiene
- Making sure all instructions for wound care and follow up are understood before discharge

Performance Improvement Plan

Follow this checklist if the leadership team has determined that a performance improvement project is necessary:

- Gather the right project team.** Be sure to involve the right people on the team. You'll want two teams: an oversight team that is broad in scope, has 10-15 members, and includes the executive sponsor to validate outcomes, remove barriers, and facilitate spread. The actual project team consists of 5-7 representatives who are most impacted by the process. Whether a discipline should be on the advisory team or the project team depends upon the needs of the organization. Patients and family members should be involved in all improvement projects, as there are many ways they can contribute to safer care.

Complete this Lean Improvement Activity:



Conduct a SIPOC analysis to understand the current state and scope of the problem. A SIPOC is a lean improvement tool that helps leaders to carefully consider everyone who may be touched by a process, and therefore, should have input on future process design.

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RECOMMENDED SURGICAL SITE INFECTION IMPROVEMENT TEAM

- Infection preventionists
- Operating room nurses
- Surgeons
- Anesthesiologists
- Nurse anesthetists
- Operating room technicians
- Floor nurses
- ICU nurses
- Social workers/care coordinators
- Clinical educators
- Blood bank personnel
- Quality improvement leaders
- Admitting and registration staff

Table 1: Understanding the necessary disciplines for a surgical site infection improvement team

- Understand what is currently happening and why.** Reviewing objective data and trends is a good place to start to understand the current state, and teams should spend a good amount of time analyzing data (and validating the sources), but the most important action here is to go to the point of care and observe. Even if team members work in the area daily, examining existing processes from every angle is generally an eye-opening experience. The team should ask questions of the frontline during the observations that allow them to understand each step in the process and identify the people, supplies, or other resources needed to improve patient outcomes.



Create a process map once the workflows are well understood that illustrates each step and the best practice gaps the team has identified (IHI, 2015). Brainstorm with the advisory team to understand why the gaps exist, using whichever root cause analysis tool your organization is accustomed to (IHI, 2019). Review the map with the advisory team and invite the frontline to validate accuracy.

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SURGICAL SITE INFECTION PROCESSES TO CONSIDER ASSESSING

- Use of the standard surgical safety checklist
- Antimicrobial prophylaxis
- Delivery of antibiotics
- Documentation of wound care
- Hair removal
- Determination of the process/protocol that will be used for decolonization
- Identification of surgical site infections
- Discharge coordination
- Use of blood transfusions
- Set up of operating room conditions
- Maintenance and sterilization of operating rooms
- Fire risk assessment
- Consideration of non-invasive alternatives
- Sterile technique adherence
- Procedural delays
- Adaptation of procedure due to equipment or staffing shortages
- Storage and disposal of antiseptics
- Glucose and temperature control techniques intraoperatively and postoperatively

Table 2: Consider assessing these processes to understand where the barriers contributing to SSI be in your organization

- Prioritize the gaps to be addressed and develop an action plan.** Consider the cost effectiveness, time, potential outcomes, and realistic possibilities of each gap identified. Determine which are a priority for the organization to focus on. Be sure that the advisory team supports moving forward with the project plan so they can continue to remove barriers. Design an experiment to be trialed in one small area for a short period of time and create an action plan for implementation.

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The action plan should include the following:

- Assess the ability of the culture to change and adopt appropriate strategies
- Revise policies and procedures
- Redesign forms and electronic record pages
- Clarify patient and family education sources and content
- Create a plan for changing documentation forms and systems
- Develop the communication plan
- Design the education plan
- Clarify how and when people will be held accountable

TYPICAL GAPS IDENTIFIED IN SURGICAL SITE INFECTION PREVENTION

- | | |
|--|---|
| <ul style="list-style-type: none"> • Some clinicians aren't aware of checklists as a tool for safety. • Team members don't understand the roles/responsibilities of other team members. • There's a resistance to use a checklist or standardizing protocol. • The culture does not support collaboration and teamwork. • There's a perception that the checklist is one individual's responsibility, therefore, all team members are not involved. | <ul style="list-style-type: none"> • There are unnecessary delays in initiating the procedure. • There's a lack of staff for adequate surveillance. • Early indicators of SSI may be hard to detect. • There's a lack of awareness and education for detection of infection. • Patients don't have a clear, quick way to contact providers with concerns post-operatively. |
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Table 3: By identifying the gaps in SSI prevention processes, organizations can tailor their project improvement efforts more effectively.

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- **Evaluate outcomes, celebrate wins, and adjust the plan when necessary.** Measure both process and outcome metrics. Outcome metrics include the rates outlined in the leadership checklist. Process metrics will depend upon the workflow you are trying to improve and are generally expressed in terms of compliance with workflow changes. Compare your outcomes against other related metrics your organization is tracking.

Routinely review all metrics and trends with both the advisory and project teams and discuss what is going well and what is not. Identify barriers to completion of action plans, and adjust the plan if necessary. Once you have the desired outcomes in the trial area, consider spreading to other areas (IHI, 2006).

It is important to be nimble and move quickly to keep team momentum going, and so that people can see the results of their labor. At the same time, don't move so quickly that you don't consider the larger, organizational ramifications of a change in your plan. Be sure to have a good understanding of the other, similar improvement projects that are taking place

Read this paper from the Institute for Healthcare Improvement to understand how small local steps



SURGICAL SITE INFECTIONS METRICS TO CONSIDER ASSESSING

- | | |
|--|--|
| <ul style="list-style-type: none"> • Completion of antibiotics given preoperatively • Completion and use of the pre-operative checklist • Time from antibiotic administration to start of the procedure • Procedural delays • Preoperative skin preparation | <ul style="list-style-type: none"> • Hand hygiene • Outpatient calls and reports about infection • Cost impact of SSI to facility and patient • Post-operative LOS • Familiarity with surgical team members |
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Table 4: Consider evaluating related metrics to better understand surgical site infection contributing factors

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What We Know About Surgical Site Infections (SSI)

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SSIs can be defined as an infection that occurs after surgery in the part of the body where surgical procedure took place (CDC, 2010).

Symptoms and Epidemiology

Symptoms of an SSI include redness and pain around the surgical site area, drainage of cloudy fluid from the surgical wound, and/or fever.

SSIs can be caused by:

- **Endogenous factors**, such as from the patient's flora or seeding from a distant site of infection.
- **Exogenous factors**, such as from surgical staff, physical environment and ventilation, tools, equipment, and materials in the operating room.

Risk Factors

Any patient undergoing a surgical procedure is at risk for SSI. However, patient-specific risk factors include (Cheng et al., 2015):

- Pre-existing infection
- Low serum albumin concentration
- Old age
- Obesity/diabetes
- Smoking
- Ischemia
- Trauma
- Blood transfusions
- Hypothermia
- Hypoxia
- Hyperglycemia
- Abdominal surgery

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Barriers to SSI Prevention

Some common organizational barriers to safe surgery and SSI prevention include:

- **Awareness:** Current research suggests that up to 50% of nurses and healthcare staff are unaware of the evidence-based recommendations to prevent SSIs (Lin et al., 2019).
- **Attitudes:** It has been suggested that clinicians may not agree on the standardized protocols or may not feel confident in their abilities to execute these standards effectively. Providers may not agree that the presented evidence is applicable to their patient's situation. Hospital leaders should evaluate the number of steps in SSI prevention standards to better understand the operational barriers that even the most well-intended clinicians may face (AHRQ, 2017).
- **Detection:** Detecting SSIs is becoming increasingly challenging due to the lack of standardized methods for post-discharge and outpatient surveillance. This is in part due to an increased number of outpatient surgeries and shorter postoperative inpatient stays.

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Resources

Resources for SSI Prevention

- AHRQ: Implementing your Surgical Site Infection Prevention Bundle
- Effectiveness of Wound Surveillance Program
- APSIC: Guidelines for Prevention of Surgical Site Infections
- WHO: Surgical Safety Checklist
- Five Steps to Safer Surgery
- IHI: Preventing Infection after Hip and Knee Replacement
- IHI: A New Emergency Checklist for Office-based Surgery
- Journal of Wound Care: Surgical Site Infection: Prevention and Management across Healthcare Sectors
- Strategies for Surgical Patient Safety
- Engaging the Patient and Family in the Surgical Safety Process Utilizing SafeStart



Resources for SSI Prevention

- Kaiser Northern California, San Rafael: Your Guide to Surgery
- How-to Guide: Prevent Surgical Site Infections

For General Improvement

- CMS: Hospital Improvement Innovation Networks
- IHI: A Framework for the Spread of Innovation
- The Joint Commission: Leaders Facilitating Change Workshop
- IHI: Quality Improvement Essentials Toolkit
- SIPOC Example and Template for Download
- SIPOC Description and Example

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Endnotes

Conflicts of Interest Disclosure

The Patient Safety Movement Foundation partners with as many stakeholders as possible to focus on how to address patient safety challenges. The recommendations in the AEBP are developed by workgroups that may include patient safety experts, healthcare technology professionals, hospital leaders, patient advocates, and medical technology industry volunteers. Workgroup members are required to disclose any potential conflicts of interest.

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