



# Surgical Site Infection (SSI) Road Map

MHA’s road maps provide hospitals and health systems with evidence-based recommendations and standards for the development of topic-specific prevention and quality improvement programs, and are intended to align process improvements with outcome data. Road maps reflect published literature and guidance from relevant professional organizations and regulatory agencies, as well as identified proven practices. MHA quality and patient safety committees provide expert guidance and oversight to the various road maps.

Each road map is tiered into fundamental and advanced strategies:

- **Fundamental strategies** should be prioritized for implementation, and generally have a strong evidence base in published literature in addition to being supported by multiple professional bodies and regulatory agencies.
- **Advanced strategies** should be considered in addition to fundamental strategies when there is evidence the fundamental strategies are being implemented and adhered to consistently and there is evidence that rates are not decreasing and/or the pathogenesis (morbidity/mortality among patients) has changed.

**Operational definitions** are included to assist facility teams with road map auditing and identifying whether current work meets the intention behind each road map element.

**Resources** linked within the road map include journal articles, expert recommendations, electronic order sets and other pertinent tools which organizations need to assist in implementation of best practices.

*Note: Pre-hospital and preoperative measures are generally intended for elective surgeries. Best practices should be followed as closely as possible for emergent surgeries, where possible.*

Road map sections	Road map questions (if not present at your hospital or answering no, please see next column for suggested resources)	If specific road map element is missing, consider the following resources:
Patient & family education	<p><b>FUNDAMENTAL</b> (check each box if “yes”)</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Prior to procedure, the patient/family is educated on SSI prevention. <ul style="list-style-type: none"> <li>- Education includes identification of modifiable risk factors (e.g., smoking, obesity, diabetes management, and preoperative skin care [1-4].</li> </ul> </li> <li><input type="checkbox"/> Prior to discharge, the patient/family is educated about the development of SSI. <ul style="list-style-type: none"> <li>- Education includes symptoms of a surgical site infection, what health care personnel are doing to prevent an infection, and what the patient can do to help prevent an infection [1].</li> </ul> </li> <li><input type="checkbox"/> Prior to discharge, the patient/family is educated using teach back on post-op surgical care e.g., when to resume showering, swimming and other activities, hand hygiene, wound care and signs and symptoms of infection to report to provider [2].</li> </ul>	<p>Patient engagement plays an important role in prevention SSI. Consider the following when developing teaching materials:</p> <ul style="list-style-type: none"> <li>• <a href="#">Slashing SSI patient education</a></li> <li>• Centers for Disease Control and Prevention <a href="#">FAQs about SSI</a></li> <li>• <a href="#">Patient engagement with surgical site infection prevention: an expert panel perspective</a></li> </ul> <p>The Institute for Healthcare Improvement (IHI) <a href="#">“Always use teach back!”</a> tools were developed to assist in confirming patient understanding of care instructions.</p>

Road map sections	Road map questions (if not present at your hospital or answering no, please see next column for suggested resources)	If specific road map element is missing, consider the following resources:
Cleaning surgical equipment & environment	<p><b>FUNDAMENTAL</b> (check each box if “yes”)</p> <p><input type="checkbox"/> The facility has a process to limit and monitor the use of immediate use steam sterilization (IUSS).</p> <ul style="list-style-type: none"> <li>- The facility has a policy in place to limit IUSS to instances when there are no other viable options (i.e., do not use for convenience, preference or when adequate inventory could eliminate the need for it) [1,5-8]. Consider the following: planning for infrequently used instruments, case scheduling to account for sterilization, and not using implants unless other options have been exhausted. Follow appropriate preparation methods for IUSS [1,5,8].</li> <li>- The facility has a policy in place to audit IUSS practices [1,8], reviewing IUSS audit data on a periodic basis and considering improvement activities as needed.</li> </ul> <p><input type="checkbox"/> The facility has a process in place for appropriate cleaning and disinfection of the surgical environment.</p> <ul style="list-style-type: none"> <li>- The facility follows standard definitions and guidelines for cleaning and disinfection.</li> <li>- Assign responsibility for cleaning and disinfecting the surgical environment [9,10].</li> <li>- Routinely evaluate and audit the cleaning and disinfection process [9,10].</li> </ul>	<p>Multiple recommendation and guidance documents exist and should be reviewed to inform cleaning/disinfection and sterilization practices in healthcare facilities.</p> <ul style="list-style-type: none"> <li>• <a href="#">CDC Guideline for Disinfection and Sterilization in Healthcare Facilities</a></li> <li>• <a href="#">Association of periOperative Registered Nurses (AORN)</a></li> <li>• <a href="#">Association for the Advancement of Medical Instrumentation (AAMI)</a></li> </ul>
Undergoing surgery pre-procedure	<p><b>FUNDAMENTAL</b> (check each box if “yes”)</p> <p><input type="checkbox"/> The facility has clearly communicated to providers that they are expected to address the following: preoperative planning which includes assessment of modifiable risk factors and offering education and services for risk reduction (e.g., smoking cessation, weight loss, glucose management).</p> <ul style="list-style-type: none"> <li>- Providers should follow their organization’s criteria for rescheduling or cancelling a surgery based on risk factors.</li> </ul> <p><input type="checkbox"/> The preoperative physical includes evaluation and treatment for existing infections including, but not limited to; skin, urinary tract, sinus and periodontal.</p>	<p>Consider the following example antimicrobial surgical prophylaxis protocols when establishing organizational protocols:</p> <ul style="list-style-type: none"> <li>• Nebraska Medicine <a href="#">Antimicrobial Surgical Prophylaxis</a></li> <li>• Penn Medicine <a href="#">Surgical Prophylaxis Guidelines</a></li> </ul> <p>The World Health Organization’s <a href="#">surgical safety checklist</a> identifies three phases of an operation and within each phase describes key components of the normal work flow which must be completed before a surgery team proceeds with the operation.</p>

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Undergoing surgery pre-procedure, continued	<ul style="list-style-type: none"> <li>- If identified, infections are treated before elective surgery and surgery is postponed until resolution of bacterial infection (excludes emergency surgery) [1,5].</li> <li><input type="checkbox"/> An evidence-based standardized protocol is in place for the use of prophylactic antibiotics.             <ul style="list-style-type: none"> <li>- Surgeons, pharmacy, infectious disease and anesthesia staff are involved in the protocol development to ensure appropriate timing, selection and duration of antibiotics.</li> <li>- Pre-printed or computerized standard orders are in place specifying antibiotic, timing, dose and discontinuation [2,11]. Instructions for re-dosing (e.g., related to duration of surgery and blood loss) or special weight considerations, especially for obese patients (body mass index &gt;30) are included [1,12,13].                 <ul style="list-style-type: none"> <li>○ Intra-operative re-dosing of surgical prophylactic antibiotics is to be performed for procedures that last longer than two half-lives of the drug [1,12-16].</li> <li>○ Intra-operative re-dosing of surgical prophylactic antibiotics is to be performed for procedures involving blood loss &gt;1500cc. [1,12,13,16].</li> <li>○ A weight-based dosing protocol is to be implemented per the American Society of Health-System Pharmacists (ASHP), Infectious Diseases Society of America (IDSA), Surgical Infection Society (SIS), and Society for Healthcare Epidemiology of America (SHEA) guidelines [1,12-14,16,17].</li> </ul> </li> <li>- Roles are clearly assigned for ensuring that antibiotics are administered [2] within one hour prior to surgical incision (two hours for vancomycin and fluoroquinolones) and for re-dosing if needed [1,12].</li> </ul> </li> <li><input type="checkbox"/> A process is in place to verify administration of antibiotic during “time-out” period or pre-procedural briefing [1,2,11,18].</li> <li><input type="checkbox"/> The facility has a preoperative patient skin preparation process.             <ul style="list-style-type: none"> <li>- Patient is assessed for allergies or sensitivities to skin preparation agents [19].</li> <li>- Removal of any jewelry at or near the surgical site before cleaning the skin [19].</li> </ul> </li> </ul>	<p>The <a href="#">AORN Comprehensive Surgical Checklist</a> can be downloaded and customized to a facility, and includes key safety checks such as those outlined by WHO and The Joint Commission.</p> <p>The <a href="#">Minnesota Time Out Process</a> was developed to bring together administration, physicians, and front-line staff to hold each other accountable for conducting robust, effective time-outs for every patient, every invasive procedure, every time.</p> <p>Consider the following example of preoperative skin preparation when designing an organizational process:</p> <ul style="list-style-type: none"> <li>• Johns Hopkins <a href="#">Bathing Instructions</a></li> <li>• Johns Hopkins <a href="#">Preoperative Infection Prevention Guide</a></li> <li>• Vanderbilt <a href="#">Surgical Scrub Checklist - Carepartner</a></li> <li>• <a href="#">HRET SSI Change Package (2018) Appendix III (page 22): Cynosure Health Joint Surgery Patient Bathing Instructions</a></li> </ul>

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<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Undergoing surgery pre-procedure, continued</p>	<ul style="list-style-type: none"> <li>- Patients are to be advised to shower or bathe (full body) with either soap (antimicrobial or non-antimicrobial) [20] or an antiseptic agent, once the evening before and once the morning of the surgical procedure [1,5,13,19,21-23].</li> <li>- Upon admission to the preoperative area, an FDA-approved antiseptic solution is to be applied in full strength to the operative site [1,5,13,19,20,24].</li> <li>- Adherence to instructions for preoperative antiseptic showering or bathing at home is to be assessed upon admission to the preoperative area as a part of a preoperative bundle/checklist. If a patient reports that he or she was unable, an antiseptic shower, bath or full body wipe is to be completed preoperatively.</li> <li>- Hospital inpatients requiring surgery are to receive an antiseptic shower, bath, or full body wipe prior to surgery whenever possible.</li> <li><input type="checkbox"/> The facility has a process in place for operative site preparation. <ul style="list-style-type: none"> <li>- The preoperative antiseptic agent selected significantly reduces microorganisms and is broad spectrum, fast-acting and has a persistent effect [19]. Consider use of 2% chlorhexidine gluconate (CHG) with isopropyl alcohol or iodine povacrylex with alcohol (70%) unless contraindicated [2,3,20,24].</li> <li>- Wearing sterile gloves unless the antiseptic prep applicator is of sufficient length to prevent hand contamination [19].</li> <li>- Any skin preparation containing alcohol must be allowed to dry [19].</li> </ul> </li> <li><input type="checkbox"/> The facility has a process in place to pre-warm the patient's body temperature to &gt;96.8° F/ 36° C during surgery [2,11,25,26].</li> </ul>	
	<p><b>ADVANCED</b> (check each box if "yes")</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Measure preoperative blood glucose early enough so that if it is unexpectedly high, a plan of action can be initiated [2,11].</li> </ul>	

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During the procedure	<p><b>FUNDAMENTAL</b> (check each box if “yes”)</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> The facility has a process in place to maintain perioperative normothermia. <ul style="list-style-type: none"> <li>- Maintain the patient’s body temperature at &gt;96.8° F/ 36° C during surgery [1,2,5,11,20,25,26].</li> <li>- Measure the patient’s temperature just prior to or shortly after anesthesia has ended [26].</li> <li>- Excludes: intentional hypothermia, patients on cardiopulmonary bypass, and short cases (e.g., cases with anesthesia duration of &lt;60 minutes).</li> </ul> </li> <li><input type="checkbox"/> The facility maintains perioperative glycemic control with blood glucose target levels &lt;200 mg/dL for diabetic and non-diabetic patients. [1,2,5,11,27].</li> <li><input type="checkbox"/> The facility has a process in place to ensure antibiotic dose is repeated during surgery at the appropriate time if indicated [1,12].</li> <li><input type="checkbox"/> For all bowel procedures, the facility has a process in place to utilize clean instruments, water, and gloves/gowns for wound closure [2,3,28]. The recommendation applies to surgeries with primary wound closures [<a href="#">NHSN definition</a>]. <ul style="list-style-type: none"> <li>- Closing protocol expectations include all staff working in the sterile field</li> <li>- Closing protocol is included in the preoperative briefing</li> <li>- Note: the use of clean instruments, water, and gloves/gowns for wound closure (when bundled with other best practices for bowel surgery) has been shown to be an effective strategy for decreasing superficial SSI.</li> </ul> </li> </ul>	<p>The National Healthcare Safety Network (NHSN) provides standardized definitions through their <a href="#">SSI protocol</a>.</p> <p>Consider the following local examples when developing closing protocols:</p> <ul style="list-style-type: none"> <li>• <a href="#">Regions Hospital colon surgery closing protocol</a></li> <li>• <a href="#">Mayo Clinic closing pan protocol with roles OR</a></li> <li>• <a href="#">Mayo Clinic closing pan protocol and cost</a></li> </ul>
	<p><b>ADVANCED</b> (check each box if “yes”)</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> The facility has set clear expectations with regard to OR traffic. <ul style="list-style-type: none"> <li>- The OR door is only opened for essential passage of equipment, personnel and patient during surgery [1,2,7].</li> <li>- Responsibility is assigned to monitor the room once sterile supplies are opened.</li> <li>- An assessment of OR traffic, with the intent to reduce unnecessary traffic, is performed periodically [1,2].</li> </ul> </li> </ul>	<p>Consider the following local example when developing closing protocols for class II and higher clean/contaminated laparotomies:</p> <ul style="list-style-type: none"> <li>• <a href="#">CentraCare closing tray process for Cesarean Section</a></li> </ul>

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During the procedure, continued	<ul style="list-style-type: none"> <li><input type="checkbox"/> For class II and higher clean/contaminated laparotomies (e.g., hysterectomies, Cesarean sections), the facility has a process in place to utilize clean instruments, water, and gloves/gowns for wound closure. The recommendation applies to surgeries with primary wound closures <a href="#">[NHSN definition]</a>. <ul style="list-style-type: none"> <li>- Closing protocol expectations include all staff working in the sterile field.</li> <li>- Closing protocol is included in the pre-operative briefing.</li> </ul> </li> <li><input type="checkbox"/> The need for closing trays/closing instruments is to be added to the preoperative briefing or timeout script.</li> </ul>	
Post-procedure	<p><b>FUNDAMENTAL</b> <i>(check each box if “yes”)</i></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> The facility sets expectations for postoperative wound care. <ul style="list-style-type: none"> <li>- Surgical sterile dressings are to be left intact 24–48 hours unless there is bleeding or a reason to suspect early infection [2,5].</li> <li>- Where postoperative dressing changes are necessary, sterile dressings should be used [2,5].</li> </ul> </li> <li><input type="checkbox"/> The facility has a process in place to maintain the patient’s body temperature at &gt;96.8° F/ 36° C in the post-anesthesia care area [2,11,25,26].</li> <li><input type="checkbox"/> Maintain glucose levels at &lt;200 mg/dl on postoperative days 1 and 2 (with the procedure day being day 0) for cardiac patients while an inpatient [2,11,29].</li> <li><input type="checkbox"/> The facility has a process in place to ensure all antibiotics are discontinued appropriately, following current guidelines [1,5,12,13,20]. <ul style="list-style-type: none"> <li>- Exceptions include: implant-based breast reconstruction, joint arthroplasty and cardiac procedures where optimal duration of antibiotic therapy remains unknown) [13].</li> </ul> </li> </ul> <p><b>ADVANCED</b> <i>(check each box if “yes”)</i></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Maintain glucose levels at &lt;200 mg/dl on postoperative days 1 and 2 (with the procedure day being day 0) for diabetic and non-diabetic patients while an inpatient.</li> </ul>	<p>Consider the following example when defining expectations for postoperative wound care:</p> <ul style="list-style-type: none"> <li>• <a href="#">Allina Health Wound Classification Algorithm</a></li> <li>• <a href="#">CentraCare Health Cesarean Section incision dressing protocol</a></li> </ul> <p>The Washington State Hospital Association’s <a href="#">glucose control toolkit for surgical patients</a> walks through a step by step implementation process for change and includes multiple examples of order sets and protocols.</p> <p>The American Society of Health-System Pharmacists, the Infectious Diseases Society of America, the Surgical Infection Society, and the Society for Healthcare Epidemiology of America jointly developed <a href="#">clinical practice guidelines for antimicrobial prophylaxis in surgery</a>.</p>

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OR team accountability/ communication	<p><b>ADVANCED</b> (check each box if “yes”)</p> <p><input type="checkbox"/> The facility has a process for a discussion on antibiotic, timing, need for re-dosing, need for closing tray; any special considerations and equipment/supply needs to minimize the need to bring in additional equipment/ supplies during the procedure [1,2,20].</p> <p><input type="checkbox"/> The facility clearly defines “hard stops” (key steps that if not completed the staff do not move forward with the next process steps) e.g., patient refuses preoperative warming, antibiotic is not given within appropriate timeframe, organizationally approved antiseptic prep is not used to prep the site.</p> <ul style="list-style-type: none"> <li>- Excludes non-elective procedures.</li> </ul>	<p>The <a href="#">Minnesota Time Out Process</a> was developed to bring together administration, physicians, and front-line staff to hold each other accountable for conducting robust, effective time-outs for every patient, every invasive procedure, every time.</p>
Education for health care personnel (HCP) including all staff and licensed independent practitioners involved in surgical procedures	<p><b>FUNDAMENTAL</b> (check each box if “yes”)</p> <p><input type="checkbox"/> Ongoing SSI prevention education is incorporated into training on hire and at least annually for all staff and licensed independent practitioners involved in surgical procedures.</p> <p><input type="checkbox"/> The facility has set and enforces clear expectations for surgical attire in restricted and semi-restricted areas.</p> <ul style="list-style-type: none"> <li>- Fresh surgical attire laundered by the hospital or health care-accredited laundry is donned upon arrival before entering the restricted and semi-restricted areas each day [30].</li> <li>- Surgical attire is changed if it becomes visibly soiled [2,5,30].</li> <li>- Scrubs are not to be worn outside the hospital. This applies to all staff and licensed independent practitioners involved in surgical procedures, and vendors [30].</li> <li>- Personal attire worn in a restricted/semi-restricted area must be completely covered by hospital-provided attire [30].</li> <li>- Jewelry that is not covered by surgical attire is removed prior to entering restricted and semi-restricted area [30].</li> <li>- Scalp and hair, including facial hair, is completely covered by disposable coverings that are laundered by the hospital or health care-accredited laundry and changed daily [5,30].</li> </ul>	<p>Johns Hopkins Medicine developed an <a href="#">OR Attire and Procedures Audit Tool</a> to reinforce expectations for surgical attire.</p> <p>The Agency for Healthcare Research and Quality developed a <a href="#">Glucose Control Factsheet: Facts About Glucose Control and the Prevention of Surgical Site Infections</a> to support staff education.</p>

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	<ul style="list-style-type: none"> <li>- Non-scrubbed health care personnel in the OR wear hospital-laundered long-sleeved cover jackets [30].</li> <li>- The “Just Culture” model will be applied when HCP and prescribers are observed not following facility expectation for appropriate surgical attire.</li> </ul>	
Performance measurement	<p><b>FUNDAMENTAL</b> (check each box if “yes”)</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> The facility conducts SSI surveillance using standardized definitions and reviews data on a regular basis [1].</li> <li><input type="checkbox"/> A process is in place to communicate progress on outcomes to surgical and perioperative personnel and leadership [1].</li> <li><input type="checkbox"/> Identify process measure(s) to routinely audit and provide feedback to surgeons and leadership [1]. <ul style="list-style-type: none"> <li>- Consider the following process measures: practices related to skin preparation, prophylactic antibiotics received within one hour prior to incision, prophylactic antibiotic selection, prophylactic antibiotics discontinuation after surgery end time, normothermia, glucose control, patient hair removal, etc.</li> </ul> </li> <li><input type="checkbox"/> A process is in place to observe and assess OR personnel and the OR environment of care [31]. To guide observations, consider developing a process/checklist that supports the goals of perioperative and infection prevention teams. <ul style="list-style-type: none"> <li>- Collaborate with representatives from perioperative nursing, surgeons, and anesthesia providers to develop the OR observation process/checklist.</li> <li>- Review pertinent perioperative policies and procedures.</li> <li>- Consider including the following topics/practices: <ul style="list-style-type: none"> <li>○ Attire</li> <li>○ Environment – including evaluation of traffic during cases such as such as the number of people in the room and number of door openings, and traffic control patterns to improve preparedness, to minimize unnecessary movement, etc.</li> <li>○ Skin prep application per product</li> <li>○ Sterile technique</li> </ul> </li> </ul> </li> </ul>	

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Performance measurement, continued	<ul style="list-style-type: none"> <li>○ Hand hygiene by nonscrubbed members of the team</li> <li>○ Instrument handling and reprocessing</li> <li>○ Central line-associated bloodstream infection prevention practices</li> <li>○ Catheter-associated urinary tract infection prevention practices</li> <li>○ Health care-associated pneumonia prevention practices</li> </ul> <input type="checkbox"/> Consider the use of bundled interventions to improve adherence to best practices [13].	<ul style="list-style-type: none"> <li>● See references 32-39 for bundled interventions to improve adherence to best practices.</li> </ul>

## REFERENCES

1. Anderson DJ, Podgorny K, Berríos-Torres SI, et al. Strategies to Prevent Surgical Site Infections in Acute Care Hospitals: 2014 Update. *Infection Control and Hospital Epidemiology*. 2014;35:605-627. Available at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4267723/>
2. Health Research & Educational Trust. Surgical Site Infections Change Package: 2017 Update. Chicago, IL: Health Research & Educational Trust. Accessed at [www.hret-hiin.org](http://www.hret-hiin.org).
3. Cima R, Dankbar E, Lovely J, et al; Colorectal Surgical Site Infection Reduction Team. Colorectal surgery surgical site infection reduction program: a national surgical quality improvement program-driven multidisciplinary single-institution experience. *Journal of the American College of Surgeons*. 2013;216:23-33.
4. Joint Commission Center for Transforming Health Care. Reducing Colorectal Surgical Site Infections. [http://www.centerfortransforminghealthcare.org/assets/4/6/SSI\\_storyboard.pdf](http://www.centerfortransforminghealthcare.org/assets/4/6/SSI_storyboard.pdf)
5. Berríos-Torres BI, Umscheid CA, Bratzler DW, et al; for the Hospital Infection Control Practices Advisory Committee (HICPAC). Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017. *JAMA Surg*. Published online May 3, 2017. Available at: <http://jamanetwork.com/journals/jamasurgery/fullarticle/2623725>
6. Association for the Advancement of Medical Instrumentation (AAMI), Accreditation Association for Ambulatory Health Care (AAAHC), Association of periOperative Registered Nurses (AORN), Association for Professionals in Infection Control and Epidemiology (APIC), ASC Quality Collaboration, Association of Surgical Technologists (AST), and International Association of Healthcare Central Service Materiel Management (IAHCSMM). Immediate-Use Steam Sterilization. Undated. Accessed 4/22/2014 at: [http://www.aami.org/publications/standards/ST79\\_Immediate\\_Use\\_Statement.pdf](http://www.aami.org/publications/standards/ST79_Immediate_Use_Statement.pdf)
7. Sehulster LM, Chinn RYW, Arduino MJ, et al. Guidelines for environmental infection control in health-care facilities. Recommendations from CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). Chicago IL; American Society for Healthcare Engineering/American Hospital Association; 2004. Available at [http://www.cdc.gov/hicpac/pdf/guidelines/eic\\_in\\_HCF\\_03.pdf](http://www.cdc.gov/hicpac/pdf/guidelines/eic_in_HCF_03.pdf)
8. Rutala WA, Weber DJ; the Healthcare Infection Control Practices Advisory Committee. Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008. Atlanta, GA: Centers for Disease Control and Prevention; 2008. Available at [http://www.cdc.gov/hicpac/Disinfection\\_Sterilization/5\\_Ocleaning.html](http://www.cdc.gov/hicpac/Disinfection_Sterilization/5_Ocleaning.html)

9. Association of periOperative Registered Nurses (AORN). Recommended practices for environmental cleaning. In: Perioperative Standards and Recommended Practices. Denver, CO: AORN, Inc; 2013:255-276.
10. Allen G. Recommended Practices for Environmental Cleaning. AORN J 2014;99:571-579. Available at [https://www.aorn.org/websitedata/cearticle/pdf\\_file/CEA14517-0001.pdf](https://www.aorn.org/websitedata/cearticle/pdf_file/CEA14517-0001.pdf)
11. How-to Guide: Prevent Surgical Site Infections. Cambridge, MA: Institute for Healthcare Improvement; 2012. Available at <http://www.ihl.org/topics/ssi/pages/default.aspx>
12. Bratzler DW, Dellinger EP, Olsen KM, et al; American Society of Health-System Pharmacists; Infectious Disease Society of America; Surgical Infection Society; Society for Healthcare Epidemiology of America. Clinical practice guidelines for antimicrobial prophylaxis in surgery. American Journal of Health-System Pharmacy. 2013;70:195-283. Available at [http://www.idsociety.org/uploadedFiles/IDSA/Guidelines-Patient\\_Care/PDF\\_Library/2013%20Surgical%20Prophylaxis%20ASHP,%20IDSA,%20SHEA,%20SIS\(1\).pdf](http://www.idsociety.org/uploadedFiles/IDSA/Guidelines-Patient_Care/PDF_Library/2013%20Surgical%20Prophylaxis%20ASHP,%20IDSA,%20SHEA,%20SIS(1).pdf)
13. Ban KA, Minei JP, Laronga C, et al. American College of Surgeons and Surgical Infection Society: Surgical Site Infection Guidelines, 2016 Update. Journal of the American College of Surgeons. 2017;224:59-74. Available at: [http://www.journalacs.org/article/S1072-7515\(16\)31563-0/abstract](http://www.journalacs.org/article/S1072-7515(16)31563-0/abstract)
14. Bratzler DW, Houck PM, for the Surgical Infection Prevention Guideline Writers Workgroup. Antimicrobial prophylaxis for surgery: an advisory statement from the National Surgical Infection Prevention Project. Clinical Infectious Diseases. 2004;38:1706-1715.
15. American College of Obstetricians and Gynecologists. ACOG Practice Bulletin No. 120: Use of prophylactic antibiotics in labor and delivery. Obstetrics and Gynecology. 2011;117:1472-1483.
16. Engelman R, Shahian D, Shemin R, et al. The Society of Thoracic Surgeons Practice Guideline Series: Antibiotic Prophylaxis in Cardiac Surgery, Part II: Antibiotic Choice. Annals of Thoracic Surgery. 2007;83:1569-1576.
17. van Schalkwyk J, Van Eyk N; Society of Obstetricians and Gynaecologists of Canada Infectious Diseases Committee. Antibiotic prophylaxis in obstetric procedures. Journal of Obstetrics and Gynaecology Canada. 2010;32:878-892
18. World Health Organization (WHO). Implementation Manual – WHO Surgical Safety Checklist (First Edition). [http://www.who.int/patientsafety/safesurgery/tools\\_resources/SSSL\\_Manual\\_finalJun08.pdf?ua=1](http://www.who.int/patientsafety/safesurgery/tools_resources/SSSL_Manual_finalJun08.pdf?ua=1)
19. Association of periOperative Registered Nurses (AORN). Perioperative standards and recommended practices: Recommended practices for preoperative patient skin antisepsis, recommendation I. 2014.
20. World Health Organization (WHO). Global Guidelines for the Prevention of Surgical Site Infection. 2016. Available at: <http://www.who.int/gpsc/ssi-prevention-guidelines/en/>
21. Veiga DF, Damasceno CA, Veiga-Filho J, et al. Randomized controlled trial of the effectiveness of chlorhexidine showers before elective plastic surgical procedures. Infection Control and Hospital Epidemiology. 2009;30:77-79.
22. Veiga DF, Damasceno CA, Veiga Filho J, et al. Influence of povidone-iodine preoperative showers on skin colonization in elective plastic surgery procedures. Plastic and Reconstructive Surgery. 2008;121:115-118.
23. Webster J, Osborne S. Preoperative bathing or showering with skin antiseptics to prevent surgical site infection. Cochrane Database of Systematic Reviews. 2012, Issue 9. Art. No.: CD004985.

24. How-to Guide: Prevent Surgical Site Infection for Hip and Knee Arthroplasty. Cambridge, MA: Institute for Healthcare Improvement; 2012. Available at <http://www.ihi.org/resources/Pages/Tools/HowtoGuidePreventSSIforHipKneeArthroplasty.aspx>
25. Association of periOperative Registered Nurses (AORN). Guideline for prevention of unplanned patient hypothermia. In: Guidelines for Perioperative Practice. 2016:531-554.
26. American Society of PeriAnesthesia Nurses. Clinical guideline for the prevention of unplanned perioperative hypothermia. J Perianesth Nurs. 2001;16:305-314.
27. Wang R, Panizales MT, Hudson MS, et al. Preoperative glucose as a screening tool in patients without diabetes. Journal of Surgical Research. 2014;186:371-378.
28. Association of periOperative Registered Nurses (AORN). Perioperative standards and recommended practices: Recommended practices for sterile techniques, recommendation V. 2014.
29. Kiran RP, Turina M, Hammel J, Fazio V. The clinical significance of an elevated postoperative glucose value in nondiabetic patients after colorectal surgery: evidence for the need for tight glucose control. Annals of Surgery. 2013;258:599-605.
30. Association of periOperative Registered Nurses (AORN). Recommended practices for surgical attire. In: Perioperative Standards and Recommended Practices. 2011:57-72.
31. Association for Professionals in Infection Control and Epidemiology (APIC) Implementation Guide: Infection Preventionist's Guide to the OR. 2018. <https://apic.org/wp-content/uploads/2019/03/NEW-Infection-Preventionist-Guide-to-the-OR.pdf>
32. McGee MF, Kreutzer L, Quinn CM, et al. Leveraging a Comprehensive Program to Implement a Colorectal Surgical Site Infection Reduction Bundle in a Statewide Quality Improvement Collaborative. Ann Surg. 2019;270:701-711.
33. Andiman SE, Xu X, Boyce JM, et al. Decreased Surgical Site Infection Rate in Hysterectomy: Effect of a Gynecology-Specific Bundle. Obstet Gynecol. 2018;131:991-999.
34. Kline SE, Neaton JD, Lynfield R, et al. Randomized controlled trial of a self-administered five-day antiseptic bundle versus usual disinfectant soap showers for preoperative eradication of Staphylococcus aureus colonization. Infect Control Hosp Epidemiol. 2018;39:1049-1057.
35. Itani KM. Care bundles and prevention of surgical site infection in colorectal surgery. JAMA. 2015;314:289-290.
36. Schweizer ML, Chiang HY, Septimus E, et al. Association of a bundled intervention with surgical site infections among patients undergoing cardiac, hip, or knee surgery. JAMA. 2015;313:2162-2171.
37. Keenan JE, Speicher PJ, Thacker JK, et al. The preventive surgical site infection bundle in colorectal surgery: an effective approach to surgical site infection reduction and health care cost savings. JAMA Surg. 2014;149:1045-1052.
38. Cima R, Dankbar E, Lovely J, et al. Colorectal surgery surgical site infection reduction program: a National Surgical Quality Improvement Program-driven multidisciplinary single-institution experience. J Am Coll Surg. 2013;216:23-33.
39. Awad SS, Palacio CH, Subramanian A, et al. Implementation of a methicillin-resistant Staphylococcus aureus (MRSA) prevention bundle results in decreased MRSA surgical site infections. Am J Surg. 2009;198:607-610.