



# **How-to Guide: Prevent Surgical Site Infection for Hip and Knee Arthroplasty**

**Prevent surgical site infection for hip and knee arthroplasty by implementing the interventions recommended in this guide.**

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## **Contents**

<b>Introduction</b> .....	3
• What is the Institute for Healthcare Improvement (IHI)?.....	3
• What is a How-to Guide? .....	3
<b>Goal</b> .....	3
<b>The Impact of Hip and Knee Arthroplasty SSIs</b> .....	4
<b>Evidence Supporting Interventions to Prevent SSI for Hip and Knee Arthroplasty</b> .....	5
• Use an Alcohol-Containing Antiseptic Agent for Preoperative Skin Preparation.....	5
• Instruct Patients to Bathe or Shower with Chlorhexidine Gluconate (CHG) Soap for at Least Three Days Before Surgery.....	6
• Screen Patients for <i>Staphylococcus aureus</i> (SA) and Decolonize SA Carriers with Five Days of Intranasal Mupirocin and Bathing or Showering with Chlorhexidine Soap for at Least Three Days Before Surgery.....	7
<b>Implementing the Interventions to Prevent SSI for Hip and Knee Arthroplasty</b> .....	8
• Use an Alcohol-Containing Antiseptic Agent for Preoperative Skin Preparation.....	10
• Instruct Patients to Bathe or Shower with Chlorhexidine Gluconate (CHG) Soap for at Least Three Days Before Surgery.....	11
• Screen Patients for <i>Staphylococcus aureus</i> (SA) and Decolonize SA Carriers with Five Days of Intranasal Mupirocin and Bathing or Showering with Chlorhexidine Soap for at Least Three Days Before Surgery.....	13
<b>Applicable SCIP Practices</b> .....	15
• Appropriate Use of Prophylactic Antibiotics.....	15
• Appropriate Hair Removal .....	16
<b>Using the Model for Improvement</b> .....	17
<b>Forming the Team</b> .....	18
<b>Measurement Strategies</b> .....	19

## Introduction

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### What is the Institute for Healthcare Improvement (IHI)?

The Institute for Healthcare Improvement (IHI) is a leading innovator in health and health care improvement worldwide. For more than 25 years, we have partnered with a growing community of visionaries, leaders, and front-line practitioners around the globe to spark bold, inventive ways to improve the health of individuals and populations. Together, we build the will for change, seek out innovative models of care, and spread proven best practices. To advance our mission, IHI is dedicated to optimizing health care delivery systems, driving the Triple Aim for populations, realizing person- and family-centered care, and building improvement capability.

### What is a How-to Guide?

IHI's How-to Guides address specific health care interventions hospitals and/or entire health systems can pursue to improve the quality of health care. The interventions to prevent surgical site infection for hip and knee arthroplasty that are recommended in this How-to Guide are based on the work of teams participating in Project JOINTS (Joining Organizations IN Tackling SSIs), an initiative funded by the US Department of Health and Human Services and supported by the American Academy of Orthopaedic Surgeons, whose aim was to give participants support from IHI on how to test, implement, and spread the interventions.

## Goal

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The *How-to Guide: Prevent Surgical Site Infection for Hip and Knee Arthroplasty* recommends implementing three evidence-based interventions to prevent surgical site infection (SSI) in patients undergoing hip and knee arthroplasty procedures, in addition to two applicable Surgical Care Improvement Project (SCIP) practices.

### Three evidence-based interventions for preventing SSI for hip and knee arthroplasty:

1. Use an alcohol-containing antiseptic agent for preoperative skin preparation
2. Instruct patients to bathe or shower with chlorhexidine gluconate (CHG) soap for at least three days before surgery
3. Screen patients for *Staphylococcus aureus* (SA) and decolonize SA carriers with five days of intranasal mupirocin and bathing or showering with chlorhexidine gluconate soap for at least three days before surgery

### Two applicable SCIP practices:

4. Appropriate use of prophylactic antibiotics
5. Appropriate hair removal

## How-to Guide: Prevent Surgical Site Infection for Hip and Knee Arthroplasty

These five recommended interventions to prevent SSI for hip and knee arthroplasty build on the interventions described in the IHI *How-to Guide: Prevent Surgical Site Infections* (<http://www.ihl.org/knowledge/Pages/Tools/HowtoGuidePreventSurgicalSiteInfection.aspx>) that were initially developed during the IHI 5 Million Lives Campaign (2006-2008), a voluntary initiative to protect patients from medical harm.

## The Impact of Hip and Knee Arthroplasty SSIs

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Among surgical procedures, arthroplastic (hip and knee) surgeries are key high-cost, high-volume surgeries targeted for SSI prevention. Both are included in the Surgical Care Improvement Project (SCIP), a collaborative quality improvement effort led by ten national organizations, including the Centers for Medicare & Medicaid Services (CMS), Centers for Disease Control and Prevention (CDC), and IHI. In addition, more than 15 states have mandated SSI reporting for arthroplastic surgery.

Based on National Healthcare Safety Network reported SSI data, in the US approximately 365,000 total hip and 550,000 total knee arthroplasties are performed annually on patients between the ages of 45 to 79 years of age.<sup>1</sup> The same report describes knee arthroplasty surgical site infection rates ranging from 0.68% to 1.60%, depending on patient risk, and hip arthroplasty infection rates ranging from 0.67% to 2.4%.

If these rates were applied to all hip and knee replacement surgeries performed in the US, we estimate that 6,000 to 20,000 SSIs occur annually in the hip and knee replacements. These infections result in substantial morbidity, impacting the quality of life and productivity of affected patients and their families. (See “A Brief for Hospital Administrators: The Business Case for Preventing SSI for Hip and Knee Arthroplasty,” available at <http://www.ihl.org/knowledge/Pages/Tools/ABriefforHospitalAdministratorsBusinessCasePreventSSIHipKnee.aspx>.)

Despite their relatively low incidence, infections that occur can be devastating for the patient and those caring for the patient. Treatment for these infections often requires one or more of the following:

- A second operation to remove the hardware and insert a spacer device impregnated with antibiotics;
- Prolonged systematic antibiotic therapy, along with possible side effects of these drugs;
- Substantial pain and impaired mobility that may require reliance on a wheelchair and/or walker;
- A third operation four to six weeks after completion of antibiotics for re-implantation of the joint, followed by additional physical therapy and recuperation; and

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<sup>1</sup> Edwards J, Peterson K, Mu Y, et al. National Healthcare Safety Network (NHSN) report: Data summary for 2006 through 2008, issued December 2009. *American Journal of Infection Control*. 2009;37(10):783-805.

- Considerable out-of-pocket expenses for patients, time away from work, and reliance on family members and caregivers.

Other potential consequences of these infections include the potential for litigation; possible adverse publicity for both the hospital and surgeon; and possible increase in publicly reported infection rates, where required by law.

## Evidence Supporting Interventions to Prevent SSI for Hip and Knee Arthroplasty

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This How-to Guide recommends three evidence-based interventions for preventing SSI for patients undergoing hip and knee arthroplasty, in addition to two applicable SSI prevention practices that have been widely implemented and promulgated through the Surgical Care Improvement Project (SCIP).

### 1. Use an Alcohol-Containing Antiseptic Agent for Preoperative Skin Preparation

- Adequate preoperative skin preparation to prevent entry of skin flora into the surgical incision is an important basic infection prevention practice.
- Preoperative skin preparation of the operative site involves use of an antiseptic agent with long-acting antimicrobial activity, such as chlorhexidine gluconate (CHG) and iodophors.
- Two types of preoperative skin preparations that combine alcohol (which has an immediate and dramatic killing effect on skin bacteria) with long-acting antimicrobial agents appear to be more effective at preventing SSI than povidone-iodine (an iodophor) alone:
  - CHG plus alcohol
  - Iodophor plus alcohol

**Evidence to support the use of CHG plus alcohol:** A randomized, double-blind, placebo-controlled study of patients undergoing clean-contaminated surgery comparing use of povidone-iodine versus CHG plus alcohol preoperative skin antisepsis found that CHG plus alcohol use was associated with significantly lower superficial and deep SSI rates. This study, involving six hospitals, did not compare CHG plus alcohol to iodophor plus alcohol.<sup>2</sup>

**Evidence to support the use of iodophor plus alcohol:** A sequential intervention observational study performed at one hospital compared the effects of three different skin preparations on SSI rates and found

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<sup>2</sup> Darouiche R, Wall M, Itani K, et al. Chlorhexidine-alcohol versus povidone-iodine for surgical-site antisepsis. *New England Journal of Medicine*. 2010;362(1):18-26.

## How-to Guide: Prevent Surgical Site Infection for Hip and Knee Arthroplasty

that the use of iodophor plus alcohol and use of povidone-iodine followed by alcohol were associated with lower SSI rates than use of chlorhexidine plus alcohol.<sup>3</sup>

	Povidone-iodine (no alcohol)	Povidone-iodine + alcohol	CHG + alcohol	Iodine povacrylex + alcohol
Swenson ( <b>single hospital</b> observational study without controls)		8.7%	10.7%	5.9%
Darouiche ( <b>multicenter</b> randomized controlled study)	<b>16.1%</b>		9.5%	

Conclusion: The combination of a long-acting agent (either an iodophor or CHG) is better than povidone-iodine alone for preventing SSI. There is insufficient evidence to support recommending the use of one combination agent over another.

## 2. Instruct Patients to Bathe or Shower with Chlorhexidine Gluconate (CHG) Soap for at Least Three Days Before Surgery

- The evidence that preoperative bathing or showering with CHG soap reduces SSI rates is controversial. A Cochrane Systematic Review that included data from seven randomized controlled studies concluded that there was no clear evidence that CHG bathing reduced the risk of SSI, although most of these studies used only one or two applications of CHG washes.<sup>4</sup>
- However, studies do show that CHG bathing or showering substantially reduces the density of microorganisms on skin that can lead to SSI. This is the rationale for the 1999 Hospital Infection Control Practices Advisory Committee (HICPAC) guidelines for prevention of SSI recommendation that patients shower or bathe with an antiseptic agent at least the night before the operative day.<sup>5</sup>
- Studies (as outlined below) also show that *repeated use* of CHG soap for bathing or showering enhances the residual antimicrobial effects of CHG (i.e., the ability of CHG to reduce bacterial counts on skin not only during the immediate period after the shower but for a number of hours afterwards) and that this results in progressive reductions in bacterial counts on the skin.

<sup>3</sup> Swenson B, Hedrick T, Metzger R, Bonatti H, Pruett TL, Sawyer R. Effects of preoperative skin preparation on postoperative wound infection rates: A prospective study of 3 skin preparation protocols. *Infection Control and Hospital Epidemiology*. 2009;30(10):964-971.

<sup>4</sup> Webster J, Osborne S. Preoperative bathing or showering with skin antiseptics to prevent surgical site infection. *Cochrane Database of Systematic Reviews*. 2007;2. DOI: 10.1002/14651858.CD004985.pub

<sup>5</sup> Mangram A, Horan T, Pearson M, Silver L, Jarvis W. Guideline for Prevention of Surgical Site Infection. *Infection Control and Hospital Epidemiology*. 1999; 20(4): 250-280.

- A study evaluated the impact of a CHG shower/bath application on volunteers who performed five days of CHG shower washes and had abdominal and inguinal skin swabs performed on days one, two, and five. CHG provided significant microbial reductions from baseline, with greater reductions noted as the study progressed.<sup>6</sup>
- A study compared patients having three showers with CHG versus placebo. CHG use resulted in decreased bacterial counts on skin with a median of five days before skin recolonization.<sup>7</sup>
- There was a prospective randomized study comparing the ability of preoperative showers with CHG, povidone-iodine, and a lotion soap to diminish the staphylococcal skin flora of patients scheduled for elective cardiac surgery or coronary artery angioplasty. CHG was more effective than povidone-iodine or lotion soap in diminishing skin colonization with staphylococci. Repeated applications of CHG were superior to a single shower with this agent.<sup>8</sup>

Conclusion: Although there is limited scientific evidence to guide recommendations, these study results suggest that patients may benefit from bathing or showering with CHG soap *for at least three days* before surgery in order to achieve the most benefit. It is unknown whether using CHG soap for longer time periods (e.g., five days) has additional benefit.

### **3. Screen Patients for *Staphylococcus aureus* (SA) and Decolonize SA Carriers with Five Days of Intranasal Mupirocin and Bathing or Showering with Chlorhexidine Soap for at Least Three Days Before Surgery**

- Patients who carry SA in their nares or on their skin are more likely to develop SA surgical site infections. *This is true for methicillin-sensitive as well as methicillin-resistant SA.*<sup>9,10,11</sup>

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<sup>6</sup> Paulson D. Efficacy evaluation of a 4% chlorhexidine gluconate as a full-body shower wash. *American Journal of Infection Control*. 1993;21(4):205-209.

<sup>7</sup> Byrne D, Napier A, Phillips G, Cushieri A. Effects of whole body disinfection on skin flora in patients undergoing elective surgery. *The Journal of Hospital Infection*. 1991;17(3):217-222.

<sup>8</sup> Kaiser A, Kernodle D, Barg N, Petracek M. Influence of preoperative showers on staphylococcal skin colonization: A comparative trial of antiseptic skin cleansers. *The Annals of Thoracic Surgery*. 1988;45(1):35-38.

<sup>9</sup> Kluytmans J, Mouton J, Ijzerman E, Vandenbroucke-Grauls C, Maat A, Wagenvoort J, et al. Nasal carriage of *Staphylococcus aureus* as a major risk factor for wound infections after cardiac surgery. *The Journal of Infectious Diseases*. 1995;171(1):216-219.

<sup>10</sup> Huang S, Platt R. Risk of methicillin-resistant *Staphylococcus aureus* infection after previous infection or colonization. *Clinical Infectious Diseases*. 2003;36(3):281-285.

<sup>11</sup> Rao N, Cannella B, Crossett L, Yates A, McGough R, Hamilton C. Preoperative screening/decolonization for *Staphylococcus aureus* to prevent orthopedic surgical site infection: Prospective cohort study with 2-year follow-up. *The Journal of Arthroplasty*. 2011;26(8):1501-1507.

## How-to Guide: Prevent Surgical Site Infection for Hip and Knee Arthroplasty

- The combination of intranasal mupirocin and CHG bathing or showering eliminates SA, at least temporarily, from the nares and skin, the natural reservoirs where SA is most often carried.
  - The results of several studies, including studies in orthopedic surgery, have suggested that preoperative intranasal mupirocin reduces the risk of SSI for SA carriers.<sup>12,13</sup>
  - A recent randomized, double-blinded, placebo-controlled trial showed that SA carriers treated with five days of intranasal mupirocin and CHG washes before surgery had a 60% lower SA SSI rate than the placebo group.<sup>14</sup>
  - Implementing a hospital-wide prescreening program to identify and decolonize SA carriers prior to elective orthopedic surgery is feasible and can lead to significant reductions in SSI rates.<sup>15</sup>

### Applicable SCIP Practices

Evidence also strongly supports the importance of the two applicable Surgical Care Improvement Project (SCIP) practices that have become usual care in most hospitals — *appropriate use of prophylactic antibiotics* and *appropriate hair removal* — described in more detail below.

## Implementing the Interventions to Prevent SSI for Hip and Knee Arthroplasty

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Implementing the interventions to prevent SSI for hip and knee arthroplasty presents a unique and important opportunity to build collaboration within and beyond the hospital setting, including the following:

- Enlisting the support of executive leadership in the hospital and surgeon’s office;
- Identifying one or two surgeons to “champion” the case and influence peers to enhance the adoption of, implementation of, and adherence to these interventions;

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<sup>12</sup> Kalmeijer M, Coertjens H, van Nieuwland-Bollen P, Bogaers-Hofman D, de Baere G, Stuurman A, et al. Surgical site infections in orthopedic surgery: The effect of mupirocin nasal ointment in a double-blind, randomized, placebo-controlled study. *Clinical Infectious Diseases*. 2002; 35(4):353-358.

<sup>13</sup> van Rijen M, Bonten M, Wenzel R, Kluytmans J. Intranasal mupirocin for reduction of Staphylococcus aureus infections in surgical patients with nasal carriage: A systematic review. *Journal of Antimicrobial Chemotherapy*. 2008;61:254-261.

<sup>14</sup> Bode L, Kluytmans J, Wertheim H, Bogaers D, Vandenbroucke-Grauls C, Roosendaal R, et al. Preventing surgical site infections in nasal carriers of Staphylococcus aureus. *New England Journal of Medicine*. 2010;362(1):9-17.

<sup>15</sup> Kim D, Spencer M, Davidson S, Li L, Shaw J, Gulczynski D, et al. Institutional prescreening for detection and eradication of methicillin-resistant Staphylococcus aureus in patients undergoing elective orthopedic surgery. *The Journal of Bone & Joint Surgery*. 2010;92(9):1820-1826.

- Exploring how to best communicate these interventions through proven strategies such as face-to-face communication at staff meetings, outreach to surgeons' offices, or telephone calls from opinion leaders to their peers;
- Building collaborative relationships between the hospital operating room (OR) management team and orthopedic surgeons' offices to establish reliable processes and handoffs for preoperative assessment, planning, and follow up;
- Establishing a collaborative relationship with the laboratory to ensure timely and appropriate testing and reporting of SA screening results; and
- Engaging the patient and family as partners by providing information and tools to enhance their understanding of and participation in care.

### Assessing Your Current Process

In order to know where to focus attention, it is essential to take account of the unique situation in your hospital and surgeon's office.

- Assess the **current reliability** of each recommended intervention (percent of cases where the intervention is accomplished) to determine the area most in need of improvement. Reviewing the last 20 joint replacement surgeries will give you an idea of the reliability of your current system. (See section below entitled "Measurement Strategies for Assessing Adoption of the Interventions to Prevent SSI for Hip and Knee Arthroplasty.")
- Consider **sequencing** implementation of the three interventions for preventing hip and knee arthroplasty SSIs before implementing all three together, since each intervention requires changes in different systems.
- Consider the **complexity** of the change:
  - Hospitals have found that changing to use of an alcohol-containing agent for preoperative skin antisepsis has often been less complex intervention to implement because the change takes place within a more controlled environment (the hospital) and is under the control of the surgeon, the OR, and surgical management structure.
  - In contrast, developing processes to ensure preoperative showering or bathing with CHG and SA screening are more complex interventions to implement, as they start well before the patient comes to the OR and require working across multiple settings (hospital, preoperative assessment, surgeon's office, home).
  - Review the results of any *pilot testing* of the intervention in your hospital to determine what changes are needed to enhance effectiveness before spreading the

## How-to Guide: Prevent Surgical Site Infection for Hip and Knee Arthroplasty

intervention more broadly.

The three interventions to prevent SSI for hip and knee arthroplasty are described in more detail below. Each intervention will require a different implementation strategy. To develop the most effective implementation strategy, carefully consider the current practices in your hospital for each intervention and develop a coordinated strategy to accelerate change.

### 1. Use an Alcohol-Containing Antiseptic Agent for Preoperative Skin Preparation

**Behavioral objective:** Change the operating room skin prep for hip and knee arthroplasty to a long-acting antiseptic agent in combination with alcohol.

#### Assess your current process and potential barriers:

- Identify surgeons currently using an alcohol-based skin prep to champion the change in practice with their peers.
- Determine the high-volume surgeons and focus your efforts on working with them.
- Conduct brief interviews with representative surgeons to identify any misconceptions or key barriers to using an alcohol-based skin prep.

#### Design strategies to accelerate change:

##### *Tools and materials:*

- Provide a brief summary of the scientific evidence supporting change to an alcohol-containing skin prep to influence change of habit or traditional behavior. See the Preventing Surgical Site Infection for Hip and Knee Arthroplasty One-Pager for Surgeons <http://www.ihi.org/knowledge/Pages/Tools/PreventingSSIHipKneeOnePagerForSurgeons.aspx>.
- Demonstrating the use of alcohol-based skin prep products is a powerful method for educating staff. For example, paint a knee or hand with the antiseptic, time the drying time, and allow staff to feel the tackiness. The demonstration will give staff an opportunity to raise questions and concerns about the product, and possibly dismiss perceived barriers to its use.

#### Changes in practice:

- Offer opportunities to surgeons and surgery teams to conduct pilot testing of available alcohol-based antiseptic agents to assess acceptability and surgeon buy-in. Considerations include “drippiness,” packaging, drying time, manufacturer instructions and warnings, etc.
- Incorporate agreed upon alcohol-based skin prep products into individual surgeons’ preference cards as agreement is reached regarding use of alcohol-based skin prep.

- Ensure the alcohol-based skin prep is applied correctly:
  - Skin prep should be completely dry prior to draping.
  - Cleanse the incision area for 30 seconds and then paint the rest of the extremity.
  - Consider use of a tinted CHG-alcohol prep (orange or teal) for greater visibility.
  - Avoid pooling of the skin prep.

## **2. Instruct Patients to Bathe or Shower with Chlorhexidine Gluconate (CHG) Soap for at Least Three Days Before Surgery**

**Behavioral Objective:** Provide patients with, or give them information on where to purchase, chlorhexidine gluconate soap or wipes, and instruct them to use the soap in bathing or showering or the wipes for at least three days before surgery.

### **Assess your current process and potential barriers:**

- Assess if and *where* most preoperative assessments are currently taking place in your setting, because that is the optimal time to discuss use of CHG soap or wipes with patients.
- Tailor the implementation process to your setting:
  - Consider the feasibility of giving CHG soap or wipes to all patients during the preoperative assessment visit. If not feasible, provide specific information to patients and families about where they can purchase the soap or wipes locally and the approximate cost.
- Develop a process flow diagram, specific to your hospital setting, to define all necessary components of the process for patient bathing/showering for at least three days prior to surgery. Build into the preoperative assessment visit a process for providing CHG soap or wipes, or information for patients on where to obtain the products and instructions for use.

### **Design strategies to accelerate change:**

#### *Tools and materials:*

- Develop a skill guide or quick reference for staff to ensure consistent messaging is provided to patients on the rationale for the use of chlorhexidine and the importance of repeated CHG showering/bathing to remove bacteria and reduce the risk of SSI.
- Provide instructions to the patient and family on patient bathing/showering.
- Develop a simple form for patients to track days of CHG bathing or showering completion and instruct the patient/family to bring the form with them on the day of surgery.

## How-to Guide: Prevent Surgical Site Infection for Hip and Knee Arthroplasty

- Sample tools created by hospitals to instruct and support patients on bathing or showering with CHG soap before surgery to reduce the risk of SSI:
  - Preparing Your Skin Before Surgery: Patient Instructions to Prevent Surgical Site Infection  
<http://www.ihl.org/knowledge/Pages/Tools/PreparingYourSkinBeforeSurgeryPatientInstructionsSSI.aspx>.
  - Preoperative Skin Preparation for Joint Replacement Surgery: Patient Instructions to Prevent Surgical Site Infection  
<http://www.ihl.org/knowledge/Pages/Tools/PreopSkinPrepJointReplacementSurgeryPatientInstructionsSSI.aspx>.
  - Preoperative Skin Preparation to Prevent Surgical Site Infection: Spanish Language Patient Instructions  
<http://www.ihl.org/knowledge/Pages/Tools/PreopSkinPrepSSISpanishPatientInstructions.aspx>.

### Communication:

- Instruct the patient/family at the preoperative assessment visit of the importance of and process for CHG showering/bathing prior to surgery:
  - Bathing/showering should be repeated for at least three days prior to surgery to reduce bacteria on the skin. (Note: In practice, patients are most often instructed to bathe or shower two days before *and* the morning of surgery. The goal is *at least three baths or showers with CHG prior to surgery*.)
  - The whole body should be washed “from the neck down” to avoid soap getting into the eyes, ears, nose, or mouth.
  - Genital areas should not be washed with CHG soap.
  - Lotions or moisturizers should not be used following CHG showering/bathing.

### Changes in practice:

- Investigate the feasibility for the hospital or surgeons’ practices to provide CHG soap or wipes to patients during the preoperative assessment visit *or* instruct patients to obtain CHG from their local pharmacy.
- Consider the use of CHG-impregnated wipes, which some hospitals have found to increase patient compliance.
  - Before using the wipes, consider asking individual patients if they're willing to use the wipes instead of showering, as many patients prefer showering.

- Instruct patients to use them on the full body, concentrating on the area to be operated.
- See sample instructions for patients on how to use CHG wipes  
<http://www.ihi.org/knowledge/Pages/Tools/PreparingYourSkinBeforeSurgeryPatientInstructionsSSL.aspx>.
- Consider patient and family concerns and preferences when making changes in practice. For example, we have heard the following from hospitals:
  - Some patients prefer showering and consequently favor using CHG soap over the wipes.
  - Some patients report that their skin feels “tacky” or uncomfortable after using the wipes.
  - In contrast, some patients (those with physical limitations, for example) prefer the CHG wipes because their use can decrease the risk of slipping or falling when showering or bathing.
  - When possible, patients and families appreciate being offered options that meet their individual needs and preferences.

### **3. Screen Patients for *Staphylococcus aureus* (SA) and Decolonize SA Carriers with Five Days of Intranasal Mupirocin and Bathing or Showering with Chlorhexidine Soap for at Least Three Days Before Surgery**

**Behavioral Objective:** Screen all patients for *Staphylococcus aureus* — methicillin-resistant (MRSA) and methicillin-sensitive (MSSA) — prior to surgery, allowing enough time for those patients who screen positive to be decolonized with five days of intranasal mupirocin and bathing or showering with CHG soap for at least three days before surgery.

#### **Assess your current process and potential barriers:**

If preoperative visits currently take place in your setting, evaluate whether there is sufficient time to screen and decolonize SA carriers prior to surgery.

- Work with your laboratory to ensure screening includes *both* methicillin-resistant and methicillin-sensitive SA, using whichever methodology is available — Polymerase Chain Reaction (PCR) assay or culture.
- Develop a process to ensure information on screening and decolonization is available prior to the time of surgery.
- Develop a process flow diagram, specific to your hospital setting, to define all necessary components of the process for patient screening and treatment; build a process into the

## How-to Guide: Prevent Surgical Site Infection for Hip and Knee Arthroplasty

preoperative assessment visit for obtaining SA screening and reliably reporting results to facilitate providing a mupirocin prescription, as needed.

### Design strategies to accelerate change:

#### *Tools and materials:*

- Develop a protocol for staff that outlines the SA decolonization process.
- Provide patients who test positive for SA with a simple form to track mupirocin treatment and CHG bathing or showering, and instruct the patient/family to bring the form with them on the day of surgery.
- At the preoperative assessment visit, instruct the patient/family about the importance of and process for SA screening.
- Sample tools:
  - Keeping You Safe for Surgery: *Staphylococcus aureus* Nasal Screening Patient Instructions  
<http://www.ihi.org/knowledge/Pages/Tools/StaphAureusNasalScreeningPatientInstructions.aspx>
  - Surgery Preparation Checklist for Patients: *Staphylococcus aureus* Decolonization  
<http://www.ihi.org/knowledge/Pages/Tools/SurgeryPrepChecklistPatientsStaphAureusDecolonization.aspx>
  - *Staphylococcus aureus* Decolonization Patient Preparation Checklist  
<http://www.ihi.org/knowledge/Pages/Tools/StaphAureusDecolonizationPatientPrepChecklist.aspx>

### Changes in practice:

- Address all components of the process needed for patient screening and treatment:
  - Order SA screening test and educate patient during preoperative assessment visit;
  - Obtain SA screening results following testing;
  - Provide mupirocin prescription, as needed, and instructions to patients for CHG bathing/showering for at least three days prior to surgery; and
  - Assess satisfactory completion of decolonization on day of surgery.
- Incorporate screening for SA and prescribing mupirocin into surgeons' preoperative assessment orders.

- In developing a process to ensure patients colonized with SA receive mupirocin, build on established preoperative assessment processes that require patient follow-up/treatment before surgery, such as positive urinalysis/urine culture requiring antibiotic treatment.
- Create a process to be used during surgery that flags patients who test positive for MRSA to ensure Vancomycin is used as the prophylactic antibiotic.
- Test implementing this intervention by conducting several small tests of change for this multipart process — for example:
  - To start, focus on developing a reliable process of communication between the microbiology lab and the preoperative team.
  - At the next preoperative visit, ask two patients to help you test a new process.
  - Screen the patients for *Staphylococcus aureus* via a swab and inform them they will be contacted and asked to fill a prescription for mupirocin if test is positive.
  - Follow the process from the initial screening to appropriate notification by the designated person and assess if the patients were notified if SA-positive.
  - Additional small tests of this process may include: flagging patients who test positive for MRSA; verifying that SA-positive patients pick up the mupirocin prescription; and confirming that the patient administered the mupirocin.

## Applicable SCIP Practices

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Below is a brief description of the two applicable SCIP practices that are recommended, in addition to the three interventions described above for preventing SSI for hip and knee arthroplasty. A more complete discussion and specific recommendations for implementing the applicable SCIP practices can be found in IHI's *How-to Guide: Prevent Surgical Site Infections*.<sup>16</sup>

### 4. Appropriate Use of Prophylactic Antibiotics

- Prophylactic antibiotic received within 1 hour prior to surgical incision
- Prophylactic antibiotic selection for surgical patients consistent with national guidelines (as defined in The Joint Commission/CMS Specification Manual and SCIP for Measure SCIP-Inf-2).
- Prophylactic antibiotics discontinued within 24 hours after surgery end time.

These components of care apply to antibiotics administered for SSI prophylaxis only.

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<sup>16</sup> *How-to Guide: Prevent Surgical Site Infections*. Cambridge, MA: Institute for Healthcare Improvement; 2012. Available at: <http://www.ihl.org/knowledge/Pages/Tools/HowtoGuidePreventSurgicalSiteInfection.aspx>.

## **5. Appropriate Hair Removal**

For many years, it has been known that the use of razors prior to surgery increases the incidence of wound infection when compared to clipping, depilatory use, or no hair removal at all. Razors can cause small cuts and nicks to skin, many of which may be microscopic and not visible to the human eye. However, many teams assessing this practice have found that the use of razors in their own institutions can range from zero to nearly 100%.

Hair removal may not be necessary for many surgical procedures, yet has been “carried over” from years ago when surgical patients commonly received extensive preoperative shaving. When hair must be removed to perform the procedure safely, it should never occur with a razor. The use of clippers has been found to be the best method in many hospitals, as depilatory creams can cause skin reactions. Staff must be trained in the proper use of clippers because an untrained user can damage the skin. If hair must be removed preoperatively, it is generally recommended that this not occur in the operating room itself, as loose hairs are difficult to control.

## Using the Model for Improvement

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In order to move this work forward, IHI recommends using the Model for Improvement. Developed by Associates in Process Improvement, the Model for Improvement is a simple yet powerful tool for accelerating improvement that has been used successfully by hundreds of health care organizations to improve many different health care processes and outcomes.

The model has two parts:

- Three fundamental questions that guide improvement teams:
  - 1) What are we trying to accomplish?
  - 2) How will we know if a change is an improvement?
  - 3) What changes can we make that will result in an improvement?
- The Plan-Do-Study-Act (PDSA) cycle to conduct small-scale tests of change in real work settings — by planning a test, trying it, observing the results, and acting on what is learned. This is the scientific method, used for action-oriented learning.

**First Test of Change:** A first test of change should involve a very small sample size (typically one surgeon or one patient) and should be described ahead of time in a Plan-Do-Study-Act format so that the team can easily predict what they think will happen, observe the results, learn from them, and continue to the next test.

**Implementation:** After testing a change on a small scale, learning from each test, and refining the change through several PDSA cycles, the team can implement the change on a broader scale — for example, for an entire pilot population.

**Spread:** After successful implementation of a change for a pilot population, the team can spread the changes to other parts of the organization or to other organizations.

You can learn more about using the Model for Improvement on IHI's website:

<http://www.ihl.org/knowledge/Pages/HowtoImprove/ScienceofImprovementHowtoImprove.aspx>.

## **Forming the Team**

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No single person can create system-level improvements alone. First, it is crucial to have the active support of leadership in this work. Leadership must make patient safety and quality of care strategic priorities in order for any surgical care improvement team to be successful.

Once leadership has publicly given recognition and support (dollars, person-time) to the program, the improvement team can be quite small. Successful teams include a physician (either a surgeon, an anesthesiologist, or both); an operating room nurse; a member of the orthopedic surgeon office staff, as appropriate; and someone from the quality and/or infection prevention department. Each hospital and surgical practice will have its own methods for selecting a core team. The team should use the Model for Improvement to conduct small-scale, rapid tests of the ideas for improvement over various conditions in a pilot surgical population. The team should also track performance on a set of measures designed to help them see if the changes they are making are leading to improvement, and regularly report these measures back to leadership.

Improvement takes place over time. Determining if improvement has really happened and if it is lasting requires observing patterns over time. Run charts are graphs of data over time and are one of the single most important tools in performance improvement.

Using run charts has a variety of benefits:

- They help improvement teams formulate aims by depicting how well (or poorly) a process is performing.
- They help in determining when changes are truly improvements by displaying a pattern of data that you can observe as you make changes.
- As you work on improvement, they provide information about the value of particular changes.

## Measurement Strategies for Assessing Adoption of the Interventions to Prevent SSI for Hip and Knee Arthroplasty

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Measurement provides information on whether the changes made to implement interventions to prevent SSI for hip and knee arthroplasty are resulting in improvement. In any improvement initiative, the ultimate goal is to improve an outcome measure (e.g., reduce SSIs); hospitals and surgical practices will accomplish this by first improving the processes that are key drivers.

The process measures described on the following pages are recommended for assessing your organization's progress over time in implementing the interventions recommended in this How-to Guide.

An Excel template is available that you can use to track data for the process measures:

<http://www.ihl.org/knowledge/Pages/Tools/PreventSSIHipKneeDataTrackerWorksheet.aspx>.

The template generates automatic run charts and allows you to add data for optional measures you may be tracking at your facility.

### Process Measures to Assess Compliance with Implementing the Three Recommended Interventions to Prevent SSI for Hip and Knee Arthroplasty

#### 1. Use an Alcohol-Containing Antiseptic Agent for Preoperative Skin Preparation

**Definition:** Percentage of patients undergoing hip or knee replacement surgery with skin antisepsis at the surgical site using an alcohol-containing preoperative skin antisepsis agent

**Goal:** 95% or higher

#### CALCULATION DETAILS:

**Numerator Definition:** Number of patients undergoing hip or knee replacement surgery with skin antisepsis at the surgical site using an alcohol-containing preoperative skin antisepsis agent (e.g., chlorhexidine gluconate plus alcohol or iodophor plus alcohol)

**Denominator Definition:** Number of patients undergoing elective hip or knee replacement surgery

#### **Numerator and Denominator Exclusions:**

- Patients who are less than 18 years of age
- Patients who had a principal or admission diagnosis suggestive of preoperative infectious diseases
- Patients with physician-documented infection prior to surgical procedures
- Patients undergoing non-elective hip or knee replacement surgery

## How-to Guide: Prevent Surgical Site Infection for Hip and Knee Arthroplasty

**Measurement Period Length:** Monthly

**Calculate as:** (Numerator/Denominator); as a percentage

### 2. Instruct Patients to Bathe or Shower with Chlorhexidine Gluconate (CHG) Soap for at Least Three Days Before Surgery

**Definition:** Percentage of patients undergoing elective hip or knee replacement surgery who have bathed or showered with CHG soap or wipes for at least three days prior to surgery

**Goal:** 95% or higher

#### CALCULATION DETAILS:

**Numerator Definition:** Number of patients undergoing hip or knee replacement surgery who have bathed or showered with CHG soap or wipes for at least the three days prior to surgery

**Denominator Definition:** Number of patients undergoing elective hip or knee replacement surgery

#### **Numerator and Denominator Exclusions:**

- Patients who are less than 18 years of age
- Patients who had a principal or admission diagnosis suggestive of preoperative infectious diseases
- Patients with physician-documented infection prior to surgical procedures
- Patients undergoing non-elective hip or knee replacement surgery

**Measurement Period Length:** Monthly

**Calculate as:** (Numerator/Denominator); as a percentage

### 3. Screen Patients for *Staphylococcus aureus* (SA) and Decolonize SA Carriers with Five Days of Intranasal Mupirocin and Bathing or Showering with Chlorhexidine Soap for at Least Three Days Before Surgery

**Definition:** Percentage of patients undergoing hip and knee replacement surgery who have had preoperative nasal swabs to screen for *Staphylococcus aureus* [screening measure]

**Goal:** 95%

**CALCULATION DETAILS:**

**Numerator Definition:** Number of patients undergoing hip or knee replacement surgery who have had a nasal swab specimen processed to screen for *Staphylococcus aureus* prior to surgery

**Denominator Definition:** Number of patients undergoing elective hip or knee replacement surgery

**Numerator and Denominator Exclusions:**

- Patients who are less than 18 years of age
- Patients who had a principal or admission diagnosis suggestive of preoperative infectious diseases
- Patients with physician-documented infection prior to surgical procedures
- Patients undergoing non-elective hip or knee replacement surgery

**Measurement Period Length:** Monthly

**Calculate as:** (Numerator/Denominator); as a percentage