Establishing A Culture of Safety: The 7 S Bundle To Prevent Surgical Site Infections

Maureen Spencer, RN, M.Ed., CIC
Infection Preventionist Consultant
Boston, MA

www.7sbundle.com
www.workingtowardzero.com
www.infectionpreventionistconsultants.com
Despite current preventive measures, SSIs remain a significant problem

- In the US (2006) there were ~ 80 million surgical procedures
- Between 2006 -2009 approximately 1.9% developed SSI\(^1\)
- Between 2009-2010 SSIs accounted for 23% of 69,475 HAIs reported to NHSN\(^2\)

<table>
<thead>
<tr>
<th>Event</th>
<th>No. (%) of events reported 2007-2008 ((n = 47,582))</th>
<th>No. (%) of events reported 2009-2010 ((n = 69,475))</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLABSI</td>
<td>18,651 (39.2)</td>
<td>27,766 (40.0)</td>
</tr>
<tr>
<td>CAUTI</td>
<td>11,863 (24.9)</td>
<td>19,058 (27.4)</td>
</tr>
<tr>
<td>VAP</td>
<td>6,290 (13.2)</td>
<td>6,632 (9.5)</td>
</tr>
<tr>
<td>SSI</td>
<td>10,778 (22.7)</td>
<td>16,019 (23.1)</td>
</tr>
</tbody>
</table>


### TABLE 4. Distribution of Procedure-Associated Infections Reported to the National Healthcare Safety Network, by Type of Surgery, 2009–2010

<table>
<thead>
<tr>
<th>Type of surgery</th>
<th>No. (%) of SSIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthopedic</td>
<td>6,486 (40.5)</td>
</tr>
<tr>
<td>Abdominal</td>
<td>3,598 (22.5)</td>
</tr>
<tr>
<td>Cardiac</td>
<td>3,508 (21.9)</td>
</tr>
<tr>
<td>Ob/gyn</td>
<td>1,543 (9.6)</td>
</tr>
<tr>
<td>Neurological</td>
<td>386 (2.4)</td>
</tr>
<tr>
<td>Vascular</td>
<td>245 (1.5)</td>
</tr>
<tr>
<td>Transplant</td>
<td>160 (1.0)</td>
</tr>
<tr>
<td>Breast</td>
<td>64 (0.4)</td>
</tr>
<tr>
<td>Neck</td>
<td>14 (0.1)</td>
</tr>
<tr>
<td>Other</td>
<td>15 (0.1)</td>
</tr>
<tr>
<td>Total</td>
<td>16,019 (100)</td>
</tr>
</tbody>
</table>

Special Risk Population: Orthopedic Implants

- Hip or Knee aspiration
- If positive – irrigation and debridement
- Removal of hardware may be necessary
- Insertion of antibiotic spacers
- Revisions at future date
- Long term IV antibiotics in community or rehab

- Future worry about the joint
- In other words – **DEVASTATING FOR THE PATIENT AND SURGEON**
<table>
<thead>
<tr>
<th>Pathogen Involved with SSIs</th>
<th>No (%) of SSI Pathogens</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staph aureus (includes MRSA)</td>
<td>6415 (30.4)</td>
<td>1</td>
</tr>
<tr>
<td>Coagulase neg staph</td>
<td>2477 (11.7)</td>
<td>2</td>
</tr>
<tr>
<td>E.Coli</td>
<td>1981 (9.4)</td>
<td>3</td>
</tr>
<tr>
<td>Enterococcus faecalis</td>
<td>1240 (5.9)</td>
<td>4</td>
</tr>
<tr>
<td>Pseudomonas aerug</td>
<td>1156 (5.5)</td>
<td>5</td>
</tr>
<tr>
<td>Enterobacter spp</td>
<td>849 (4.0)</td>
<td>6</td>
</tr>
<tr>
<td>Klebsiella spp</td>
<td>844 (4.0)</td>
<td>7</td>
</tr>
<tr>
<td>Enterococcus spp</td>
<td>685 (3.2)</td>
<td>8</td>
</tr>
<tr>
<td>Proteus spp</td>
<td>667 (3.2)</td>
<td>9</td>
</tr>
<tr>
<td>Enterococcus faecium</td>
<td>517 (2.5)</td>
<td>10</td>
</tr>
<tr>
<td>Serratia spp</td>
<td>385 (1.8)</td>
<td>11</td>
</tr>
<tr>
<td>Candida albicans</td>
<td>367 (1.3)</td>
<td>12</td>
</tr>
<tr>
<td>Acinetobacterbaum</td>
<td>119 (0.6)</td>
<td>13</td>
</tr>
<tr>
<td>Other Candida spp</td>
<td>96 (0.5)</td>
<td>14</td>
</tr>
<tr>
<td>Other organisms</td>
<td>3399 (16.1)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>21,100 (100)</td>
<td></td>
</tr>
</tbody>
</table>

Mortality risk is high among patients with SSIs

• A patient with an SSI is:
  – 5x more likely to be readmitted after discharge\(^1\)
  – 2x more likely to spend time in intensive care\(^1\)
  – 2x more likely to die after surgery\(^1\)

• The mortality risk is higher when SSI is due to MRSA
  – A patient with MRSA is 12x more likely to die after surgery\(^2\)

<table>
<thead>
<tr>
<th>HAI</th>
<th>Est Annual %</th>
<th>Est Direct Cost</th>
<th>Avg Length of Stay</th>
<th>Attributable Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical Site Infection (SSI)</td>
<td>33.7%</td>
<td>$20 785</td>
<td>~11.days</td>
<td>~4%</td>
</tr>
<tr>
<td>MRSA SSI</td>
<td></td>
<td>$42 300</td>
<td>~23 days</td>
<td></td>
</tr>
<tr>
<td>Central Line Associated Bloodstream Infection (CLABSI)</td>
<td>18.9%</td>
<td>$45 814</td>
<td>~10 days</td>
<td>~26%</td>
</tr>
<tr>
<td>MRSA CLABSI</td>
<td></td>
<td></td>
<td>~16 days</td>
<td></td>
</tr>
<tr>
<td>Ventilator Associated Pneumonia (VAP)</td>
<td>31.6%</td>
<td>$40 144</td>
<td>~13 days</td>
<td>~24%</td>
</tr>
<tr>
<td>Catheter Associated Urinary Tract Infection (CAUTI)</td>
<td>&lt;1%</td>
<td>$896</td>
<td>&lt; 1 day</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Clostridium difficile Infection (CDI)</td>
<td>15.4%</td>
<td>$11 285</td>
<td>~ 3 days</td>
<td>~4%</td>
</tr>
</tbody>
</table>

Cost of Surgical Site Infections

- Cost of an SSI in a prosthetic joint implant can exceed $90,000\textsuperscript{1,2}

- Cost of an SSI can exceed more than $90,000 if it involves MRSA\textsuperscript{3}


Pathogens survive on surfaces

<table>
<thead>
<tr>
<th>Organism</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clostridium difficile</strong></td>
</tr>
<tr>
<td><strong>Methicillin resistant Staphylococcus aureus (MRSA)</strong></td>
</tr>
<tr>
<td><strong>Vancomycin-resistant enterococcus (VRE)</strong></td>
</tr>
<tr>
<td><strong>Escherichia coli</strong></td>
</tr>
<tr>
<td><strong>Acinetobacter</strong></td>
</tr>
<tr>
<td><strong>Klebsiella</strong></td>
</tr>
<tr>
<td><strong>Salmonella typhimurium</strong></td>
</tr>
<tr>
<td><strong>Mycobacterium tuberculosis</strong></td>
</tr>
<tr>
<td><strong>Candida albicans</strong></td>
</tr>
<tr>
<td><strong>Most viruses from the respiratory tract (eg: corona, coxsackie, influenza, SARS, rhino virus)</strong></td>
</tr>
<tr>
<td><strong>Viruses from the gastrointestinal tract (eg: astrovirus, HAV, polio- or rota virus)</strong></td>
</tr>
<tr>
<td><strong>Blood-borne viruses (eg: HBV or HIV)</strong></td>
</tr>
<tr>
<td><strong>Survival period</strong></td>
</tr>
<tr>
<td>35- &gt;200 days.2,7,8</td>
</tr>
<tr>
<td>14- &gt;300 days.1,5,10</td>
</tr>
<tr>
<td>58- &gt;200 days.2,3,4</td>
</tr>
<tr>
<td>&gt;150- 480 days.7,9</td>
</tr>
<tr>
<td>150- &gt;300 days.7,11</td>
</tr>
<tr>
<td>&gt;10- 900 days.6,7</td>
</tr>
<tr>
<td>10 days- 4.2 years.7</td>
</tr>
<tr>
<td>120 days.7</td>
</tr>
<tr>
<td>120 days.7</td>
</tr>
<tr>
<td>Few days.7</td>
</tr>
<tr>
<td>60- 90 days.7</td>
</tr>
<tr>
<td>&gt;7 days.5</td>
</tr>
</tbody>
</table>

2. BIOQUELL trials, unpublished data.
## Prior room occupancy increases risk

<table>
<thead>
<tr>
<th>Study</th>
<th>Healthcare associated pathogen</th>
<th>Likelihood of patient acquiring HAI based on prior room occupancy (comparing a previously ‘positive’ room with a previously ‘negative’ room)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martinez 2003¹</td>
<td>VRE – cultured within room</td>
<td>2.6x</td>
</tr>
<tr>
<td>Huang 2006²</td>
<td>VRE – prior room occupant</td>
<td>1.6x</td>
</tr>
<tr>
<td></td>
<td>MRSA – prior room occupant</td>
<td>1.3x</td>
</tr>
<tr>
<td>Drees 2008³</td>
<td>VRE – cultured within room</td>
<td>1.9x</td>
</tr>
<tr>
<td></td>
<td>VRE – prior room occupant</td>
<td>2.2x</td>
</tr>
<tr>
<td></td>
<td>VRE – prior room occupant in previous two weeks</td>
<td>2.0x</td>
</tr>
<tr>
<td>Shaughnessy 2008⁴</td>
<td>C. difficile – prior room occupant</td>
<td>2.4x</td>
</tr>
<tr>
<td>Nseir 2010⁵</td>
<td>A. baumannii – prior room occupant</td>
<td>3.8x</td>
</tr>
<tr>
<td></td>
<td>P. aeruginosa – prior room occupant</td>
<td>2.1x</td>
</tr>
</tbody>
</table>

A 7 S BUNDLE APPROACH TO PREVENTING SURGICAL SITE INFECTIONS
7 “S” Bundle to Prevent SSI

**SAFETY** – is your OPERATING ROOM safe?

**SCREEN** – are you screening for risk factors and presence of MRSA & MSSA

**SHOWERS** – do you have your patients cleanse their body the night before and morning of surgery with CHLORHEXIDINE (CHG)?

**SKIN PREP** – are you prepping the skin with alcohol based antiseptics such as CHG or Iodophor?

**SOLUTION** - are you irrigating the tissues prior to closure to remove exogenous contaminants? Are you using CHG?

**SUTURES** – are you closing tissues with antimicrobial sutures?

**SKIN CLOSURE** – are you sealing the incision or covering it with an antimicrobial dressing to prevent exogenous contamination?
#1 – Safe Operating Room

- traffic control, number staff in room
- air handling systems, filtration, grills
- SCIP: hair clipping, warmers, oxygenation, surgical prophylaxis, foley catheter removal 48 hrs
- room turnover and terminal cleaning
- surgical technique and handling of tissues
- instrument cleaning/sterilization process, biological indicators
- storage of supplies, clean supply bins, carts, tables, stationary equipment
Follow AORN Recommended Practices

- *Preoperative Patient Skin Antisepsis. AORN, 2008:537-553.
- *Cleaning and Processing Anesthesia Equipment. AORN, 2008:275-284
- *Sterilization in the Perioperative Setting. AORN,2008:575-284
- *Hand Hygiene in the Perioperative Setting. AORN, 2011;p. 73–8
- *Perioperative Management of Multiple Drug Resistant Organisms.
- *Surgical attire  AORN, 2011;p. 57–72
Antimicrobial prophylaxis

- Performance measures include the antibiotic being
  - given within 60 minutes before incision
  - consistent with current published recommendations
  - re-dosed if the time since administration exceeds two half-lives of the medication
  - dose per BMI
  - discontinued within 24 hours of conclusion of procedure
Hair removal

- Shaving increases risk for SSI
- Hair removal should be performed
  - using a clipper
  - on the day of surgery
  - in a location outside of the procedure room
  - Assure clipper is cleaned between use
- Only interfering hair should be removed
Environmental strategies

• HVAC
  – HVAC systems dilute and remove contaminants
  – Air quality
  – Air volume exchanges
  – Airflow direction
  – Humidity should be maintained between 20% and 60%
    • Low humidity increases potential for dust
    • High humidity increases microbial growth
  – Temperature should be maintained between 68°F to 73°F
Environmental cleaning

- Evaluate between room cleaning procedures
- Terminal cleaning procedures on evening/night shift
- Sufficient staff to terminally clean all OR rooms?

AORN RP: Environmental Cleaning in the Perioperative Setting 2012
New Technology for Operating Room Terminal Cleaning Being Used in Some Operating Rooms

Ultraviolet C lights

Disinfectant surface sprays

Vaporized Hydrogen Peroxide Room Decontaminator
Head Covers

- Approximately 10% of skin squames carry viable microorganisms
- It’s estimated that individuals shed approximately 1 million microorganisms from their bodies each day.
- AORN “Recommended practices for surgical attire” section IV.a. states that:
  
  “a clean, low-lint surgical head cover or hood that confines all hair and covers scalp skin should be worn.
  The head cover or hood should be designed to minimize microbial dispersal.
  Skullcaps may fail to contain the side hair above and in front of the ears and hair at the nape of the neck.”

Boyce, Evidence in Support of Covering the Hair of OR Personnel AORN Journal ● Jan 2014
Laminar Flow and Exhaust Suits

No data to support reduction in SSIs

- Lipsett PA. Do we really need laminar flow ventilation in the operating room to prevent surgical site infections? Ann Surg 2008;248:701
Personal Items Don’t Belong in the OR

- Items may harbor pathogens and be difficult to clean or disinfect adequately
  - Pathogens have been shown to survive on fabrics and plastics
  - Microorganisms may be transported from one location to another

AORN Journal ● January 2012 Vol 95 No 1
Jewelry and Personal Clothing Doesn’t Belong in OR

- Wearing jewelry increases bacterial counts on skin surfaces
  - when jewelry is in place
  - after removal
- Removing watches and bracelets allows for more thorough hand washing
- Personal clothing should be completely covered by surgical attire

AORN Journal ● January 2012 Vol 95 No 1
Hot Topic due to recent outbreaks: Cleaning/Sterilization of Instruments

- Inspection of Instruments
  - Lumens, grooves, sorting, hand cleaning, disassembly required – massive kits
  - Many instruments cannot be disassembled
  - Correct use of Biologic Indicators

- Pre-soaking and rinsing of tissue and blood from the instruments in the operating room before sent to decontamination

Tosh et al. Outbreak of Pseudomonas aeruginosa Surgical Site Infections after Arthroscopic Procedures: Texas, 2009
Infect Control Hosp Epidemiol 2011;32(12):1179-1186
Most Important Control Measure

• HAND HYGIENE in the operating room
• Wash hands several times a shift – especially if you have had gloves on for more than 20 minutes – organisms multiply every 20 minutes

Communication between organisms to pass resistance factors
Hand Contamination of Anesthesia Providers Is an Important Risk Factor for Intraoperative Bacterial Transmission

Randy W. Loftus, MD,* Matthew K. Muffy, MD,* Jeremiah R. Brown, PhD, MS,* Michael L. Beach MD, PhD,* Matthew D. Koff, MD,* Howard L. Corwin, MD,* Stephen D. Surgenor, MD,* Kathryn B. Kirkland, MD,* and Mark P. Yeager, MD*

(Anesth Analg 2011;112:98–105)
<table>
<thead>
<tr>
<th>Organism</th>
<th>Providers N/total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRSA</td>
<td>12/164 (7%)</td>
</tr>
<tr>
<td>MSSA</td>
<td>18/164 (11%)</td>
</tr>
<tr>
<td>VRE</td>
<td>4/164 (2%)</td>
</tr>
<tr>
<td>Enterococcus (non-VRE)</td>
<td>1/164 (0.6%)</td>
</tr>
<tr>
<td>Staph other</td>
<td>164/164 (100%)</td>
</tr>
<tr>
<td>Micrococcus</td>
<td>110/64 (67%)</td>
</tr>
<tr>
<td>Corynobacterium</td>
<td>14/164 (9%)</td>
</tr>
<tr>
<td>Streptococcus</td>
<td>128/164 (78%)</td>
</tr>
<tr>
<td>Gram negativeb</td>
<td>81/164 (49%)</td>
</tr>
</tbody>
</table>

MRSA = methicillin-resistant *Staphylococcus aureus*; MSSA = methicillin-sensitive *Staphylococcus aureus*; VRE = vancomycin-resistant Enterococcus.

*a* Samples taken upon entry to the patient environment but before patient contact and after an opportunity to perform hand hygiene.

*b* *E. coli, Klebsiella, Serratia, Pseudomonas,* and *Acinetobacter.*

(Anesth Analg 2011;112:98–105)
## Table 3. Evidence for Intraoperative Transmission of Bacterial Pathogens from Anesthesia Provider Hands to the Anesthesia Environment and Patient IV Catheters

<table>
<thead>
<tr>
<th>Direction of transmission</th>
<th>Provider hands (site B)</th>
<th>End case 1</th>
<th>Case 2</th>
<th>Before case 2</th>
<th>End case 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stopcock</td>
<td>Machine APL/D</td>
<td></td>
<td>Stopcock</td>
<td>Machine APL/D</td>
</tr>
<tr>
<td>Micro</td>
<td>Attending</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>S. epi</td>
<td>Attending</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>S. hae</td>
<td>Attending</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>S. epi</td>
<td>Attending</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>S. epi</td>
<td>Attending</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Micro</td>
<td>Attending</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. epi</td>
<td>Attending</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. epi</td>
<td>Attending</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Micro</td>
<td>Attending</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sites were cultured as described, and pathogens were found at the times and locations noted.

APL = anesthesia machine adjustable pressure limiting valve; D = anesthesia machine inhaled agent concentration dial; X = transmission event confirmed by biotype analysis; S. epi = Staphylococcal epidemic; S. hae = Staphylococcal haemolyticus; Strep = streptococcus; Pseud = pseudomonas; MRSA = methicillin-resistant Staphylococcal aureus; MSSA = methicillin-sensitive Staphylococcal aureus; S. auric = Staphylococcal auricularis; CRNA = certified registered nurse anesthetist.

* Provider was negative at the start of case 1; hands contaminated by bacterial organisms brought in by other providers.

(Anesth Analg 2011;112:98–105)
Contaminated hands have the potential to leave biofilm on stopcocks and other devices.
Abdominal Wound Protector/Retractor for Colon Surgery Shown to Reduce SSI

Horiuchi et al: A Wound Protector Shields Incision Sites from Bacterial Invasion
SURGICAL INFECTIONS Volume 11, Number 6, 2010

Reid et al: Barrier Wound Protection Decreases Surgical Site Infection in Open Elective Colorectal Surgery: A Randomized Clinical Trial  DISEASES OF THE COLON & RECTUM VOLUME 53: 10 (2010)
#2 SCREEN for Risk Factors and MRSA and MSSA Colonization
Evaluate Your Patient Risk Characteristics that might increase risk of SSI

<table>
<thead>
<tr>
<th></th>
<th>ASA Score 3 or &gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>Nutritional status</td>
<td>Obesity</td>
</tr>
<tr>
<td><strong>Diabetes mellitus</strong></td>
<td>Blood glucose level</td>
</tr>
<tr>
<td><strong>Chronic tobacco use</strong></td>
<td>Corticosteroid use</td>
</tr>
<tr>
<td>Drug abuse</td>
<td>Alcoholism</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>Chronic lung disease</td>
</tr>
<tr>
<td>Chronic liver disease</td>
<td>Malignant disease</td>
</tr>
<tr>
<td>Preoperative chemotherapy</td>
<td>Anergy</td>
</tr>
<tr>
<td><strong>Nasal colonization with MRSA</strong></td>
<td>Hematoma</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>Skin conditions</td>
</tr>
<tr>
<td>Preoperative antibiotics</td>
<td>Trauma patients</td>
</tr>
</tbody>
</table>
Risk Factors for Orthopedic Surgery

Table 4. Infection risk factor

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Odds ratio (confidence interval)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current tobacco use</td>
<td>3.00 (1.78 5.06)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Current or history of bone cancer</td>
<td>12.85 (4.64 35.59)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>2.44 (1.55 3.82)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>7.34 (0.96 56.1)</td>
<td>0.027</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>5.59 (2.21 14.19)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>MRSA colonization or prior infection</td>
<td>7.34 (2.85 18.91)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>MSSA colonization or prior infection</td>
<td>8.64 (3.75 19.89)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Staphylococcal colonization or prior infection</td>
<td>6.52 (3.41 12.51)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Underweight (BMI &lt; 18.5 kg/m²)</td>
<td>1.90 (0.26 13.7)</td>
<td>0.56</td>
</tr>
<tr>
<td>Overweight (BMI 25.0 29.9 kg/m²)</td>
<td>0.60 (0.24 1.50)</td>
<td>0.24</td>
</tr>
<tr>
<td>Obese (BMI 30.0 39.9 kg/m²)</td>
<td>0.84 (0.51 1.41)</td>
<td>0.52</td>
</tr>
<tr>
<td>Morbid obesity</td>
<td>1.28 (0.61 2.65)</td>
<td>0.51</td>
</tr>
<tr>
<td>(BMI 40.0 49.9 kg/m²)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super obesity (BMI 50 + kg/m²)</td>
<td>15.69 (5.97 41.21)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Obesity hypoventilation syndrome</td>
<td>10.2 (1.17 88.5)</td>
<td>0.01</td>
</tr>
</tbody>
</table>

MRSA = methicillin resistant *Staphylococcus aureus*; MSSA = methicillin susceptible *S. aureus*; BMI = body mass index.

Everheart JS et al. Medical comorbidities are independent preoperative risk factors for surgical infections after total joint arthroplasty. Clin orthoped relat res. March22, 2013 online pub
Patients who carry *Staph aureus* and MRSA in their nares or on their skin are more likely to develop *Staph aureus* SSIs.


Huang SS, Platt R. Risk of methicillin *Staphylococcus aureus* infection after previous infection or colonization. *Clinical Infectious Diseases*. 2003;36(3):281-5.

Decolonization Protocols

*Staph aureus* carriers treated with five days of intranasal mupirocicn and CHG washes before surgery have a 60% lower *Staph aureus SSI rate* than the placebo group


Preoperative screening/decolonization was associated with fewer SSIs after elective Total Joint Arthroplasty

Does using mupirocin eradicate *Staph aureus* nasal carriage? – Evidence Based

- Short-term nasal mupirocin (4-7 days) is an effective method for *Staph aureus* eradication
- 90% success at one week
- 1% develop mupirocin resistance

Systematic review: Ammerlaan HS, et al. CID 2009): 8 studies comparing mupirocin to placebo
Implementation of a Screening Program For MRSA and Staph aureus Before Inpatient Orthopedic Surgery

Implemented Decolonization Protocol

• 5-day application of intranasal 2% mupirocin - applied twice daily - for MRSA and Staph aureus positive patients

• Prescription called in by Nurse Practitioner in prescreening unit

• Daily body wash with chlorhexidine (purchased by patient)

• MRSA Patients – Unique sticker system to notify Pre-surgery Unit of Vancomycin surgical prophylaxis
Polymerase Chain Reaction (PCR) for Nasal Screens – Lab Challenges

• Instructing staff on how to obtain a nares specimen with proper swabs
• Molecular lab up and running in a short time frame with cross-training of staff in the use of Cepheid’s GeneXpert System
• Reporting system for positive results
• Analysis of results
## Institutional Prescreening for Detection and Elimination of Methicillin Resistant Staphylococcus aureus in Patients Undergoing Elective Orthopaedic Surgery

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>N</td>
<td>5293</td>
<td>7019</td>
<td></td>
</tr>
<tr>
<td>MRSA Infection</td>
<td>10 (0.18%)</td>
<td>4 (0.06%)</td>
<td>0.0315</td>
</tr>
<tr>
<td>MSSA Infection</td>
<td>14 (0.26%)</td>
<td>9 (0.13%)</td>
<td>0.0937</td>
</tr>
<tr>
<td>Total SSIs</td>
<td>24 (0.45%)</td>
<td>13 (0.18%)</td>
<td>0.0093</td>
</tr>
</tbody>
</table>

# Pre-op MRSA and S. aureus Decolonization

## Results:

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Inpatient Surgeries</th>
<th># of Surgical Infections</th>
<th>%MRSA/MSSA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FY06</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/01/05-07/16/06*</td>
<td>5,293* *Historical Controls</td>
<td>24</td>
<td>0.45%*</td>
</tr>
<tr>
<td><strong>FY07</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07/17/06-09/30/07</td>
<td>7,019</td>
<td>6</td>
<td>0.08%</td>
</tr>
<tr>
<td><strong>FY08</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/01/07-09/30/08</td>
<td>6,323</td>
<td>7</td>
<td>0.11%</td>
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<tr>
<td><strong>FY09</strong></td>
<td></td>
<td></td>
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<tr>
<td>10/01/08-09/30/09</td>
<td>6,364</td>
<td>11</td>
<td>0.17%</td>
</tr>
<tr>
<td><strong>FY10</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/01/10-09/30/10</td>
<td>6,437</td>
<td>6</td>
<td>0.09%</td>
</tr>
</tbody>
</table>
#3 – **Showers** with CHG
OR Risk Factors: Bacteria on Patient’s Skin

- Pre-op Showers:
  - Liquid chlorhexidine shower
  - CHG impregnated washcloths
Pre-surgical Skin Preparations as a Pathway to Improving Surgical Outcomes

- Reducing the risk of SSI in orthopaedic surgery
  - Standardized pre-cleansing initiative (CHG cloths) in total joint patients (night before/morning of surgery)
  - SSI rate prior to intervention – 3.2% (N=727)
  - SSI rate post intervention – 1.6% (N=824) 50% reduction  \( p<0.01 \)

  *Eiselt – Orthopaedic Nursing 2009;28:141-145*

- Bundling risk reduction strategies – Quality initiative
  - MRSA prescreening in orthopaedic, obstetric, bariatric patients – decolonization
  - Pre-surgical antisepsis (CHG cloths) prior to surgery
  - Pre-intervention SSI rate 1.6% (N=17/1,095) vs post intervention SSI rate 0.57% (N=7/1,225) >60% reduction

  *Lipke VL, Hyott AS. AORNJ 2010';62:288-296*

- MRSA SSI rate 0.73% vs 0.16% >75% reduction  \( p<0.01 \)
<table>
<thead>
<tr>
<th>Publication</th>
<th>CHG Prep Cloth Applications</th>
<th>Outcome</th>
<th>Significance</th>
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</thead>
<tbody>
<tr>
<td>Johnson JKS 2012</td>
<td>2</td>
<td>72% SSI reduction</td>
<td>p.021</td>
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<tr>
<td>Kapadia JOA 2012</td>
<td>2</td>
<td>70% SSI reduction</td>
<td>p.05</td>
</tr>
<tr>
<td>Lipke AORN 2010</td>
<td>2</td>
<td>62% SSI reduction</td>
<td>p.0196</td>
</tr>
<tr>
<td>Eiselt Orthop Nurs 2009</td>
<td>2</td>
<td>50% SSI reduction</td>
<td></td>
</tr>
<tr>
<td>Murray JSES 2011</td>
<td>2</td>
<td>66% reduction of MRSA</td>
<td>p.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>colonization</td>
<td></td>
</tr>
<tr>
<td>Thompson AJIC 2013</td>
<td>2 preop + postop</td>
<td>72% SSI reduction</td>
<td>P0.003</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Cardio/Neuro)</td>
</tr>
<tr>
<td>Phillips ID Week 2012 Poster of RCT</td>
<td>2</td>
<td>0% SSI reduction</td>
<td>p.05</td>
</tr>
<tr>
<td>(manuscript submitted)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kapadia/Mont RCT interim data submitted to FDA</td>
<td>2</td>
<td>0% SSI reduction</td>
<td>p.05</td>
</tr>
<tr>
<td>hearing on Sterile Preps 12/2012</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Bailey ICHE 2011</td>
<td>2</td>
<td>CHG Cloth product is cost</td>
<td>N/A</td>
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<tr>
<td></td>
<td></td>
<td>effective for routine</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>distribution even low</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>patient compliance.</td>
<td></td>
</tr>
<tr>
<td>Graling AORN 2013</td>
<td>1</td>
<td>77% SSI reduction</td>
<td>p.01</td>
</tr>
</tbody>
</table>
#4 **Skin Prep** – Alcohol based surgical skin prep
Skin preparation

- FDA requires skin preparation antiseptics are
  - Fast acting (ie, within 10 minutes)
    - Two-log bacterial reduction on abdomen
    - Three-log bacterial reduction on groin
      - One log = microorganisms reduced 10 times
      - Two log = microorganisms reduced 100 times
      - Three log = microorganisms reduced 1000 times
  - Persistent
    - No return to baseline flora at six hours post application
Use an alcohol-containing antiseptic agent for preoperative skin preparation

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:

– Chlorhexidine plus alcohol
– Iodophor plus alcohol

Prevention of SSI: Institute for Healthcare Improvement (IHI) 2012
## Skin antiseptic agents

<table>
<thead>
<tr>
<th>Antiseptic agent</th>
<th>Rapidity of action</th>
<th>Persistent activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>Excellent</td>
<td>None</td>
</tr>
<tr>
<td>CHG</td>
<td>Moderate</td>
<td>Excellent</td>
</tr>
<tr>
<td>PI</td>
<td>Moderate</td>
<td>Minimal</td>
</tr>
<tr>
<td>CHG w/alcohol</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>PI w/alcohol</td>
<td>Excellent</td>
<td>Moderate</td>
</tr>
<tr>
<td>PCMX</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
# 5 Sutures – Antimicrobial Plus Sutures
Risk Factor: Bacterial colonization of the suture

- Like all foreign bodies, sutures can be colonized by bacteria:
  - Implants provide nidus for attachment of bacteria\(^1\)
  - Bacterial colonization can lead to biofilm formation\(^1\)
  - Biofilm formation increases the difficulty of treating an infection\(^2\)

On an implant, such as a suture, it takes only 100 staphylococci per gram of tissue for an SSI to develop\(^3\)

Contamination | Colonization | Biofilm Formation
---|---|---
Why Antimicrobial Sutures?
OR Air Current Contamination

In teaching hospitals:
- Surgeon leaves room
- Resident, Physician Assistant or Nurse Practitioner work on incision
- Circulating Nurse counts sponges and starts room breakdown
- Scrub Technician starts breaking down tables and preparing instruments for Central Processing
- Anesthesia move in and out of room
- Instrument representative might leave room and Visitors may leave room
Potential for Contamination of Sutures at End of Case

Suture with Staphylococcus colonies

Air settling plates in the operating room at the last hour of a total joint case from the anesthesia cart, bovie cart, computer

Antibacterial Suture Challenge

• Studied the “zone of inhibition” around the suture
  – A pure culture—0.5 MacFarland Broth—of *S. aureus* was prepared on a culture plate

  – An antibacterial suture was aseptically cut, planted on the culture plate, and incubated for 24 hrs – held at 5 and 10 days
Bacterial Adherence to Surgical Sutures: Can Antibacterial-Coated Sutures Reduce the Risk of Microbial Contamination?

Charles E Edmiston, PhD, Gary R Seabrook, MD, FACS, Michael P Goheen, MS, Candace J Krepel, MS, Christopher P Johnson, MD, FACS, Brian D Lewis, MD, FACS, Kellie R Brown, MD, FACS, Jonathan B Towne, MD, FACS

J Am Coll Surg 2006;203:481-489
Mean Microbial Recovery from Standard Polyglactin 910 Sutures (V) and Triclosan-Coated Polyglactin 910 Braided Sutures (VT)

Exposure Time 2 Minutes

Mean colony forming units (cfu/cm suture)

S. aureus (MRSA)  S. epidermidis RP62A  E. coli

10^2  10^5  10^2  10^5  10^2  10^5

N=10

p<0.01

Systematic review and meta-analysis of triclosan-coated sutures for the prevention of surgical-site infection

Z. X. Wang¹,², C. P. Jiang¹,², Y. Cao¹,² and Y. T. Ding¹,²

¹Department of Hepatobiliary Surgery, Affiliated Drum Tower Hospital, School of Medicine, Nanjing University, and ²Jiangsu Province’s Key Medical Centre for Liver Surgery, Nanjing, Jiangsu Province, China

Correspondence to: Professor Y. T. Ding, 321 Zhong Shan Road, Nanjing, Jiangsu Province, China 210008 (e-mail: dingyiao@yahoo.com.cn)


Is there an evidence-based argument for embracing an antimicrobial (triclosan)-coated suture technology to reduce the risk for surgical-site infections?: A meta-analysis

Charles E. Edmiston, Jr, PhD, a Frederic C. Daoud, MD, b and David Leaper, MD, FACS, c Milwaukee, WI, Paris, France, and London, UK

Edmiston et al: Surgery 2013;154:89-100
Evidence-Based Argument for Antimicrobial (Triclosan) Coated Sutures

#6 Solution – to Pollution is Dilution
Pulsatile Lavage and Antibiotic Irrigation

- High-pressure pulsatile lavage and low-pressure pulsatile lavage result in **higher rates of deep bacterial seeding** in bone than does brush and bulb-syringe lavage\(^1\)

- Higher irrigant pressures result in greater **osseous damage** and perhaps impairment of osseous healing\(^1\)

- Kalteis et al. revealed that compared with brush and bulb-syringe lavage high and low-pressure pulsatile lavage resulted in **significantly (p < 0.001) higher rates of deep bacterial seeding in bone**\(^2\)

- No evidence that Bacitracin/Polymixin irrigations reduce rate of SSI\(^2\)

---


New Chlorhexidine 0.05% Irrigation Solution

• Meets American College of Emergency Physicians (ACEP) guidelines for wound irrigation volume and pressure
• Proprietary SplatterGuard protects healthcare workers, patients and the environment from biohazard contamination
• Chlorhexidine Gluconate 0.05% has demonstrated antimicrobial efficacy and persistence in laboratory testing
• The mechanical action effectively loosens and removes wound debris
• Safe for mucous membranes – approved by FDA
• www.irrisept.com
Why CHG Irrigation: Environmental Contaminants in the Operating Room and at the End of Case
Molecular epidemiology of microbial contamination in the operating room environment: Is there a risk for infection?

Charles E. Edmiston Jr, PhD, a Gary R. Seabrook, MD, a Robert A. Cambria, MD, a Kellie R. Brown, MD, a Brian D. Lewis, MD, a Jay R. Sommers, PhD, b Candace J. Krepel, MS, a Patti J. Wilson, BSN, c Sharon Sinski, BSN, a and Jonathan B. Towne, MD, a Milwaukee, Wis, and Roswell, Ga
Intraoperative Recovery of Airborne Microbial Populations During Vascular Surgery (N=70)

Distance from operative field (m):
- 0.5 - 1.0
- 4.0 - 5.5

Percent recovery

Fig 5. PFGE of clonally related strains of *S. epidermidis* and *S. aureus* recovered from members of the vascular surgical team and perioperative airborne sampling. Lanes 3a/3b and 4a/9a, *S. epidermidis* clonality; lanes 7a/7b and 1a/1b/1c/1d, *S. aureus* clonality.

Original research article

Reducing the risk of surgical site infections: Does chlorhexidine gluconate provide a risk reduction benefit?

Charles E. Edmiston, Jr. PhD a,*, Benjamin Bruden PharmD b, Maria C. Rucinski BS c, Cindy Henen RPh b, Mary Beth Graham MD d, Brian L. Lewis MD a

a Department of Surgery, Medical College of Wisconsin, Milwaukee, WI
b Pharmacy Department, Froedtert Hospital, Milwaukee, WI
c Florida State University School of Medicine, Tallahassee, FL
d Department of Medicine, Medical College of Wisconsin, Milwaukee, WI
Impact of Intraoperative Irrigation on Resolution of Mesh Contaminated Animal Model

<table>
<thead>
<tr>
<th>Study Group</th>
<th>Irrigation Fluid</th>
<th>Bacterial Isolates</th>
<th>Initial Challenge</th>
<th>Study Population, N = animals at 7 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Saline (Control)</td>
<td>MRSA</td>
<td>~3.7 log&lt;sub&gt;10&lt;/sub&gt; CFU</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>0.05% CHG&lt;sup&gt;a&lt;/sup&gt;</td>
<td>MRSA</td>
<td>~3.7 log&lt;sub&gt;10&lt;/sub&gt; CFU</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study Group</th>
<th>Positive Recovery at 7 days (log&lt;sub&gt;10&lt;/sub&gt; CFU)</th>
<th>Negative Recovery at 7 day (log&lt;sub&gt;10&lt;/sub&gt; CFU)</th>
<th>Biofilm Formation (log&lt;sub&gt;10&lt;/sub&gt; CFU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saline</td>
<td>8/8, 4.26 log&lt;sub&gt;10&lt;/sub&gt; CFU</td>
<td>No, 0/8</td>
<td>8/8, 6.3 log&lt;sub&gt;10&lt;/sub&gt; CFU</td>
</tr>
<tr>
<td>0.05% CHG</td>
<td>1/8, 1.8 log&lt;sub&gt;10&lt;/sub&gt; CFU p&lt;0.001</td>
<td>Yes, 7/8</td>
<td>2/8, 2.6 log&lt;sub&gt;10&lt;/sub&gt; CFU p&lt;0.01</td>
</tr>
</tbody>
</table>

<sup>a</sup> Irrisept<sup>®</sup>  
Edmiston CE, et al., 2013 Am J Infect Control
#7 Skin Adhesive – Care of the Incision

## Wound Healing Phases

### Inflammatory
1. Immediate to 2-5 days
2. Bleeding stops (haemostasis)
   - i. Constriction of the blood supply
   - ii. Platelets start to clot
   - iii. Formation of a scab
3. Inflammation
   - i. Opening of the blood supply
   - ii. Cleansing of the wound

### Proliferative
1. 5 days to 3 weeks
2. Granulation
   - i. New collagen tissue is laid down
   - ii. New capillaries fills in defect
3. Contraction
   - i. Wound edges pull together
4. Epithelialization
   - i. Cells cross over the moist surface
   - ii. Cell travel about 3 cm from point of origin

### Maturation
1. Collagen forms which increases tensile strength to wounds
2. Scar tissue is only 80 percent as strong as original tissue
3. 3 weeks to 2 years
Challenges in the Post-op Patient

- Incision collects fluid – serum, blood - growth medium for organisms – small dehiscences
- Spine fusions - incisions close to the buttocks or neck
- Body fluid contamination from bedpans/commodores
- Heavy perspiration common with obese patients
- Friction and sliding - skin tears and blisters
- Itchy skin - due to pain medications - skin breakdown
Cesarean Delivery: Sutures vs Staples

• Prospective, randomized study of 435 c-section patients
  ▫ 197 patients: staples
  ▫ 219 patients: 4-0 MONOCRYL™ (poliglecaprone 25) Suture on PS2 needle
    – Wound separation rate: 17% (staples) vs. 5% (sutures)
    – Wound complication rate: 22% (staples) vs. 9% (sutures)
    – Staple closure was a significant independent risk factor for wound separation after adjustment for all other factors (GDM, BMI >30, incision type, etc)

• Meta-analysis of 6 studies with a total of 1487 c-section patients
  ▫ 803 patients: staples
  ▫ 684 patients: subcuticular suture closure
    – Staple closure was associated with a two-fold increase in risk of wound infection or separation

Sutures versus staples for skin closure in orthopaedic surgery: meta-analysis

Toby O Smith, research physiotherapist in orthopaedics, honorary lecturer Debbie Sexton, senior orthopaedic physiotherapist Charles Mann, consultant orthopaedic surgeon Simon Donell, consultant orthopaedic surgeon, honorary professor in musculoskeletal disorders

In orthopaedic surgery the risk of infection after staple closure was three times the risk with suture closure; after hip surgery the risk was four times greater.

To minimise wound infection, orthopaedic surgeons should close wounds with sutures rather than staples.
Innovative Technology: Topical Skin Adhesive

• Wounds are most vulnerable to infection in the first 48-72 hours\(^1\)
  – Until the epithelial barrier is complete (usually within 48 hours) wounds are solely dependent on the wound closure device to maintain integrity\(^1\)

• The extent of microbial protection depends on barrier integrity\(^1\)
  – Effective barriers must maintain their integrity for the first 48 hours

• Incisional adhesive provides a strong microbial barrier that prevents bacteria from entering the incision site\(^2\)

Topical Skin Adhesive: Benefits Beyond Risk Reduction

- For Hospital Staff
  - No time spent removing staples or sutures
  - Reduces hospitalization costs
  - Reduces number of suture set ups
  - Simplifies post-op wound checks
  - Reduces number of wound dressings
  - Can reduce staff suture exposures

- For Patients
  - **7 days of wound healing strength in less than one minute** of application
  - Shower immediately
  - Outstanding cosmesis
  - Reduced follow-up
  - Less pain and anxiety
Adhesive Border and Healing
6 Weeks Post-op and Beyond
Incisional Adhesive on Total Knee
Clinical Use of Incisionial Adhesive in Orthopedic Total Joints

**Hip:** Sealed with adhesive covered with gauze and transparent dressing for incision protection

**Knee:** Sealed with incisional adhesive, covered with Telfa and a transparent dressing for incision protection

**Healed incision**
Which Would You Prefer???

Topical Incisional Adhesive (TSA)
Octyl Cyanoacrylate
OTHER OPTIONS
WHEN ADHESIVES ARE NOT USED
Antimicrobial (PHMB) Dressings with Hypoallergenic Fabric Tape

Spencer et al: The Use of Antimicrobial Gauze Dressing (AMD) After Orthopedic Surgery To Reduce Surgical Site Infections  NAON 2010 Annual Congress - May 15-19, 2010
Antimicrobial Silver Dressings

Silver dressing and transparent dressing left on until discharge – seals the incision from exogenous contaminants

NAON – May 2006
Spencer et al: The Use of A Silver Gauze Dressing in Spine Surgery to Reduce the Incidence of MRSA Surgical Site Infections
IN CONCLUSION.....
What to DO? Establish a Multidisciplinary Team

The team representatives
- OR nursing, CSS, Surgeons & Anesthesia, Managers from infection control, healthcare quality, facilities and environmental services

Evaluate
- Procedures and Practices
- Facility design and Environment of Care Issues
- Patient Risk Factors
- Infection Rates
- Innovative Infection Prevention Products and Practices

Working Toward Zero Teams

• Senior leadership and surgeons – must be involved and lead the effort
• Clear goals
  – Structured program with clearly defined goal of zero tolerance for HAIs
• Communication – effective and consistent
• Ongoing and creative education
• Financial support to Infection Prevention program
• Use process improvement tools (fishbone, pareto, mind-mapping)
Risk is a Myriad Event
SSI Fishbone Diagram

Pre-operative Factors
- Lack of hand hygiene
- Patient body colonization
- Lack of pre-op shower

Peri-operative Team Factors
- Lack of traffic control – too many in room
- Improper surgical hand antisepsis
- Improper surgical attire
- Unsterile instruments
- Use of Staples or steri-strips

Organizational and Management Factors
- Financial constraints
- Poor leadership
- Increase hospitalization days

Patient Factors
- MRSA or MSSA nasal colonization
- Infection at another site
- Smoker
- Use of Drains
- Lack of re-dosing of antibiotic
- Immunosuppressive agents

Surgeon Factors
- Obese
- Diabetic
- Use of staples

Work Environmental Factors
- Poor surgical technique
- Workload and shift patterns
- Contaminated environment
- Environment and physical plant problems (air handling system)
- Lack of hand hygiene

Care Delivery problems (CDPs)
- Lack of discontinuation of antibiotics at 24 hrs
- Contamination of incision post-op
- Inadequate staffing for post-op care
- Lack of foley catheter removal within 48 hrs
The Joint Commission’s Implementation Guide for NPSG.07.05.01 on Surgical Site Infections: The SSI Change Project
<table>
<thead>
<tr>
<th></th>
<th>Elements of Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Educate staff and licensed independent practitioners involved in surgical procedures about surgical site infections and the importance of prevention. Education occurs upon hire, annually thereafter, and when involvement in surgical procedures is added to an individual’s job responsibilities.</td>
</tr>
<tr>
<td>2.</td>
<td>Educate patients, and their families as needed, who are undergoing a surgical procedure about surgical site infection prevention.</td>
</tr>
<tr>
<td>3.</td>
<td>Implement policies and procedures aimed at reducing the risk of surgical site infections: These policies and procedures meet regulatory requirements and are aligned with evidence-based guidelines (for example, The Centers for Disease Control and Prevention (CDC) and/or other professional organizational guidelines).</td>
</tr>
</tbody>
</table>
| 4. | As part of the effort to reduce surgical site infections:  
- Conduct periodic risk assessments for surgical site infections in a time frame determined by the hospital.  
- Select surgical site infection measures using best practices or evidence-based guidelines.  
- Monitor compliance with best practices or evidence-based guidelines.  
- Evaluate the effectiveness of prevention efforts.  
Note: Surveillance may be targeted to certain procedures based on the hospital’s risk assessment. |
| 5. | Measure surgical site infection rates for the first 30 days following procedures that do not involve inserting implantable devices and for the first year following procedures involving implantable devices. The hospital’s measurement strategies follow evidence-based guidelines. Note: Surveillance may be targeted to certain procedures based on the hospital’s risk assessment.* |
| 6. | Provide process and outcome (for example, surgical site infection rate) measure results to key stakeholders. |
| 7. | Administer antimicrobial agents for prophylaxis for a particular procedure or disease according to evidence-based practices. |
| 8. | When hair removal is necessary, use a method that is cited in the scientific literature or endorsed by professional organizations. |
Unit Based Champions: Role Models, “Positive Deviance” Empowerment at Staff Level

- Role Models and Responsibilities enhance self-efficacy
- Participate in educational activities
- Hand hygiene observations
- Precaution Carts and direct care observations
- Communicate information to staff
- Assist in implementing practice change
- “Call-out” breaks in techniques
- Attend monthly meetings
- Contribute to an annual “Bug Beat Fair”
- Participate in Performance Improvement Studies
- Clinical ladder for professional advancement

National Association of Orthopedic Nurses (NAON), May 2006 Poster Presentation:
The Bug Beat Fair: An Innovative Infection Control Educational Campaign in An Orthopedic Specialty Hospital
Engage Your Staff: *Got Soap?*

- Engaged the OR staff in a *Got Soap?* Campaign
  - OR Nurses
  - Surgeons
  - Administration
  - Used shaving cream for soap and used medical photographer

www.creativehandhygiene.com
Creative Themes and Posters

Foam In - Foam Out
F.O.A.M. - Fight Organisms And Microbes

I am CLOSTRIDIUM DIFFICILE. I cause colitis.
Call me Beta STREPTOCOCCI Group A. I can give you a sore throat.
I am KLEBSIELLA. I can cause wound infections.
Hi! I am STAPHYLOCOCCUS. I cause skin infections and can get resistant (MRSA).
I'm known as INFLUENZA. I love to give you pneumonia.
I'm NOROVIRUS. I cause diarrhea.
Boo! I am E. coli - short for ESCHERICHIA coli. I can cause diarrhea or urinary tract infections.
I'm PSEUDOMONAS AERUGINOSA. I infect wounds and produce blue-green pus.

Don't spread these germs to others.
Wash hands often.
Wash after going to the bathroom.
Wash before eating.
Washing your hands is the single most important thing you can do to stop the spread of infection.

New England Baptist Hospital

www.creativehandhygiene.com
**LOVE = WASH**

* Lose Organisms Very Easily
  * Workers Assuring Safe Hands

**Hand Hygiene Fair**
February 7, 2006
11:30 a.m. - 1:30 p.m.
in the Cafeteria
Free Gifts!

**F.I.E.S.T.A. Bug Beat Fair**
June 8th
11:00am - 2:00pm
Courtyard Conference Room
Games, Educational Displays, and Raffle Prizes!
Also join us for cafeteria displays
June 7th, 11:30am - 1:30pm
Sponsored by the Infection Control Liaisons

**October is Infection Control Month**

**B.A.T.S.**
**Bugs Are Terminated with Soap/Sanitizer**

**Watching You! Bug Beat Fair**
June 24, 2008
11:30am – 1:30pm
Courtyard Conference Room
Wear Red White and Blue and Get a Prize

**R.E.D. S.O.C.K.S.**
Ready to Eradicate Disease?
Strike-out Organisms by Cleaning, Keep us Safe!

**K.I.S.S.**
Kill Infection with Soap and Sanitizer

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**Infection Control Liaisons Present**
**Don’t Catch the Flu Bear Blues**

**December 10, 2009**
11:30am - 1:30pm

Cafeteria Display
Free Holiday Bear and Hand Sanitizer
Teddy Bear Raffle

**Infection Control Liaisons**
**Hand Hygiene Program**

**E.L.F.**
**EVERYONE LOVES FOAM**

**December 18, 2008**
11:30am – 1:30pm

- Cafeteria Display
- Come and Pick up An E.L.F. Bear and Sanitizer
- Candy Bags for Everyone!

**The G.H.O.S.T.**
**Hand Hygiene Campaign**

**October 19-23, 2009**

**Infection Prevention Week**

Lecture Overview of Hot Topics:
HIV, MRSA, Clostridium difficile
Saturday, October 17, 2009
Monday, October 19, 2009
Friday, October 23, 2009
12:00pm - 1:00pm
Chapel, Main 3

**The GHOST Bug Beat Fair**
Games, Food, Prizes, and Raffle
October 23, 2009
11:30am – 1:30pm
Courtyard Conference Room

**M.R.S.A. Fair**
Make Resistance Stay Away

**F.O.A.M.**
Fight Organisms And Microbes
Happy Fingers!
References


The End