Strategies for the Prevention of Surgical Site Infections

Updated Guidelines and Questions about Surveillance

Dale W. Bratzler, DO, MPH
Professor and Associate Dean, College of Public Health
Professor, College of Medicine
Chief Quality Officer – OU Physicians Group
Oklahoma University Health Sciences Center

April 17, 2014
Disclosures

• Dr. Bratzler serves as a consultant to the Oklahoma Foundation for Medical Quality (CMS contractor), and Telligen (CMS and Oklahoma Medicaid Contractor), but has no financial relationships related to surgical site infection prevention.
Objectives

• Discuss the burden of surgical site infections (SSIs) in the US

• Review issues related to SSI surveillance

• Highlight the development of new national guidelines on prevention of SSI

• Discuss implementation of performance improvement initiatives to reduce SSI
67 year old female preparing for elective total hip arthroplasty. She is generally independent and has been healthy other than a long history of rheumatoid arthritis. Over the years she has been treated with a variety of medications including NSAIDS, corticosteroids, methotrexate, and most recently etanercept. She was last hospitalized two months ago because of a fall attributed to her painful hip.

Her vital signs are normal. Her height is 5’2” (157.5 cm) and her weight is 165 pounds (75 kg) [BMI 30.2]. With the exception of joint changes due to RA, her physical examination is otherwise normal. Her baseline laboratory is largely unremarkable however, her cholesterol is mildly elevated (210 mg/dL) and her fasting blood sugar was 135 mg/dL.
Current SSI Burden

Burden-US
• ~300,000 SSIs/yr – probably the most common hospital-acquired infection
• 2%-5% of patients undergoing inpatient surgery

Mortality
• 3% mortality
• 75% of deaths among SSI patients are directly attributable to SSI

Morbidity- long-term disabilities

Length of Hospital Stay
• ~7-10 additional postoperative hospital days

Cost
• $3000-$29,000/SSI depending on procedure & pathogen
• Up to $10 billion annually

Factors Affecting Rates of Surgical Site Infections

**Host factors**
- age
- morbid obesity
- malnutrition
- prolonged preoperative stay
- infection at distal sites
- cancer
- diabetes
- immunosuppression
- ASA score
- disease severity
- prior operations, revision vs primary

**Endogenous flora/ Microbial factors**
- ASA score
- disease severity
- prior operations, revision vs primary
- nasal/skin carriage
- virulence
- adherence
- inoculum

**Surgical procedures**
- abdominal site
- wound classification
- procedure duration
- poor hemostasis
- drains/foreign bodies
- dead space
- urgency of surgery

**Surgical team and hospital practice factors**
- razor shaves
- intraoperative contamination
- prophylactic antibiotic timing, selection and duration
- preoperative cleansing with chlorhexidine
- pre-operative screening for resistant organisms and decolonization
- surgeon’s skill
- surgical volume
# SSI Risk Varies by Operation

<table>
<thead>
<tr>
<th>Operation</th>
<th>Pooled Mean SSI Rate (%)</th>
<th>25&lt;sup&gt;th&lt;/sup&gt;, 75&lt;sup&gt;th&lt;/sup&gt; Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABG, Chest and Donor Site</td>
<td>4.26</td>
<td>1.33, 5.81</td>
</tr>
<tr>
<td>Colon</td>
<td>7.06</td>
<td>2.38, 9.09</td>
</tr>
<tr>
<td>Abdominal Hysterectomy</td>
<td>4.05</td>
<td>0.00, 4.86</td>
</tr>
<tr>
<td>Hip prosthesis</td>
<td>2.40</td>
<td>0.00, 3.70</td>
</tr>
<tr>
<td>Laminectomy</td>
<td>2.30</td>
<td>0.00, 3.73</td>
</tr>
<tr>
<td>Peripheral Vascular Bypass</td>
<td>6.98</td>
<td>2.75, 8.47</td>
</tr>
</tbody>
</table>

Risk index category “2” operations

Voluntary Reporting to NHSN

SSI Rate in a Clinical Trial Compared to NHSN Reported SSI Rates

<table>
<thead>
<tr>
<th>Infection</th>
<th>Ertapenem N=338 (%)</th>
<th>Cefotetan N=334 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any SSI</td>
<td>62 (18.1)</td>
<td>104 (31.1)</td>
</tr>
<tr>
<td>Superficial incisional</td>
<td>45 (13.1)</td>
<td>75 (22.4)</td>
</tr>
<tr>
<td>Deep incisional</td>
<td>13 (3.7)</td>
<td>17 (5.1)</td>
</tr>
<tr>
<td>Organ-space</td>
<td>4 (1.2)</td>
<td>12 (3.7)</td>
</tr>
</tbody>
</table>

Total infections identified = 166 (24.7%)
Deep incisional and organ-space = 46 (6.8%)

NHSN Pooled Mean = 7.06%
NHSN 90th Percentile = 13.8%

Colorectal SSI Rate by Quarter
(NSQIP)

Baseline SSI Rate: 27%

Year 1
SSI: 17%

Year 2
SSI Rate: 20%

Year 3
SSI Rate: 11%??

Quarter 1
Pre-op warming
Enhanced sterile technique
Intervention checklist

Quarter 3
Skin preparation protocol
Pre-op wash clothes

Quarter 4
CUSP kickoff
Antibiotic deficiencies addressed

Quarter 4
Briefing/Debriefing
Mechanical bowel prep with oral antibiotics

Goal: 15%
Claims-based surveillance detected 1.8–4.7-fold more SSIs than traditional surveillance, including detection of all previously identified cases. For hip and vascular surgery, there was a 5-fold and 1.6-fold increase in detection of deep and organ/space infections, respectively, with no increased detection of deep and organ/space infections following knee surgery.
“Whether intentional or unintentional, the pressure to adjudicate cases by persons without familiarity of or strict adherence to NHSN criteria is problematic...... Of note, adjudicators can be consciously or unconsciously biased if they are held accountable for institutional HAI performance. This clear conflict of interest creates a disincentive to adjudicate on the side of infection.

Although we must still strive to eliminate all preventable HAIs, the drive to “reach zero” can exacerbate the pressure to err on the side of underreporting HAIs described earlier.
Development of National Guidelines for Antimicrobial Prophylaxis and Prevention of SSI
Clinical Practice Guidelines for Antimicrobial Prophylaxis in Surgery

Clinical practice guidelines for antimicrobial prophylaxis in surgery


Am J Health-Syst Pharm. 2013; 70:195-283

Antimicrobial Prophylaxis

- Review of new literature since the 1999 publication of the ASHP guideline
  - Searches of MEDLINE®, Embase®, and The Cochrane Collection® database of systematic reviews, and a review of published guidelines on surgical antimicrobial prophylaxis
  - Evidence ratings provided for key recommendations
  - Adult and pediatric recommendations (we do not address newborn or premature infants)

Recognize that there are a limited number of adequately powered randomized control trials evaluating antibiotic prophylaxis for some operations.
A few principles....

• In almost every study for every type of surgery, antibiotic prophylaxis reduces the risk of SSI
  – However for some operations the risk is so low or consequences so trivial, that antibiotic prophylaxis may not be warranted for all operations

• Guideline was developed to be specialty specific and was posted for open public comment
## Dosing (and Re-dosing) Table

### Table 1.
Recommended Doses and Redosing Intervals for Commonly Used Antimicrobials for Surgical Prophylaxis

<table>
<thead>
<tr>
<th>Antimicrobial</th>
<th>Recommended Dose</th>
<th>Half-life in Adults With Normal Renal Function, hr(^a)</th>
<th>Recommended Redosing Interval (From Initiation of Preoperative Dose), hr(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampicillin-sulbactam</td>
<td>3 g (ampicillin 2 g/sulbactam 1 g)</td>
<td>0.8–1.3</td>
<td>2</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>2 g</td>
<td>1–1.9</td>
<td>2</td>
</tr>
<tr>
<td>Aztreonam</td>
<td>2 g</td>
<td>1.3–2.4</td>
<td>4</td>
</tr>
<tr>
<td>Cefazolin</td>
<td>2 g, 3 g for pts weighing ≥120 kg</td>
<td>1.2–2.2</td>
<td>4</td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>1.5 g</td>
<td>1–2</td>
<td>4</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>1 g(^a)</td>
<td>0.9–1.7</td>
<td>3</td>
</tr>
<tr>
<td>Cefoxitin</td>
<td>2 g</td>
<td>0.7–1.1</td>
<td>2</td>
</tr>
<tr>
<td>Cefotetan</td>
<td>2 g</td>
<td>2.8–4.6</td>
<td>6</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>2 g(^a)</td>
<td>5.4–10.9</td>
<td>NA</td>
</tr>
<tr>
<td>Ciprofloxacin(^f)</td>
<td>400 mg</td>
<td>3–7</td>
<td>NA</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>900 mg</td>
<td>2–4</td>
<td>6</td>
</tr>
<tr>
<td>Ertaopenm</td>
<td>1 g</td>
<td>3–5</td>
<td>NA</td>
</tr>
<tr>
<td>Fluconazole</td>
<td>400 mg</td>
<td>30</td>
<td>NA</td>
</tr>
<tr>
<td>Gentamicin(^i)</td>
<td>5 mg/kg based on dosing weight (single dose)</td>
<td>2–3</td>
<td>NA</td>
</tr>
<tr>
<td>Levofloxacin(^f)</td>
<td>500 mg</td>
<td>6–8</td>
<td>NA</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>500 mg</td>
<td>6–8</td>
<td>NA</td>
</tr>
</tbody>
</table>

Neonates weighing < 1200 g should receive a single 7.5-mg/kg dose

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# Comprehensive Summary Table

## Antibiotic Recommendations

**Table 2. Recommendations for Surgical Antimicrobial Prophylaxis**

<table>
<thead>
<tr>
<th>Type of Procedure</th>
<th>Recommended Agents&lt;sup&gt;a,b&lt;/sup&gt;</th>
<th>Alternative Agents in Pts With β-Lactam Allergy</th>
<th>Strength of Evidence&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardiac</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coronary artery bypass</td>
<td>Cefazolin, cefuroxime</td>
<td>Clindamycin&lt;sup&gt;4&lt;/sup&gt;, vancomycin&lt;sup&gt;1&lt;/sup&gt;</td>
<td>A</td>
</tr>
<tr>
<td>Cardiac device insertion procedures (e.g., pacemaker implantation)</td>
<td>Cefazolin, cefuroxime</td>
<td>Clindamycin, vancomycin</td>
<td>A</td>
</tr>
<tr>
<td>Ventricular assist devices</td>
<td>Cefazolin, cefuroxime</td>
<td>Clindamycin, vancomycin</td>
<td>C</td>
</tr>
<tr>
<td><strong>Thoracic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noncardiac procedures, including lobectomy, pneumonectomy, lung resection, and thoracotomy</td>
<td>Cefazolin, ampicillin–sulbactam</td>
<td>Clindamycin&lt;sup&gt;4&lt;/sup&gt;, vancomycin&lt;sup&gt;1&lt;/sup&gt;</td>
<td>A</td>
</tr>
<tr>
<td>Video-assisted thoracoscopic surgery</td>
<td>Cefazolin, ampicillin–sulbactam</td>
<td>Clindamycin&lt;sup&gt;4&lt;/sup&gt;, vancomycin&lt;sup&gt;1&lt;/sup&gt;</td>
<td>C</td>
</tr>
<tr>
<td><strong>Gastrointestinal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procedures involving entry into lumen of gastrointestinal tract (bariatric, pancreaticoduodenectomy)</td>
<td>Cefazolin</td>
<td>Clindamycin or vancomycin + aminoglycoside&lt;sup&gt;6&lt;/sup&gt; or aztreonam or fluoroquinolone&lt;sup&gt;9&lt;/sup&gt;</td>
<td>A</td>
</tr>
<tr>
<td>Procedures without entry into gastrointestinal tract (antireflux, highly selective vagotomy) for high-risk patients</td>
<td>Cefazolin</td>
<td>Clindamycin or vancomycin + aminoglycoside&lt;sup&gt;6&lt;/sup&gt; or aztreonam or fluoroquinolone&lt;sup&gt;9&lt;/sup&gt;</td>
<td>A</td>
</tr>
<tr>
<td><strong>Biliary tract</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open procedure</td>
<td>Cefazolin, cefoxitin, cefotetan, ceftriaxone&lt;sup&gt;a&lt;/sup&gt;, ampicillin–sulbactam&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Clindamycin or vancomycin + aminoglycoside&lt;sup&gt;6&lt;/sup&gt; or aztreonam or fluoroquinolone&lt;sup&gt;9&lt;/sup&gt;</td>
<td>A</td>
</tr>
<tr>
<td>Laparoscopic procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective, low-risk&lt;sup&gt;1&lt;/sup&gt;</td>
<td>None</td>
<td>None</td>
<td>A</td>
</tr>
<tr>
<td>Elective, high-risk&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Cefazolin, cefoxitin, cefotetan, ceftriaxone&lt;sup&gt;a&lt;/sup&gt;, ampicillin–sulbactam&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Clindamycin or vancomycin + aminoglycoside&lt;sup&gt;6&lt;/sup&gt; or aztreonam or fluoroquinolone&lt;sup&gt;9&lt;/sup&gt;</td>
<td>A</td>
</tr>
</tbody>
</table>

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<sup>a</sup> Recommendation is based on clinical judgment.

<sup>b</sup> Prophylaxis should be given within 1 h of skin incision.

<sup>c</sup> Strength of evidence: A = good, B = fair, C = poor.
Prevention of SSI

“Although antimicrobial prophylaxis plays an important role in reducing the rate of surgical site infections,...

– other factors, such as attention to basic infection control strategies, the surgeon’s experience and technique, duration of procedure, hospital and operating room environments, instrument sterilization issues, preoperative preparation (e.g. surgical scrub, skin antisepsis, and appropriate hair removal), perioperative management (temperature and glycemic control) and the underlying medical condition of the patient, may have a strong impact on surgical site infection rates.”

– Patient-related factors

No single intervention is going to be sufficient to prevent SSIs

Common Principles
Antimicrobial Prophylaxis

- Antibiotic selection
  - Narrowest spectrum for efficacy
  - Routine use of vancomycin for prophylaxis is not recommended for any procedure.
    - Limit use of vancomycin to patients with known colonization with MRSA, high risk of MRSA, or in patients with beta-lactam allergy
  - No consensus on patients colonized with other MDROs


Use of Vancomycin or Clindamycin

“For procedures where pathogens other than staphylococcus and streptococcus are likely, an additional agent with activity against those pathogens could be considered. For example, if there is surveillance data showing that gram negative organisms are a cause of surgical site infections for the procedure, consider combining clindamycin or vancomycin with another agent (cefazolin if not beta-lactam allergic; aztreonam, gentamicin, or single-dose fluoroquinolone if beta-lactam allergic).”

Beta-lactam Allergy

• Cephalosporins and carbapenems can safely be used in patients with an allergic reaction to penicillins other than IgE mediated reactions (e.g. anaphylaxis, urticaria, bronchospasm) or exfoliative dermatitis (Stevens-Johnson syndrome and toxic epidermal necrolysis)

• Patients should be carefully questioned about their history of beta-lactam allergies.
Antimicrobial Timing

- The first dose of prophylaxis should be initiated within 60 minutes prior to incision (120 minutes for vancomycin or fluoroquinolones)

- Patients receiving therapeutic antibiotics for a remote infection prior to surgery should also be given antibiotic prophylaxis prior to surgery to ensure adequate serum and tissue levels of antibiotics with activity against likely pathogens for the duration of the operation.
The SSI risk varies by patient and procedure factors as well as antibiotic properties but is not significantly associated with prophylactic antibiotic timing. While adherence to the timely prophylactic antibiotic measure is not bad care, there is little evidence to suggest that it is better care.

There are NO randomized trials.
Antibiotic Dosing

• Weight-based dosing – very little data upon which to make recommendations
  – Cefazolin ~25 mg/kg
  – Gentamicin 5 mg/kg single preoperative dose based on the dosing weight
  – Vancomycin 15 mg/kg

In general, gentamicin for surgical antibiotic prophylaxis should be limited to a single dose given preoperatively. Dosing is based on the patient’s actual body weight. If the patient’s actual weight is more than 30% above their ideal body weight (IBW), the dosing weight (DW) can be determined as follows: DW = IBW + 0.4(actual weight – IBW).
Antimicrobial Prophylaxis

• Re-dosing
  – Specific intervals provided – two half-lives of the drug

• Duration
  – The duration of antimicrobial prophylaxis should be less than 24 hours for all operations

• Topical antibiotics
  – “Superior to placebo but not superior to parenteral administration, and topical administration does not increase the efficacy of parenteral antibiotics when used in combination for prophylaxis.”

Colorectal Surgery

• In most patients undergoing elective colorectal surgery, a mechanical bowel prep combined with oral neomycin sulfate plus oral erythromycin base; or oral neomycin sulfate plus oral metronidazole should be given in addition to intravenous prophylaxis.


Preoperative Oral Antibiotics Reduce Surgical Site Infection Following Elective Colorectal Resections

Jamie A. Cannon, M.D. 1,2 • Laura K. Altom, M.D., M.S.P.H. 1
Rhiannon J. Deierhoi, M.P.H. 1,2 • Melanie Morris, M.D. 1,2
Joshua S. Richman, M.D., Ph.D. 1 • Catherine C. Vick, M.S. 2
Kamal M.F. Itani, M.D. 3 • Mary T. Hawn, M.D., M.P.H. 1,2

1 Department of Surgery, University of Alabama at Birmingham, Birmingham, Alabama
2 Department of Surgery, Veterans Affairs Medical Center, Birmingham, Alabama
3 Department of Surgery, Veterans Affairs Boston Health Care System, Boston, Massachusetts


A Statewide Colectomy Experience

The Role of Full Bowel Preparation in Preventing Surgical Site Infection

Edward K. Kim, BS, Kyle H. Sheetz, BS, Julie Born, BS, Scott DeRoo, BA, Christopher Lee, Isaac Stein, BA, Arya Zarinsfet, BA, Shijie Cai, PhD, Darrell A. Campbell, Jr, MD, and Michael J. Englesbe, MD

Pre-surgical Screening for *S. aureus*
**S. aureus Preoperative Screening**

- Patients with nasal carriage of *S. aureus* are at an increased risk of *S. aureus* skin colonization and 2- to 14-fold increased risk for SSI with this microorganism compared with non-carriers.

- Preoperative screening and decolonization
  - “Recent studies confirm that *S. aureus* decolonization of the anterior nares decreases SSI rates in many surgical patients. The data are most compelling in cardiac and orthopedic surgery patients.”
• Update of the 1999 HICPAC guideline on Prevention of Surgical Site Infections
  - Core section
  - Arthroplasty section

Draft guidelines have been presented at the HICPAC meeting but are not final.
Disclaimer

• This guideline is not final
  – The discussion does not reflect the official position of the Centers for Disease Control and Prevention

Draft Guideline for the Prevention of Surgical Site Infection

Sandra I. Berrios-Torres, MD\(^1\), Craig A. Umscheid, MD, MSCE\(^2\), Dale W. Bratzler, DO, MPH\(^3\), Brian Leas, MA, MS\(^2\), Erin C. Stone, MS\(^1\), Rachel R. Kelz, MD, MSCE, FACS\(^2\), Caroline Reinke, MD, MPH\(^3\), Sherry Morgan, RN, MLS, PhD\(^1\), Joseph S. Solomkin, MD\(^4\), John E. Mazuski, MD, PhD\(^5\), E. Patchen Dellinger, MD\(^6\), Kamal Itani, MD\(^7\), Elie F. Berbari, MD\(^8\), John Segreti, MD\(^9\), Javad Parvizi, MD\(^10\), Joan Blanchard, MSS, BSN, RN, CNOR, CIC\(^11\), George Allen, PhD, CIC, CNOR\(^12\), J. A. J. W. Kluytmans, MD\(^13\), Rodney Donlan, PhD\(^1\), William P. Schecter, MD\(^4\) and the Healthcare Infection Control Practices Advisory Committee\(^15\)

Available at: http://www.regulations.gov/#!docketDetail;D=CDC-2014-0003
Participants

CDC/HICPAC SSI Guideline Content Experts

American College of Surgeons (ACS)
American Academy of Orthopaedic Surgeons (AAOS)
Association of periOperative Registered Nurses (AORN)
Musculoskeletal Infection Society (MSIS)
Surgical Infection Society (SIS)
European Union
Academic Institutions
S. aureus, Biofilm, Environmental External and CDC

University of Pennsylvania Center for Evidence-based Practice
HICPAC Leads
CDC Lead

Content Experts

Core Writing Group
• **Category IA.** Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.

• **Category IB.** Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies and a strong theoretical rationale; or an accepted practice (e.g., aseptic technique) supported by limited evidence.

• **Category IC.** Required by state or federal regulations, rules, or standards.

• **Category II.** Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

• **Unresolved issue.** Represents an unresolved issue for which evidence is insufficient or no consensus regarding efficacy exists.
Study Selection Process

4961 studies identified in literature search

104 studies suggested by content experts

168 studies cited in 1999 Guideline

5233 Title and Abstract Screen

4436 studies excluded

797 Full Text Review

682 studies excluded

564: not relevant to key questions
108: study design
6: not available as full text article
4: not in English

25 Clinical practice guidelines

14 identified by writing group

16 excluded

23 guidelines cited

43 studies identified from excluded systematic reviews

133 studies extracted into Evidence and GRADE tables

97 Core and 36 Arthroplasty
Key Topics - Final

**CORE**
- Antimicrobial Prophylaxis
  - Topical antimicrobials/antiseptics
- Glycemic Control
- Normothermia
- Tissue Oxygenation
- Skin Preparation

**ARTHROPLASTY**
- Transfusion
- Immunosuppressive Therapy
- Anticoagulation
- Orthopedic exhaust (space) suits
- Antimicrobial prophylaxis duration with drains
- Biofilm
So, what can we say after grading the evidence?
Antimicrobial Prophylaxis

• No recommendation can be made regarding optimal timing of preoperative parenteral prophylactic antimicrobial agent for prevention of SSI. (No recommendation/unresolved issue)

• Administer the appropriate parenteral prophylactic antimicrobial agent prior to skin incision in all cesarean sections. (Category IA)

Disclaimer: The findings and conclusions are draft and have been presented at HICPAC but have not been formally disseminated by the CDC and should not be construed to represent any agency determination or policy.
Antimicrobial Prophylaxis (cont)

• No recommendation can be made
  – Weight-adjusted dosing
  – Intraoperative redosing

(No recommendation/unresolved issue)

Disclaimer: The findings and conclusions are draft and have been presented at HICPAC but have not been formally disseminated by the CDC and should not be construed to represent any agency determination or policy.
# Antibiotic Duration

<table>
<thead>
<tr>
<th>Specialty</th>
<th>RCTs</th>
<th>Publication Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thoracic</td>
<td>1</td>
<td>1994</td>
</tr>
<tr>
<td>Ear, Nose, Throat</td>
<td>2</td>
<td>2008, 2003</td>
</tr>
<tr>
<td>Orthopaedics-Arthroplasty</td>
<td>2</td>
<td>1992, 1989</td>
</tr>
<tr>
<td>General Surgery-Other</td>
<td>3</td>
<td>2007(2), 2005</td>
</tr>
<tr>
<td>Mixed general, urologic, GYN</td>
<td>1</td>
<td>1992</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>38</strong></td>
<td><strong>71% published before 1999</strong></td>
</tr>
</tbody>
</table>

Disclaimer: The findings and conclusions are draft and have been presented at HICPAC but have not been formally disseminated by the CDC and should not be construed to represent any agency determination or policy.
Antibiotic Duration

• In clean and clean-contaminated procedures, do not administer additional prophylactic antimicrobial agent doses after the surgical incision is closed in the operating room. (Category IA)

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Topical Antimicrobials/Antiseptics

• No recommendation/unresolved issues:
  – Intraoperative antimicrobial irrigation
  – Soaking prosthetic devices in antimicrobial or antiseptic solutions prior to implantation

• Category II
  – Consider intraoperative irrigation of deep or subcutaneous tissues with aqueous iodophor solution (but not for contaminated or dirty abdominal procedures)

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Topical Antimicrobials/Antiseptics (cont)

• Category IB
  – Do not apply topical antimicrobial agents (ointments, solutions, powders) to the surgical incision

• Category IA
  – Do not use autologous platelet-rich plasma for prevention of SSI
  – Do not use antimicrobial coated sutures for prevention of SSI

Disclaimer: The findings and conclusions are draft and have been presented at HICPAC but have not been formally disseminated by the CDC and should not be construed to represent any agency determination or policy.
Antimicrobial Dressings

• No recommendation can be made regarding the safety and effectiveness of antimicrobial dressings applied to surgical incisions following primary closure in the operating room for the prevention of surgical site infection. (No recommendation/ unresolved issue)
Glucose control

• Implement perioperative glycemic control and use blood glucose target levels < 200 mg/dL in diabetic and non-diabetic surgical patients (Category 1A)

  — No recommendation can be made regarding the safety and effectiveness of lower or narrower blood glucose target levels and SSI. (No Recommendation/unresolved issue)

  — No recommendation can be made regarding hemoglobin A1C target levels and the risk of surgical site infection in diabetic and non-diabetic patients. (No recommendation/unresolved issue)

Disclaimer: The findings and conclusions are draft and have been presented at HICPAC but have not been formally disseminated by the CDC and should not be construed to represent any agency determination or policy.
Normothermia

• Maintain perioperative normothermia (Category 1A)
  – No recommendation can be made regarding the safety or effectiveness of strategies to achieve and maintain normothermia, the lower limit of normothermia, or the optimal timing and duration of normothermia.

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Oxygenation

- For patients with normal pulmonary function undergoing surgery with general anesthesia with endotracheal intubation, administer increased fraction of inspired oxygen (FiO₂) intraoperatively and post-extubation in the immediate postoperative period in combination with strategies to optimize tissue oxygen delivery through maintenance of perioperative normothermia and adequate volume replacement. (Category 1A)

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Oxygenation

• No recommendation for
  – Those without endotracheal intubation
  – Mechanism (facemask, cannula) postoperatively
  – Optimal FiO$_2$ target, duration, and delivery method
Skin Preparation

• Require patients to shower or bathe (full body) with an antimicrobial or non-antimicrobial soap or antiseptic agent on at least the night before the operative day. (Category 1B)
  – No recommendation can be made regarding the optimal timing of the preoperative shower or bath or the total number of soap or antiseptic agent applications for the prevention of surgical site infection. (No recommendation/ unresolved issue)

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Skin Preparation

- Perform intraoperative skin preparation with an alcohol-based antiseptic agent, unless contraindicated. *(Category 1A)*

- Do not use an antimicrobial sealant following intraoperative skin preparation and prior to skin incision for the prevention of surgical site infection. *(Category 1A)*

- Use of plastic adhesive drapes with or without antimicrobial properties, is not necessary for the sole purpose of the prevention of surgical site infection. *(Category II)*

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Periprosthetic Joint Arthroplasty Section

Except for antibiotic duration, we could not make any recommendations for any of the key questions (No recommendation/unresolved issue)
One of my key takeaways

• There is still considerable need for well-designed RCTs to evaluate best practices for prevention of SSI
Hospitals improved in measures related to appropriate antimicrobial agent selection, timing, and duration; normothermia; oxygenation; euglycemia; and appropriate hair removal. The infection rate decreased 27%, from 2.3% to 1.7% in the first versus last 3 months.

This multi-institutional study shows that patients who received all 6 perioperative care measures attained a very low, risk-adjusted SSI rate of 2.0%.
Conclusions

• Surgical site infections are the most frequent healthcare-associated infection reported in hospitals
  – Probably far more common than voluntary reporting to NHSN suggests

• Risk of SSI varies by operation type

• There are multiple factors that contribute to the development of SSIs
  – No single intervention is going to be sufficient to prevent SSIs