Outline

• **Background**
  – Impact
  – HHS Prevention Targets
  – Pathogenesis
  – Epidemiology

• **Prevention Strategies**
  – Core
  – Supplemental

• **Measurement**
  – Process
  – Outcome

• **Tools for Implementation/Resources/References**
Background: Impact

Burden-US

- 1.7 million healthcare-associated infections (HAI) in US hospitals (2002)
- ~300,000 SSIs/yr (17% of all HAI; second to UTI)
- 2%-5% of patients undergoing inpatient surgery

Mortality

- 3 % mortality
- 2-11 times higher risk of death
- 75% of deaths among patients with SSI are directly attributable to SSI

Morbidity

- long-term disabilities
Background: Impact

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

Cost
- $3000-$29,000/SSI depending on procedure & pathogen
- Up to $10 billion annually
- Most estimates are based on inpatient costs at time of index operation and do not account for the additional costs of rehospitalization, post-discharge outpatient expenses, and long term disabilities.
Background: HHS Prevention Targets

- Median deep incision and organ space infection rate for each procedure/risk group will be at or below the current NHSN 25th percentile
  - Outcome - Deep incision and organ space infection rates using NHSN definitions (SCIP procedures)
- 95% adherence rates to each SCIP/NQF infection process measure
  - Process - Adherence to SCIP/NQF infection process measures

http://www.hhs.gov/ophs/initiatives/hai/prevtargets.html
Background: Pathogenesis

**Pathogen Sources**

**Endogenous**

- Patient flora
  - skin
  - mucous membranes
  - GI tract
- Seeding from a distant focus of infection
Background: Pathogenesis

**Pathogen Sources**

**Exogenous**

- Surgical Personnel (surgeon and team)
  - Soiled attire
  - Breaks in aseptic technique
  - Inadequate hand hygiene
- OR physical environment and ventilation
- Tools, equipment, materials brought to the operative field
Background: Pathogenesis

Organisms Causing SSI

January 2006-October 2007

<table>
<thead>
<tr>
<th>Organism</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>30.0%</td>
</tr>
<tr>
<td>Coagulase-negative staphylococci</td>
<td>13.7%</td>
</tr>
<tr>
<td>Enterococcus spp.</td>
<td>11.2%</td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>9.6%</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em></td>
<td>5.6%</td>
</tr>
<tr>
<td>Enterobacter spp.</td>
<td>4.2%</td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td>3.0%</td>
</tr>
<tr>
<td>Candida spp.</td>
<td>2.0%</td>
</tr>
<tr>
<td><em>Klebsiella oxytoca</em></td>
<td>0.7%</td>
</tr>
<tr>
<td><em>Acinetobacter baumannii</em></td>
<td>0.6%</td>
</tr>
</tbody>
</table>

N=7,025

Hidron Al, et.al., Infect Control Hosp Epidemiol 2008;29:996-1011
Hidron Al et.al., Infect Control Hosp Epidemiol 2009;30:107–107(ERRATUM)
Background: Epidemiology

Emerging Challenges

Challenges in detecting SSIs

• Lack of standardized methods for post-discharge/outpatient surveillance
  – Increased number of outpatient surgeries
  – Shorter postoperative inpatient stays

Antimicrobial Prophylaxis

• Increasing trend toward resistant organism may undermine the effectiveness of existing recommendations for antimicrobial prophylaxis
Background: Epidemiology

Important Modifiable Risk Factors

• Antimicrobial prophylaxis
  – Inappropriate choice (procedure specific)
  – Improper timing (pre-incision dose)
  – Inadequate dose based on body mass index, procedures >3h, or increased blood loss

• Skin or site preparation ineffective
  – Removal of hair with razors

• Colorectal procedures
  – Inadequate bowel prep/antibiotics
  – Improper intraoperative temperature regulation
Background: Epidemiology

Additional Modifiable Risk Factors

- Excessive OR traffic
- Inadequate wound dressing protocol
- Improper glucose control
- Colonization with preexisting microorganisms
- Inadequate intraoperative oxygen levels
Prevention Strategies

• Core Strategies
  – High levels of scientific evidence
  – Demonstrated feasibility

• Supplemental Strategies
  – Some scientific evidence
  – Variable levels of feasibility

*The Collaborative should at a minimum include core prevention strategies. Supplemental prevention strategies also may be utilized. Hospitals should not be excluded from participation if they already have ongoing interventions using supplemental prevention strategies. Project coordinators should carefully track which prevention strategies are being utilized by participating facilities.
Prevention Strategies: Core Preoperative Measures

Administer antimicrobial prophylaxis in accordance with evidence based standards and guidelines

- Administer within 1 hour prior to incision
  - 2hr for vancomycin and fluoroquinolones
- Select appropriate agents on basis of
  - Surgical procedure
  - Most common SSI pathogens for the procedure
  - Published recommendations
Prevention Strategies: Core Preoperative Measures

• **Remote infections**
  – Identify and treat before elective operation
  – Postpone operation until infection has resolved

• **Do not remove hair at the operative site unless it will interfere with the operation; do not use razors**
  – If necessary, remove by clipping or by use of a depilatory agent
Prevention Strategies: Core

Preoperative Measures (continued)

- **Skin Prep**
  - Use appropriate antiseptic agent and technique for skin preparation

- **Maintain immediate postoperative normothermia**

- **Colorectal surgery patients**
  - Mechanically prepare the colon (Enemas, cathartic agents)
  - Administer non-absorbable oral antimicrobial agents in divided doses on the day before the operation
• Operating Room (OR) Traffic
  – Keep OR doors closed during surgery except as needed for passage of equipment, personnel, and the patient
Prevention Strategies: Core
Postoperative Measures

• Surgical Wound Dressing
  – Protect primary closure incisions with sterile dressing for 24-48 hrs post-op

• Control blood glucose level during the immediate post-operative period (cardiac)
  – Measure blood glucose level at 6AM on POD#1 and #2 with procedure day = POD#0
  – Maintain post-op blood glucose level at <200mg/dL

• Discontinue antibiotics within 24hrs after surgery end time (48hrs for cardiac)
Prevention Strategies: Supplemental Preoperative

- Nasal screen and decolonize only *Staphylococcus aureus* carriers undergoing elective cardiac and other procedures (i.e., orthopaedic, neurosurgery procedures with implants) with preoperative mupirocin therapy

- Screen preoperative blood glucose levels and maintain tight glucose control POD#1 and POD#2 in patients undergoing select elective procedures (e.g., arthroplasties, spinal fusions)
Prevention Strategies: Supplemental Perioperative

• Redose antibiotic at the 3 hr interval in procedures with duration >3hrs (* see exceptions to this recommendation)

• Adjust antimicrobial prophylaxis dose for obese patients (body mass index >30)

• Use at least 50% fraction of inspired oxygen intraoperatively and immediately postoperatively in select procedure(s)

Prevention Strategies: Supplemental Postoperative

• Feedback of surgeon specific infection rates.
## Measurement: Process Measures

<table>
<thead>
<tr>
<th>Quality Indicator</th>
<th>Numerator</th>
<th>Denominator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriate antibiotic choice</td>
<td>Number of patients who received the appropriate prophylactic antibiotic</td>
<td>All patients for whom prophylactic antibiotics are indicated</td>
</tr>
<tr>
<td>Appropriate timing of prophylactic antibiotics</td>
<td>Number of patients who received the prophylactic antibiotic within 1hr prior to incision (2hr: Vancomycin or Fluoroquinolones)</td>
<td>All patients for whom prophylactic antibiotics are indicated</td>
</tr>
<tr>
<td>Appropriate discontinuation of antibiotics</td>
<td>Number of patients who received prophylactic antibiotics and had them discontinued in 24 h (48h cardiac)</td>
<td>All patients who received prophylactic antibiotics</td>
</tr>
</tbody>
</table>
### Measurement: Process Measures (continued)

<table>
<thead>
<tr>
<th>Quality Indicator</th>
<th>Numerator</th>
<th>Denominator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriate hair removal</td>
<td>Number of patients who did not have hair removed or who had hair removed with clippers</td>
<td>All surgical patients</td>
</tr>
<tr>
<td>Normothermia</td>
<td>Number of patients with postoperative temperature ≥36.0°C</td>
<td>All surgical patients</td>
</tr>
<tr>
<td>Glucose control</td>
<td>Number of cardiac surgery patients with glucose control at 6AM POD1 and POD2 (operation = POD0)</td>
<td>Patients undergoing cardiac surgery</td>
</tr>
</tbody>
</table>
Measurement: Outcome Measures

SSI Rate

\[
\text{# Patients with SSI after selected operations} \times 100 \div \text{Total # of selected operations performed}
\]

- Crude, unadjusted rate
- Can lead to erroneous conclusions regarding SSI risk by institution and/or surgeon
- NOT for reporting or inter-hospital comparisons
Measurement: Outcome Measures

Risk Adjustment (1)

NNIS Risk Index

Score to predict risk of acquiring SSI

• Widely used - targeted at surveillance
• Operation-specific
• Allows monitoring of trends
• Facilitates comparison
  – facility vs. national

Measurement: Outcome Measures

Risk Adjustment (2)

NNIS Risk Index

- Focus on high volume operations
- Employs Risk Stratification
  - American Society of Anesthesiologists (ASA) score (3, 4, or 5)
  - Wound Classification (contaminated or dirty)
  - Duration of Procedure (over T [proc specific] hours)
- Does not include many patient & perioperative related SSI risk factors
- Increased NNIS Risk index = Increased risk of SSI

Measurement: Outcome Measures

Risk Adjustment (2)

Standardized Incidence Ratio - SIR

\[
SIR = \frac{\text{Observed } \# \text{ SSI}}{\text{Expected } \# \text{ SSI}}
\]

Expected \# SSI =
\[
\frac{\# \text{ operations}^* \text{ in each proc risk category} \times \text{NNIS rate}}{100}
\]

- Value >1.0 = more SSIs than expected
- Helps better identify outliers
- Will be utilized for comparison within NHSN in 2010

*Performed by a surgeon, a surgical subspecialty service or a hospital
• Assess baseline policies and procedures

• Areas to consider
  – Surveillance
  – Prevention strategies
  – Measurement

• Coordinator should track new policies/practices implemented during collaboration

Standardized questions forthcoming
References


- Brendle TA. Surgical Care Improvement Project and the Perioperative Nurse's Role. AORN J 2007;86(1):94-101


References


References


References


References


References


References
SSI Bundles

• Canadian Getting Started Kit:
  http://www.saferhealthcarenow.ca/EN/Interventions/SSI/Pages/ask.aspx (Select SSI Getting Started Kit)

• IHI:
  http://www.ihi.org/IHI/Programs/Campaign/SSI.htm (Select “Power Point Presentation with Facilitator Notes)
  http://www.100liveswashington.org/resources/SSI-summary.pdf
References

SSI Bundles

- Australian:

- Scottish:
  http://www.hps.scot.nhs.uk/haiic/ic/SSIPreventionBundle/aspx
Resources for Implementation
WHO Surgical Safety Checklist

World Health Organization. Safe Surgery Saves Lives