Clinical Safety & Effectiveness
Cohort # 15
Team 14
Implementing a Program to Decrease Surgical Site Infections
CENTER FOR PATIENT SAFETY & HEALTH POLICY
UT Health Science Center
SAN ANTONIO
Educating for Quality Improvement & Patient Safety
Project Contributors

This is a UTHSCSA-sponsored multidisciplinary Quality Improvement Project by the Departments of Orthopaedics and Infectious Disease

Team members include:

- Anil Dutta, MD: CS&E Participant, Principal Investigator
- Christina Brady, MD: CS&E Participant
- David Chee, MD: CS&E Participant
- Jorge Clint Deleon, Medical Student, Team Member
- Edna Cruz, M.Sc., RN, CPHQ, Facilitator

Sponsor Department:

- John Toohey, MD: Orthopaedic Surgery Residency Program Director
- Robert Quinn, MD: Orthopaedic Surgery Chairman
- Department of Infectious Disease and Infection Control
- Claudia Thames Ortho Clinic Manager
AIM Statement

Implement a program for preoperative antimicrobial prophylaxis to decrease gram-positive surgical site infections for total joint arthroplasties including shoulders, hips and knees from 09/2013 to 12/2013 with a goal compliance rate of 80%.
### Project Milestones

<table>
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<th>Milestone</th>
<th>Date</th>
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<tr>
<td>Team Created</td>
<td>9/2014</td>
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<tr>
<td>AIM statement created</td>
<td>9/2014</td>
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<tr>
<td>Weekly Team Meetings</td>
<td>9/2014-1/2015</td>
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<tr>
<td>Background Data, Brainstorm Sessions, Workflow and Fishbone Analyses</td>
<td>9/2014</td>
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<td>Interventions Implemented</td>
<td>9/2014-1/2015</td>
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<td>Data Analysis</td>
<td>12/2014</td>
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<td>CS&amp;E Presentation</td>
<td>1/23/15</td>
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Why Implement A SSI Prevention Program?

- Surgical Site Infections (SSI) are a serious adverse event to patients and to their surgeons.
- Over the last decade, MRSA rates in the community and in healthcare settings have risen.
- There is continuing discussion to use legislative pressure for not reimbursing costs for hospital acquired infections, which would include surgical site infections.
University Hospital Surgical Site Infections

• The National Healthcare Safety Network is a hospital acquired infection tracking network by the Centers for Disease Control

• In 2012-14, the rate of infections for hip and knee prostheses for University Hospital ranged from 2.3-3.8% (National rates 1-1.4%, other studies up to 5%)

• Of those infections, 62% were from *Staphylococcus aureus* and of those 38% were MRSA
Bundled Interventions

- Bundled interventions have been shown to be effective for reducing hospital acquired infections for Ventilator Associated Pneumonias and Central Line Associated Blood Stream Infections
- Similarly, bundled interventions for skin and nasal decolonization and antimicrobial prophylaxis for Staph aureus have demonstrated a decrease in SSI.
- Estimated a number needed to screen of 250 to prevent 1 surgical site infection.
Analysis of Contributing Factors to Surgical Site Infections

**Patient Characteristics**
- Diabetes, uncontrolled glucose
- Immunosuppression
- Obesity/malnutrition
- Compliance
- MRSA colonization

**Equipment**
- Sterilization solution
- Surgical equipment
- Space Suits
- Dressings

**Surgery/Technique**
- Preoperative antibiotics
- Procedure time/technique
- Aseptic technique
- OR cleaning technique
- Patient normothermia

**Environment**
- Cleanliness
- OR traffic
- OR temperature
- Operative Room location
- Laminar flow/vent maintenance

**Providers/Staff**
- Cleaning staff
- #ppl scrubbed in a case
- SSI prevention knowledge
- Surgical Team
- Compliance to aseptic technique

**Clinical Decisions**
- Discharge process/follow up appt
- Glucose management
- Central lines/foley
- MRSA pre-screening/tx
- Antibiotic selection

**Process Analysis Tools - Ishikawa/Fishbone Diagram**

Focus areas for this project
PLAN: Intervention

• All the Orthopedic Staff performing total joint arthroplasties of the shoulder, hip or knee will be asked to participate
• The STOP SSIs Algorithm, an evidence-based algorithm supported by the Agency for Healthcare Research and Quality, was implemented
• During the preoperative visit a MRSA nasal screening will be taken and the patient will be sent home with a chlorohexadine pre-surgical scrub
• A medical assistant will follow up with the results of the study, and will contact the positively screened patients. A prescription for intranasal Mupirocin (Bactroban) will be provided. All patients will be asked to use the scrub the night before the surgery
• Data will be analyzed for efficacy of the program. Pending that analysis, we will decide if it should be continued
The STOP SSIs Algorithm

**Plan: Intervention**

Screen nares for Staph aureus (SA) (both MRSA & MSSA) within 30 days of scheduled surgery

Pre-op screening results known prior to incision?

- No, not screened or results unknown at the time of surgery
- Yes, SA positive
- Positive for Staph aureus

Decolonize with intranasal Mupirocin*** ointment (start BID x 5 days; discontinue if negative screen)

CHG*** bathing (start daily bath 5 days before operation if possible; at a minimum bathe the night before & morning of surgery using wipes or liquid)

Cefazolin* plus Vancomycin***

Cefazolin

- MSSA +

Decolonize with intranasal Mupirocin*** ointment BID x 5 days

CHG*** bathing (daily x 5 days, using wipes or liquid)

Cefazolin

- MRSA +

Decolonize with intranasal Mupirocin*** ointment BID x 5 days

CHG*** bathing (night before & morning of surgery using wipes or liquid)

Cefazolin* plus Vancomycin***

*May substitute cefuroxime for cefazolin; unconfirmed beta-lactam allergy does not preclude the use of cefazolin. For a confirmed beta-lactam allergy, use vancomycin 1.5mg/kg (<120 minutes before the operation) in place of cefazolin and add either gentamicin 5mg/kg, or aztreonam 2 Gm <60 minutes before the operation/incision.

**For vancomycin allergy, may use daptomycin (4mg/kg) in combination with cefazolin (if not beta-lactam allergic) for preoperative prophylaxis. <60 minutes before the operation/incision. If also beta-lactam allergic, use gentamicin 5mg/kg, or aztreonam 2 Gm <60 minutes before the operation/incision in combination with the daptomycin. Vancomycin, daptomycin or gentamicin prophylaxis should not be continued after the operation. Cefazolin and aztreonam should be discontinued within 24-hrs. of the operation.

*** Discontinue if patient experiences any side effects or allergic reaction to mupirocin or chlorhexidine gluconate. For the purposes of this algorithm, CHG bathing does not need to continue post-operatively.

Please contact authors for a supplemental document for additional important information on dosing guidance and mupirocin and chlorhexidine use.
Current SSI prevention flowchart

- Patient evaluated in clinic and found to be surgical candidate
- Patient contacted and scheduled for surgery
- Preoperative appointment with surgeon
- Patient sent for any necessary preop labwork (routine MRSA swab not included)
- Patient called night before surgery by OPS
- Preoperatively, labs reviewed by anesthesia

Patient cleared for surgery by anesthesia

Surgical site prep per surgeon preference

Preoperative antibiotic per surgeon preference

Patient taken to OR

Yes

No

Surgery cancelled
Implementing a bundled SSI Prevention System

Patient evaluated in clinic and found to be surgical candidate → Patient contacted and scheduled for surgery → Preoperative appointment with surgeon → In clinic: MRSA/MSSA nasal culture swab, pre-surgical scrub sent home with patient + labwork → Resident to review labwork, Screened positive for S. Aureus?

Yes → Resident to call Rx for mupirocin per algorithm to patient

No → No additional contact to patient prior to surgery

Screened positive for S. Aureus?

Yes → Resident to call Rx for mupirocin per algorithm to patient

No → No additional contact to patient prior to surgery

Patient clears for surgery by anesthesia?

Yes → Surgery cancelled

No → Patient taken to OR

Patient uses pre-surgical scrub the night before → Surgical site prep with chlorhexadine → Patient screen positive for MRSA or not performed

Yes → Preop antibiotic ancef + vanc (per protocol)

No → Preop antibiotic with ancef

Process Analysis Tools - Flowchart
## Forces to Implementing a SSI Prevention Program

<table>
<thead>
<tr>
<th>Driving Force (Positive)</th>
<th>Force Strength</th>
<th>Restraining Force (Negative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident participation</td>
<td>+5</td>
<td>Time restraints</td>
</tr>
<tr>
<td>Patient safety culture</td>
<td>+4</td>
<td>Following up cultures</td>
</tr>
<tr>
<td>Consistent clinic staff</td>
<td>+3</td>
<td>Not reaching patient</td>
</tr>
<tr>
<td>Support for QI/EBM</td>
<td>+2</td>
<td>Late surgical schedules</td>
</tr>
<tr>
<td>Patient awareness</td>
<td>+1</td>
<td>Additional Work Resentment</td>
</tr>
<tr>
<td>Attending participation</td>
<td>0</td>
<td>Multiple Institutions</td>
</tr>
<tr>
<td>Multidisciplinary QI Team</td>
<td>-1</td>
<td>Patient non-adherence</td>
</tr>
</tbody>
</table>

**Force Field Analysis**

**Process Analysis Tools - Force Field Analysis**
Implementing SSI Prevention Program

**Decision Making Tools - Decision Tree**

- Patient not screened in clinic
- Mupirocin Rx called in
  - Patient takes Rx
  - Patient does not take Rx
- No Rx or pt unavailable
- Mupirocin Rx called in
  - Patient takes Rx
  - Patient does not take Rx
- Results f/u
- Positive Screen
  - No Rx or Pt unavailable
- Negative Screen
  - No Rx or Pt unavailable
- Patient screened in clinic
- No f/u results
- Did not f/u results
- Resident not notified of pt
- Attending notified of pt
- Resident not able to get patient list
  - Resident able to get patient list
  - Attending participates to implement program
- Attending does not participate in program

**Decision Making Tools - Decision Tree**

- SSI prevention algorithm not implemented
  - SSI prevention algorithm not implemented
  - SSI prevention algorithm not implemented
  - SSI prevention algorithm implemented; not recorded
  - Checklist completed at time of operation
  - Checklist not completed
  - Retrospective chart review done
  - Retrospective chart review Not done
  - SSI prevention algorithm implemented; Data avail
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**Ideal SSI algorithm implementation**

**Per SSI algorithm**

- Patient not screened in clinic
- Mupirocin Rx called in
- Results f/u
- Positive Screen
- Negative Screen
- Patient screened in clinic
- No f/u results
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**Ideal SSI algorithm implementation**

**Per SSI algorithm**
Implementing a Program to Decrease Surgical Site Infections
in Total Joint Arthroplasty
Sum of # Compliant / # Potential Compliant p-Chart
Tools used for measurement

- List of all cases provided by the MARC
- Retrospective chart review of all patients to evaluate
  - MRSA prescreen
  - Rxs documented
  - Antibiotics given per anesthesia report at UH
- Weakness of tools
  - Only a portion of cases were done at UH
  - Can not document if chlorohexadine provided
  - Outside records not available
DO: Implementing the Change

9/2014: Orthopedic staff were asked to participate, Patient handouts were provided and medical assistant staff were taught how to do the MRSA nasal swab and to provide the scrub

Problems encountered:
- Staff not wanting to participate
- Lack of follow-up of studies or screening not being completed
Implementing a Program to Decrease Surgical Site Infections in Total Joint Arthroplasty

Sum of # Compliant / # Potential Compliant p-Chart

Program implemented

Month
Mar Apr May Jun Jul Aug Sep Oct

# Compliant - # Potential Compliant

UCL 0.0% 0.0% 5.0% 0.0% 0.0% 4.1% 2.2% 8.9% 32.5% 28.0% 12.4%
CL 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0%
Pre and Post Intervention SSI Rates

- 2.2% infection rate pre intervention in 2014
- Months without surgical site infections = 4 ± 1
- Post intervention 0% infection rate since September 2014, but sample size is small
Return on Investment- Costs to Consider

- Cost nasal mupirocin ~$116.99
- UH MRSA Nasal Screen Culture $110.00
- Vancomycin $4.12/dose, Ancef $3.00/dose
- Hibiclens soap $5.00/bottle
- Number needed to screen 250 to prevent 1 SSI (2)

- Documented Average cost of single SSI $10,000.00-$26,000.00 (1)
- Can only estimate due to patient variability
  - In house days ~$5,000.00
  - Imaging ~$150.00
  - Cost additional surgery ~$5,000.00
  - Antibiotic management ~$3,000.00
  - Additional followup visit ~$2,000.00

Preliminary cost estimate: ~$15,150.00

(2) Lonneke, GM. Et al. Preventing Surgical-Site Infections in Nasal Carriers of Staphylococcus aureus. NEJM. 2010; 361;1
Return on Investment

To prevent one surgical site infection - Based on number needed to screen 250 to prevent 1 SSI:

Savings to hospital:            ~$15,000.00
Additional revenue to hospital: ~$27,500.00
     (includes screening cost)
Cost to hospital:              ~$2,250.00
     (includes hibiclens soap, antibiotic, if not reimbursed)

\[
\text{ROI} = \left( \frac{\text{Saving} + \text{New revenue}}{\text{cost}} \right)
\]

\[
\text{ROI} = \frac{(15,000 + 27,500 - 2250)}{2250}
\]

= +17.89
ACT: Sustaining the Results

• Continue with implementation until data can be analyzed to see if there is a decrease in surgical site infections (~6months)
• Our team will continue to meet monthly and send updates to staff
• If a concomitant decrease in surgical site infections is noted, will discuss changing policy to require implementing this program
Conclusion/What’s Next

- Implementing a program for preoperative antimicrobial prophylaxis to decrease gram-positive surgical site infections for total joint arthroplasties does improve compliance
- QI projects do not always save money
- Change in culture is very difficult
- Further data needs to be collected to complete an in depth cost-benefit analysis of this program
Thank you!