MRSA Prescreening and Eradication: New England Baptist Hospital Experience

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

maureen@workingtowardzero.com
Methicillin-resistant *Staphylococcus Aureus*
S. Aureus

- Most important pathogen in SSI
- Most SSI caused by strains carried by patient into hospital
- Anterior nares main niche
MRSA vs. MSSA

- Infection associated with higher mortality  
  [Melzer et al, Clin Infect Dis 2003]

- Survive in dry conditions & on inanimate surfaces up to 20 days  
  [Clarke et al, Ir Med J 2001]

- Prevalence increasing
History of MRSA

- Resistance to PCN within 1 yr
  - By 1950’s, 3/4 of *S. aureus* strains PCN-resistant
  - Today, 90-95% clinical strains PCN-resistant
- 1959—methicillin (1\textsuperscript{st} antistaph PCN) introduced
  - 1\textsuperscript{st} MRSA strain within 2yrs
  - 60% of clinical *S. aureus* strains isolated from ICU’s are MRSA
Linezolid

- Introduced in 2000 for MRSA

Research letters

Linezolid resistance in a clinical isolate of *Staphylococcus aureus*

Sotirios Tsiodras, Howard S Gold, George Sakoulas, George M Eliopoulos, Christine Wennersten, Lata Venkataraman, Robert C Moellering Jr, Mary Jane Ferraro

—Resistant strain reported within 1 year

[Tsiodras et al, Lancet 2001]
Daptomycin

• Introduced in 2003 for MRSA

Daptomycin-Resistant, Methicillin-Resistant *Staphylococcus aureus* Bacteremia

A. Mangili, I. Bica, D. R. Snydman, and D. H. Hamer*
Division of Geographic Medicine and Infectious Diseases, Department of Medicine, Tufts-New England Medical Center and Tufts University School of Medicine, Boston, Massachusetts

• Resistant strain reported within 2 years

[Mangili et al, Clin Infect Dis 2005]
Vancomycin Resistance

- Recognized after almost 40 yrs

- High level resistance appeared in Detroit in 2002

- 2<sup>nd</sup> strain in Philadelphia
- 3<sup>rd</sup> strain in New York
MIC Creep

- Increases in vancomycin MIC in both MRSA & MSSA over time [Rhee et al, Clin Infect Dis 2005]
- Largest study of >6000 *S. aureus* isolates over 5 yrs in California university hospital
  - Drift towards reduced susceptibility
  - ↑↑ ↑↑ ing percentage of isolates with MIC ≥ 1.0 μg/mL
    - 19.9% in 2000
    - 70.4% in 2004 [Wang et al, J Clin Microbiol 2006]
MIC Creep

- ↑’d vancomycin failure rate in MRSA infections in setting of ↑’d MICs
  - [Sakoulas et al, J Clin Microbiol 2005]
Surgical Site Infection (SSI)

- Increased costs
  - Median hospital stay increased 2 wks
  - Rehospitalization rates doubled
  - Overall costs tripled

[Whitehouse et al, Infect Control Hosp Epidemiol 2002]
Average Cost of a SSI

- Surgical site infection
  - $\sim$25,000\textsuperscript{1}
- Surgical site infection with Staph aureus
  - $\geq$40,000\textsuperscript{2,3}
- Surgical site infection due to MRSA
  - $\geq$100,000\textsuperscript{4}

"We found that patients with surgical-site infections due to MRSA were 35 times more likely to be readmitted and seven times more likely to die within 90 days compared to uninfected surgical patients," Deverick J. Anderson, MD, MPH, infectious diseases specialist at Duke University Medical Center Anderson stated in the release. "These patients also required more than 3 weeks of additional hospitalization and accrued more than $60,000 in additional charges." \textsuperscript{4}

4. www.phc4.org
Risk of SSI Increased in Nasal Carriers

• Nasal carriage only independent risk factor for \textit{S. aureus} SSI in orthopaedic implant surgery
  • Kalmeijer et al, Infect Control Hosp Epidemiol 2000

• SSI rate 2-9x higher in carriers
  • Kluytmans et al, Clin Microbiol Rev 1997
  • Perl et al, Ann Pharmacother 1998
  • Wenzel et al, J Hosp Infect 1995

• In \textit{S. aureus} SSI, \textit{S. aureus} isolates from wound match nares 85\% of time
Risk Factors for S. Aureus SSI

- Observational study of 357 cardiac surgery patients
- 27% nasal carriers
- SSI rate 6.4%
  - S. aureus in 64%
  - 8/16 infections in nasal carriers
- Independent risk factors
  - Diabetes (RR 5.9)
  - Reoperation (RR 3.1)
  - S. aureus nasal carriage (RR 3.1)

[Munoz et al, J Hosp Infect 2008]
Risk of MRSA Nasal Carriage

- Case-control study of 308 vascular surgery pts (nasal swabs)
  - 11.4% MSSA carriers
  - 4.2% MRSA carriers
    - 2.9% on admission
    - 1.3% acquired in hospital
- Transfer from another dept or facility risk factors for MRSA carriage
- **MRSA infection rate**
  - 30.8% in MRSA carriers
  - 0.68% in noncarriers

Environmental Reservoirs

- MRSA infected/colonized pts contaminate rooms, contribute to endemic MRSA
- Prospective study of 25 MRSA pts
- Sampling of isolation rooms
  - 53.6% of surface samples positive
  - 28% of air samples
  - 40.6% of settle plates
- Isolates identical or closely related in 70% of patients

[Sexton et al, J Hosp Infect 2006]
Environmental Reservoirs

Table I

<table>
<thead>
<tr>
<th>Week</th>
<th>Bed</th>
<th>Mattress</th>
<th>Linen</th>
<th>Table</th>
<th>Chair</th>
<th>Window ledge</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25/42 (59.5)</td>
<td>22/42 (52.4)</td>
<td>18/42 (42.9)</td>
<td>28/42 (66.7)</td>
<td>24/41 (58.5)</td>
<td>16/42 (38.1)</td>
<td>133/251 (53)</td>
</tr>
<tr>
<td>2</td>
<td>11/25 (44)</td>
<td>11/25 (44)</td>
<td>11/25 (44)</td>
<td>16/25 (64)</td>
<td>11/25 (44)</td>
<td>8/25 (32)</td>
<td>68/150 (45.3)</td>
</tr>
<tr>
<td>3</td>
<td>6/10 (60)</td>
<td>7/10 (70)</td>
<td>4/9 (44.4)</td>
<td>6/10 (60)</td>
<td>6/10 (60)</td>
<td>5/10 (50)</td>
<td>34/59 (57.6)</td>
</tr>
<tr>
<td>4</td>
<td>7/7 (100)</td>
<td>5/7 (71.4)</td>
<td>4/7 (57.1)</td>
<td>6/7 (85.7)</td>
<td>5/7 (71.4)</td>
<td>7/7 (100)</td>
<td>34/42 (81)</td>
</tr>
</tbody>
</table>

* Sampling was carried out twice weekly where possible and the results from both sets of samples have been aggregated.

[Sexton et al, J Hosp Infect 2006]
Potential Airborne Transmission

Table II  Proportion (%) of air samples and settle plates positive for methicillin-resistant *Staphylococcus aureus* and week of sampling

<table>
<thead>
<tr>
<th>Week</th>
<th>Air samples</th>
<th>Settle plates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38/124 (30.6)</td>
<td>51/125 (40.8)</td>
</tr>
<tr>
<td>2</td>
<td>13/75 (17.3)</td>
<td>23/75 (30.7)</td>
</tr>
<tr>
<td>3</td>
<td>12/30 (40)</td>
<td>16/30 (53.3)</td>
</tr>
<tr>
<td>4</td>
<td>7/21 (33.3)</td>
<td>12/21 (57.1)</td>
</tr>
</tbody>
</table>

* a Sampling was carried out twice weekly where possible and the results from both sets were aggregated.
* b Three samples (1 L) were obtained on each occasion.
* c Plates were placed on the window ledge, locker (bedside table) and floor for 2 h.

[Sexton et al, J Hosp Infect 2006]
Airborne Transmission

- MRSA counts remain elevated for up to 15 minutes after bed making
- Consider air ventilation & filtration
- Keep doors closed

[Shiomori et al, J Hosp Infect 2002]
Inadequate Patient Space

- 18-month prospective study
- Addition of fifth bed to four-bed bay
- ↑’d relative risk of MRSA colonization 315%

[Kibbler et al, J Hosp Infect 1998]
Long-term Care Facilities

- 44% of environmental surfaces tested positive for MRSA

[Asoh et al, Intern Med 2005]
Decolonization of Carriers

- Intranasal mupirocin (Bactroban)
- Eradicates nasal colonization in most patients
- Reduces *S. aureus* infections
Mupirocin and the Risk of S. Aureus (MARS) Study

- University of Iowa
- Prospective randomized double-blind placebo-controlled
- 4020 enrolled, 3864 analyzed
  - Elective cardiothoracic, general, oncologic, gyn, neuro surgery
- Rate of S. aureus SSI (primary endpoint)
  - 2.3% in mupirocin pts
  - 2.4% in placebo pts
- No reduction in rate of S. aureus SSI
  - Among nasal carriers, risk of nosocomial S. aureus infection decreased by half (7.7% to 4.0%)

MARS Study

- Mupirocin nasal swab for up to 5 days
- Chlorhexidine shower for cardiothoracic pts night before & morning of surgery
- Power analysis
  - 4046 pts to detect 50% ↓ in *S. aureus* SSI (estimated reduction of 2.8% (57 pts) to 1.4% (28 pts) with 85% power
- 4030 enrolled, 3551 completed study
  - 82.6% received at least 3 mupirocin doses

MARS Study Infection Rates

- Risk of *S. aureus* infection among nasal carriers cut in half
- *S. aureus* SSI 4.5x higher in carriers receiving placebo
- 84.6% isolates from SSI pts identical between wound & nares
- 39 different strains among 77 patients
- Mupirocin resistance in 6/1021 (0.6%) isolates over 4 yrs
Preoperative Decolonization

- University of Pittsburgh
- Prospective observational study
- Total joint arthroplasty
- 1966 patients
  - 636 screened (nasal)
    - 26% positive for S. aureus (164/636)
    - 23% MSSA (147/636)
    - 3% MRSA (17/636)
  - 1330 control (not screened)

Pittsburgh Protocol

• Decolonization
  • Pts educated 1 wk preop
  • Mupirocin nasal ointment BID x 5 days
  • Chlorhexidine bath QD x 5 days
Pittsburgh Results

Preintervention: October 2004-05

<table>
<thead>
<tr>
<th>Infection rates</th>
<th>MSSA</th>
<th>MRSA</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Deep</td>
<td>0</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

Intervention: October 2005-06

<table>
<thead>
<tr>
<th>Infection rates</th>
<th>MSSA</th>
<th>MRSA</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Deep</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

A

- Superficial: 11/741 = 1.4%
- Deep: 9/741 = 1.2%
- Total: 20/741 = 2.6%

B

- Superficial: 5/636 = 0.8%
- Deep: 4/636 = 0.6%
- Total: 9/636 = 1.4%
Pittsburgh Results

Table 2. Staphylococcus aureus (S. aureus) surgical site infections (SSIs) in patients with nasal cultures confirmed (intervention group) or assumed (concurrent control group) to be positive for S. aureus

<table>
<thead>
<tr>
<th>Patient group</th>
<th>Number of SSIs/Number of patients</th>
<th>Infection rate %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>0/164</td>
<td>0</td>
</tr>
<tr>
<td>Concurrent control</td>
<td>12/345</td>
<td>3.5*</td>
</tr>
</tbody>
</table>

*p = 0.016 (equal variances assumed; 99% confidence interval).

- No increase in infection from other pathogens
- Estimated economic gain of $231,741/yr
In Conclusion

- Staph aureus and MRSA are the most important pathogens in surgical site infection and most infections are caused by bacteria carried by patients when they enter the hospital.
- Prevalence of MRSA is increasing, and severity of MRSA-associated infections is worsening.
- SSI dramatically increases cost of care, often without commensurate insurance reimbursement.
- Rapid PCR-based testing for MRSA during routine pre-admission screening allows early detection of carriers and successful eradication of MRSA through treatment resulting in significant reduction in surgical site infection.
The Implementation Process
New England
Baptist Hospital

- 150-bed adult medical/surgical hospital located in Mission Hill area of Boston
- Orthopaedic subspecialty hospital & “Center of Excellence”
  - Acute inpatient discharges:
    - 75% Orthopedic
    - 8% General Surgery
    - 17% Medical
- Orthopaedic Surgery ~ 12,000/cases a year
  - >4700 total joints
  - >1500 spine
  - >3600 other (foot, shoulder, etc)
  - > 3100 outpatient
Massachusetts Health Data Consortium

- There are 36 inpatient orthopedic surgical DRGs
  - NEBH is the market leader in 5 of the 10 most complex DRGs.

- NEBH dominates the market in joint replacement and spinal surgery
Massachusetts Health Data Consortium
Orthopedic Surgery Discharges

Source: FY08 MHDC Database
The inpatient orthopedic surgical market is growing and will continue – due to:

- Demographics – older population and more active lifestyles
- The emergence of new procedures (including minimally invasive surgery and artificial discs)
- Greater penetration of existing technologies
- Increase in the most complex DRGs

Orthopedic Surgical Site Infection

- Orthopedic Total Joint Infections:
  - 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 THE SURGEON
Why NEBH Implemented
An Eradication Program

Reason #1:
Increase in MRSA in Community

- Continued increase in community-acquired MRSA cases being admitted to NEBH
Reason #2

- FY05 - 49 surgical site infections (SSI) in 9216 orthopedic surgeries (0.5%)
- FY06 – 46 SSI in 8986 (0.5%)
  - Very low rates since the NHSN national overall rate for orthopedic surgery is 1.25%

However, 8 patients in end of FY05 and 5 in beginning of FY06 developed a surgical site infection with secondary bacteremia post discharge.
  - Bacteremia is associated with an increase in morbidity and mortality
Staph aureus and MRSA Secondary Bacteremias Associated with Surgical Site Infections
In October 2005

- 27 Staph aureus isolates (17 MSSA and 10 MRSA) were sent to the Mayo Clinic for pulsed field gel electrophoresis
- These included 15 healthcare acquired strains and 12 community-acquired strains

Purpose: To determine if we were experiencing a point source outbreak related to SSI with bacteremia

Results: 6 of 27 strains had similar number and size of bands

- 3 were community-acquired strains and 3 nosocomial
- The 3 healthcare acquired cases were unrelated in terms of time, person and place

Conclusion: not a point source outbreak
The Infection Control Committee recommended implementation of an MSSA/MRSA eradication program:
- to reduce nasal colonization in patients scheduled for inpatient surgery
- and treat MRSA positive screens with Vancomycin for surgical prophylaxis

Administrative support was elicited from the Board of Trustees to fund a program:
- included nasal screens with rapid polymerase chain reaction (PCR) technology, which enabled 1-hour results for MRSA and one day for MSSA.
Senior VP Patient Care Services

- Researched MRSA problem and developed a “White Paper”
- January 2006 - prepared a letter to the Infection Control Committee regarding eradicating MRSA in all surgeries
- February 2006 – conducted an anonymous active surveillance culture study in the operating room
- February 2006 – prepared three testing proposals with budgetary cost for Board of Trustees
  - traditional 3 day culture process for results
  - PCR rapid test – purchasing equipment
  - PCR rapid test – leasing equipment
February 2006
Anonymous Nares Cultures
(no names or entry into lab system)

133 patients
Obtained nasal cultures
Purpose: to determine pre-op
MRSA and MSSA colonization

Results:
38 – *Staph aureus* (29%)
*5 - MRSA* (4%)
*all undiagnosed and no precautions used in OR, postop nursing unit

All received Cefazolin for Surgical Prophylaxis
Board Approved Implementation
Task Force Established March 2006

• **Purpose:**
  • Reduce post-operative wound infections
  • Eradicate methicillin-resistant *S aureus* (MRSA)
    and methicillin-sensitive *S aureus* (MSSA) nasal colonization

• **Goal - For Inpatient surgery**
  • Nasal screens in pre-admission testing process
  • Administer a decolonization treatment
  • Adjust peri-operative antibiotics
Screening Proposals

- **February 2006** – prepared three screening proposals with costs
  1) Traditional nasal cultures - 3 day results
     $245,000.00
  2) Lease rapid PCR equipment
     $259,990.00
  3) **Purchase rapid PCR equipment**
     $337,338.00

- **March 2006** – Board approval of equipment purchase
Estimated Cost of the MRSA/MSSA Program

- >$400,000 implementation cost:
  - ~$100,000 for 2 full-time positions:
    - Microbiologist and PASU Medical Technician
  - ~$100,000 PCR rapid test equipment
  - ~$40.00/test x ~ 6,000 inpatient surgeries
    - ~ $240,000
  (compared to an MRSA culture ~ $20.00)
MRSA Reimbursement Code  
as of April 2009

<table>
<thead>
<tr>
<th>CPT Code</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>87081 Rule Out Cx</td>
<td>$28.00</td>
</tr>
<tr>
<td>87641 MRSA by PCR</td>
<td>$110.00</td>
</tr>
</tbody>
</table>

**as of 4/30/09**

<table>
<thead>
<tr>
<th>Coverage</th>
<th>Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC Indemnity</td>
<td>$76.13</td>
</tr>
<tr>
<td>Tufts</td>
<td>$62.39</td>
</tr>
<tr>
<td>Blue Care Elect</td>
<td>$55.42</td>
</tr>
<tr>
<td>HMO Blue</td>
<td>$53.20</td>
</tr>
<tr>
<td>HPHC</td>
<td>$49.49</td>
</tr>
<tr>
<td>Medicare</td>
<td>$38.03</td>
</tr>
<tr>
<td>Medicaid</td>
<td>$27.17</td>
</tr>
<tr>
<td>United Healthcare</td>
<td>$82.01</td>
</tr>
</tbody>
</table>
Implementation Steps

- March – October 2006
  - weekly meetings with surgical services, infection control, micro, administration, and medical staff members
- July 2006 – letter to all surgeons
- July 17, 2006 – initiated pilot on Spine Service
- August 2006 - presentation to the Healthcare Quality - Patient Care Assessment Committee
- August 2006 – letter to all medical staff
- August 2006 – letter to OR Scheduling
- September 2006 – initiated program for all inpatient surgeries
Policy and Procedure

Developed procedural steps for departments and units affected by the implementation

- Patient Access
- Operating Room Schedulers
- Pre-admission screening Unit (PASU)
- Pre-surgical unit (Bond Center)
- Operating Room
- Post Anesthesia Care Unit
- Nursing Units
- Microbiology Lab
- Ancillary Departments: Housekeeping, Central Transport
Implementation Steps

- May 2006 - Microbiology Lab
  - Purchased rapid polymerase chain reaction equipment
  - Hired a full-time technologist
- June 2006 - The prescreening unit (PASU)
  - Hired a full-time medical technician to
    - obtain nasal screens
    - provide patient education
    - conduct telephone surveys for treatment compliance
    - arrange follow-up MRSA screens
    - notify surgeons and others of positive screens
Lessons we learned

- Revisit screening process every six months
- Ongoing education with staff and physicians
- Establish early in your project educational materials for patient and family members
- Senior leadership involvement from the beginning is key
The Testing Process
Testing and Lab Process

- Sheep Blood Agar and a CNA plate inoculated for culture with the swabs.
- One swab is used for MRSA PCR testing
- MRSA positives - automatically broadcast to PASU
- MSSA - cultures read the next morning and then broadcast to PASU.
Lab Challenges

- Instructing staff on how to obtain a nares specimen with proper swabs
- Lab differentiation of the colonized screens from routine cultures.
- Molecular lab up and running in a short time frame with cross-training of staff
- Reporting system for positive results
PCR Equipment

• May 2006
  Cepheid’s *SmartCycler*

• June 2007
  Cepheid’s *GeneXpert*
Validation

- **Smart Cycler:**
  - First 100 PCR samples were also screened by conventional culture for MRSA

- **GeneXpert:**
  - 75 samples were run on both the *Smart Cycler* and the *GeneXpert*
    - PASU collected two sets of swabs - using the *Smart Cycler* swabs and the *GeneXpert* swabs.
Lesson Learned......

- You can bring up molecular testing in a very short time frame.
- You need to work closely with the IS department and nursing.
- By moving from the Smart Cycler to the GeneXpert we have been able to run the test 7 days per week on all three shifts. The testing in more expensive but, allows for rapid turn around time with less tech time.
- We now know a lot more about Mec A genes and SCC cassettes.
Pre-admission Testing

- Pre-admission Screening Unit (PASU) obtains screen
  - A double swab is used to collect a nares sample.
- Patient receives education:
  - brochure on MRSA and MSSA
  - instruction sheet on what to do if positive
  - hand hygiene brochure
  - a prescription for Bactroban is called to Pharmacy by Nurse Practitioner
- Patient is instructed to purchase a large bottle of Hibiclens to shower daily while applying Bactroban ointment
NEBH STAPH AUREUS AND MRSA ERADICATION PROGRAM

PRESCREENING UNIT (PASU)

Patient is screened for Staph aureus and Methicillin-resistant Staph aureus (MRSA)

- **Staph aureus**
  - Treated with 2% mupirocin (Bactroban) for five days and five days of body bathing with chlorhexidine (eg Hibiclens)
  - No further screens or precautions are necessary

- **MRSA +**
  - Flagged in Meditech as MRSA-SCR
  - Placed on the MRSA list on N Drive
  - Treated with 2% mupirocin (Bactroban) for five days and five days of body bathing with chlorhexidine (eg Hibiclens)
  - Second nasal screen obtained before surgery

- **MRSA -**
  - MRSA-SCR flag is removed from Meditech
  - Vancomycin administered as surgical prophylaxis – prepared in Bond Center one hour before surgery
  - No precautions or additional nasal screens are necessary

- **MRSA +**
  - MRSA-SCR flag changed to MRSA
  - Vancomycin administered as surgical prophylaxis – prepared in Bond Center one hour before surgery
  - Contact Precautions are implemented and used throughout the hospitalization
  - Three negative cultures required to be removed from precaution list
Teamwork

- Microbiology, PASU, Infection Control, Surgical Services, Nursing, Pharmacy and Information Systems are all involved with the MRSA eradication process.
- PASU – obtaining screens and delivering to Microbiology Lab in a timely fashion
- Microbiology – results to PASU as soon as they are available.
- Information Systems - setting up systems for automatic broadcasting
- Nursing - make sure the correct swabs are used
- Infection Control – weekly notification to surgical services of MRSA colonized or infected patients on the surgical schedule
Lessons Learned.....

- Keys to success
  - Education
  - Communication
MRSA and Staph Aureus Eradication Results
First Year Data Analysis

- FY06 October 1, 2005 – July 16, 2006
- FY07 July 17, 2006 – September 30, 2007
<table>
<thead>
<tr>
<th>Time Period</th>
<th>Inpatient surgeries</th>
<th>Surgical Infections</th>
<th>Infec. Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY06</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/01/05-07/16/06</td>
<td>5293*</td>
<td>24</td>
<td>0.45%</td>
</tr>
<tr>
<td>FY07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07/17/06-09/30/07</td>
<td>7019**</td>
<td>13</td>
<td>0.18%</td>
</tr>
</tbody>
</table>

*historical controls

**screened inpatient surgeries
61% Reduction in MRSA/MSSA Infection Rate
60% Reduction in MRSA SSI

50% Reduction in MSSA SSI
Surgical Site Infections

- MRSA colonized patients had an increased risk of SSI
- Seven (7) *Staph aureus* infections in 2712 positive patients 0.26%
- Seven (7) MRSA infections in the 507 positive patients 1.38%
- Statistically significant difference $p<=.05$
MRSA/MSSA Eradication Results

From July 17, 2006 through September 2010

26,065 patients screened

- 5988 (23%) positive for *Staph aureus*
- 1027 (4%) positive for MRSA

- Repeat nasal screens on MRSA patients revealed 77% eradication
## % MRSA and *Staph aureus SSI*

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Inpatient surgeries</th>
<th># 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>5293*</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>7019</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>6323</td>
<td>7</td>
<td>0.11%</td>
</tr>
<tr>
<td><strong>FY09</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/01/08-09/30/09</td>
<td>6364</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>6437</td>
<td>7</td>
<td>0.11%</td>
</tr>
</tbody>
</table>

*historical controls*
## % MRSA SSI in Screened Patients

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Inpt surgeries</th>
<th># MRSA SSI</th>
<th>MRSA %</th>
<th>#Infect/#MRSA+</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/01/05-07/16/06</td>
<td>5293*</td>
<td>10 (NA)</td>
<td>0.19%</td>
<td>NA</td>
</tr>
<tr>
<td>FY07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07/17/06-09/30/07</td>
<td>7019</td>
<td>3 (3+)</td>
<td>0.04%</td>
<td>3/ 309 (0.97%)</td>
</tr>
<tr>
<td>FY08</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/01/07-09/30/08</td>
<td>6245</td>
<td>4 (2+)</td>
<td>0.06%</td>
<td>2/242 (0.83%)</td>
</tr>
<tr>
<td>FY09</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/01/08-09/30/09</td>
<td>6366</td>
<td>6 (2+)</td>
<td>0.09%</td>
<td>2/234 (0.85%)</td>
</tr>
<tr>
<td>FY10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10/01/10-09/30/10</td>
<td>6437</td>
<td>1 (1+)</td>
<td>0.01%</td>
<td>1/266 (0.37%)</td>
</tr>
</tbody>
</table>
### % Staph aureus (MSSA) SSI in Screened Patients

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Inpt surg</th>
<th># MSSA SSI</th>
<th>MSSA %</th>
<th>#MSSA Infections/# MSSA +</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY06 10/01/05-07/16/06</td>
<td>5293*</td>
<td>14 (NA)</td>
<td>0.26%</td>
<td>NA</td>
</tr>
<tr>
<td>Screened Patients FY07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07/17/06-09/30/07</td>
<td>7019</td>
<td>3 (3+)</td>
<td>0.04%</td>
<td>3/1588 (0.19%)</td>
</tr>
<tr>
<td>FY08 10/01/07-09/30/08</td>
<td>6245</td>
<td>3 (1+)</td>
<td>0.05%</td>
<td>1/ 1422 (0.07%)</td>
</tr>
<tr>
<td>FY09 10/01/08-09/30/09</td>
<td>6364</td>
<td>5 (3+)</td>
<td>0.08%</td>
<td>3/1403 (0.21%)</td>
</tr>
<tr>
<td>FY10 10/01/10-09/30/10</td>
<td>6437</td>
<td>6 (1+)</td>
<td>0.09%</td>
<td>1/1450 (0.06%)</td>
</tr>
</tbody>
</table>
Orthopedic Service - Infection Rates - Date of Onset

Instituted AMD Gauze and Standardized dressing technique

MRSA/MSSA Eradication Program

Antibacterial sutures

Increase in Lami infections due to locally administered steroids

Chloroprep

Increase in total knee infections – due to improper use of needles for OR meds

Post-op hematomas being investigated
Locally Administered Steroids - Depomedrol

- Methylprednisolone acetate may be used to reduce pain and enhance recovery after lumbar
- Case control study of 203 patients of whom 55 had an infection documented.
- Results showed a higher risk of infection in both diabetic and obese patients undergoing spinal surgery.
- Results showed an associated 7 fold risk of infection in patients who received local steroids.
- FY 2007 there were 12 SSI/892 laminectomy (1.3%) Stopped routine use of depomedrol in September 2007
- FY08 there were 4 SSI/868 laminectomy (0.46%)
- FY09 -there were no laminectomy SSI

Spencer, M et al – SHEA Abstract 265 – March 2009
## NEBH Journey to Work Toward Zero
### 2003 – 2010
(outpatient and inpatient infections)

### GENERAL SSI

<table>
<thead>
<tr>
<th></th>
<th>FY03</th>
<th>FY04</th>
<th>FY05</th>
<th>FY06</th>
<th>FY07</th>
<th>FY08</th>
<th>FY09</th>
<th>FY10</th>
</tr>
</thead>
<tbody>
<tr>
<td># Infections</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td># Procedures</td>
<td>1073</td>
<td>920</td>
<td>780</td>
<td>692</td>
<td>567</td>
<td>467</td>
<td>425</td>
<td></td>
</tr>
<tr>
<td>Infection Rate</td>
<td>0.6</td>
<td>0.1</td>
<td>0.4</td>
<td>0.5</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>0</td>
</tr>
</tbody>
</table>

### ORTHOPEDIC SSI

<table>
<thead>
<tr>
<th></th>
<th>FY03</th>
<th>FY04</th>
<th>FY05</th>
<th>FY06</th>
<th>FY07</th>
<th>FY08</th>
<th>FY09</th>
<th>FY10</th>
</tr>
</thead>
<tbody>
<tr>
<td># Infections</td>
<td>63</td>
<td>60</td>
<td>49</td>
<td>46</td>
<td>39</td>
<td>37</td>
<td>28</td>
<td>32</td>
</tr>
<tr>
<td># Procedures</td>
<td>8837</td>
<td>9669</td>
<td>9216</td>
<td>8986</td>
<td>9027</td>
<td>8884</td>
<td>8890</td>
<td>9839</td>
</tr>
<tr>
<td>Overall Infection Rate</td>
<td>0.7</td>
<td>0.6</td>
<td>0.5</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>#Hip Infections</td>
<td>14</td>
<td>5</td>
<td>4</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Hip Prosthesis Rate</td>
<td>1.0</td>
<td>0.3</td>
<td>0.2</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.5</td>
<td>0.4</td>
</tr>
<tr>
<td>#Knee Infections</td>
<td>21</td>
<td>14</td>
<td>11</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Knee Prosthesis Rate</td>
<td>1.6</td>
<td>1.0</td>
<td>0.7</td>
<td>0.4</td>
<td>0.3</td>
<td>0.5</td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>#Laminectomy Infec.</td>
<td>6</td>
<td>9</td>
<td>7</td>
<td>7</td>
<td>12</td>
<td>4</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Laminectomy Rate</td>
<td>0.7</td>
<td>0.9</td>
<td>0.6</td>
<td>0.8</td>
<td>1.3</td>
<td>0.5</td>
<td>0.0</td>
<td>0.5</td>
</tr>
<tr>
<td>#Spinal Fusions Infec.</td>
<td>5</td>
<td>15</td>
<td>12</td>
<td>12</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Spinal Fusion Rate</td>
<td>0.8</td>
<td>2.0</td>
<td>1.4</td>
<td>1.1</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Other infections</td>
<td>17</td>
<td>15</td>
<td>13</td>
<td>12</td>
<td>10</td>
<td>6</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Other infection rate</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tools for Success

• Senior leadership and Board of Trustees involvement – “lead the effort” from top down
• Structured program with clearly defined goal of zero tolerance for HAIs
• Communication – effective and consistent
• Ongoing and creative education
• Financial support to Infection Control program
Thank You