Infection Prevention: Where Are We Going and Where Have we Been?

Gonzalo Bearman MD, MPH
Associate Professor of Medicine, Epidemiology and Community Health
Associate Hospital Epidemiologist
Virginia Commonwealth University

VCU Medical Center
Virginia Commonwealth University
Hospital Acquired Infections

- 5-10% of patients admitted to acute care hospitals acquire infections
  - 2 million patients/year
  - ¼ of nosocomial infections occur in ICUs
  - 100,000 deaths/year
  - Attributable annual cost: $4.5 – $5.7 billion
    - Cost is largely borne by the healthcare facility not 3rd party payors
- 70% are due to antibiotic-resistant organisms
- Invasive devices are more important than underlying diseases in determining susceptibility to nosocomial infection

Infection Prevention Timeline

Big Bang
10 billion-20 billion years ago

Many uneventful years elapse

Hotel-Dieu:
Paris hospital founded in the 7th century

Circa 600 AD
History: Florence Nightingale and Louis Pasteur, Ignaz Semmelweis

1800s: Importance of unsanitary hospital conditions and post operative complications

Developed the germ theory of disease in the late 1800s

1800s: Importance of Hand washing with chlorinated lime
Infection Control Timeline: The Modern Era

First antibiotics, sulfonamides & penicillin, developed in the late 1930s

Robert Haley, MD
1970’s SCENIC Study
Hospitals with active infection control programs have a 32% lower incidence of nosocomial infections

R.P Wenzel MD, MSc
1980: Founded Society of Healthcare Epidemiology; applied epidemiologic techniques to infection control
Infection Control Timeline: *The Modern Era*

2000-: Enhanced Public Awareness of HAIs by:
- CMS
- Joint Commission
- National Quality Foundation
- National Patient Safety Foundation
- Institute for Healthcare Improvement
- Consumer groups
- Politicians and legislatures
Status of Mandatory Reporting Legislation for Nosocomial Infections

Healthcare-Associated Reporting Laws and Regulations

- States with study laws
- Mandates public reporting of infection rates
- Mandates reporting only to state government
- Voluntary

Source: APIC, February 2008
2009: JCAHO NPSG GOAL 7

• Reduce the risk of health care-associated infections:
  – Meeting Hand Hygiene Guidelines
  – Sentinel Events Resulting from Infection
  – Preventing Multi-Drug Resistant Organism Infections
  – Preventing Central-Line Associated Blood Stream Infections
  – Preventing Surgical Site Infections

Many infections are inevitable, although some can be prevented.

Each infection is potentially preventable unless proven otherwise.

“Zero tolerance” is quickly becoming the new watchword in infection prevention, as the concept of striving for zero infiltrates U.S. hospitals…….
### Can We Really Get to Zero?

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria Fraser</td>
<td>Zero: What is it and How Do We Get There?</td>
</tr>
<tr>
<td>Washington University</td>
<td></td>
</tr>
<tr>
<td>St. Louis, Missouri</td>
<td></td>
</tr>
<tr>
<td>Chelsey Richards</td>
<td>Getting to Zero: An Emerging Policy Framework for the Elimination of HAIs</td>
</tr>
<tr>
<td>CDC</td>
<td></td>
</tr>
<tr>
<td>Atlanta, Georgia</td>
<td></td>
</tr>
<tr>
<td>Michael Edmond</td>
<td>Getting to Zero: Is it Safe?</td>
</tr>
<tr>
<td>VCUMC</td>
<td></td>
</tr>
<tr>
<td>Richmond, VA</td>
<td></td>
</tr>
</tbody>
</table>

Opening Plenary Session: SHEA Annual Meeting, Orlando 2008
The existence and dissemination of evidence based recommendations has been insufficient to ensure that evidence based infection prevention be practiced.
How Active Resisters and Organizational Constipators Affect Health Care-Acquired Infection Prevention Efforts

• Qualitative study
• In-depth phone and in-person interviews conducted with 86 participants from 14 hospitals
  – Chief executive officers, chiefs of staff, hospital epidemiologists, infection control professionals, intensive care unit directors, nurse managers, and frontline physicians and nurses

How Active Resisters and Organizational Constipators Affect Health Care-Acquired Infection Prevention Efforts

• Study identified pervasiveness of:
  – “Active resisters”—hospital personnel who vigorously and openly opposed various changes in IC practice
  – “Organizational constipators”—mid to high level executives who act as *insidious* barriers to change

• Active resisters and constipators were identified in all hospitals surveyed

Strategies for Reducing HAIs

• Increased focus on the mechanics of HAI prevention has resulted in
  – Culture change in many institutions
  – IP becoming more multidisciplinary and team based
  – Greater administrative support and accountability
  – Effective championing by engaged and respected change agents

• Promote the implementation of infection prevention best practices
Strategies for Reducing HAIs

- Enhanced transparency of reporting HAI rates
  - Feedback to management and frontline providers
- Implementation of multiple evidence based interventions- ‘bundles’
- Evidence based policies
- Procedures with checklists
  - CVC insertion bundle
- Monitoring tools for compliance assessment and feedback
  - Feedback to management and frontline providers
Prevention of Nosocomial BSIs
Hopkins Model (Central Line Bundle)

• Creation of a central line insertion cart
• Use of a insertion checklist to ensure:
  – Hand hygiene prior to the procedure
  – Sterile gloves, gown, mask, cap, full-size drape
  – Chlorhexidine skin prep of the insertion site
  – Use of subclavian vein as the preferred site
• Bedside nurse empowered to stop the procedure if a step is missed
• Ask every day during rounds whether catheters can be removed

Practice Standardization Leads to Major Reduction in ICU CLABSIIs

BSIs/1,000 catheter days

Surgical ICU at Johns Hopkins Hospital

0 10
7.7

ICUs at 103 Michigan hospitals

0 18
1.4


CLABSI Prevention

- Catheter-related bloodstream infections are expensive and result in significant morbidity and mortality
- Simple, inexpensive, and evidence-based interventions to reduce these infections are effective
- Broad use of these interventions could significantly reduce cost, morbidity and mortality
Chlorhexidine Impregnated Sponges

http://www.uwhealth.org/images/ewebeditpro/uploadimages/Piccbiopatchstat.jpg
Chlorhexidine Impregnated Sponges

- Randomized, blinded controlled trial conducted in 7 French ICUs
- Adults with arterial catheter, CVC or both for 48 hours or longer
- CHGIS vs standard dressings (controls) with scheduled change of unsoiled adherent dressings every 3 vs every 7 day
- Outcome CR-BSI and colonization rate between CHGIS vs controls at 3- vs 7-day dressing changes

Timsit JF et al. JAMA 2009 Mar 25;301(12):1231-41.
Chlorhexidine Impregnated Sponges

• Use of CHGIS dressings with intravascular catheters in the intensive care unit reduced CR-BSIs even when background infection rates were low
  – 0.6/1000 DD vs 1.4/1000 DD
    • (HR 0.39 95%CI 0.17 vs 0.93)
• Reducing the frequency of changing from every 3 days to every 7 days appeared safe

Timsit JF et al. JAMA 2009 Mar 25;301(12):1231-41.
Patient Skin Decolonization with Clorhexidine

• 4% chlorhexidine whole-body washing and *A. baumannii* skin colonization and infection among patients in a medical ICU
  – Daily whole-body disinfection with 4% CG significantly reduced *A. baumannii* colonization and infection
  • *A. baumannii*-BSIs decreased from:
    – 4.6 to 0.6 per 100 patients (P ≤ 0.001)

Head of Bed Elevation in VCU Medical ICU: Effect of Feedback

Percent Compliance

Q1-04: 26
Q2-04: 79
Q3-04: 96
Q4-04: 99
Q1-05: 99

Baseline; no feedback

Performance feedback quarterly

Head of Bed Elevation in VCU Medical ICU: Effect of Feedback

Baseline; no feedback

Performance feedback quarterly

Slide: courtesy of MB Edmond MD, MPH, MPA
Prevention of Nosocomial UTIs

• Avoid catheter when possible & discontinue- **MOST IMPORTANT**
• Aseptic insertion by trained HCWs
• Maintain closed system of drainage
• Ensure dependent drainage
• Minimize manipulation of the system
• Silver coated catheters

Lo, E et al. *Infect Control Hosp Epidemiol* 2008; 299;supplement 1
Catheter Associated UTI

• Implement an organization-wide program to identify and remove catheters that are no longer necessary
  – Daily review of the necessity of continued catheterization

• Electronic or other types of reminders
  – Automatic stop orders requiring renewal of the order

Lo, E et al. Infect Control Hosp Epidemiol 2008; 299;supplement 1
Much Cleaner Cuts

PROBLEM: Infection related to surgery • PROPOSAL: Better use of antibiotics, don’t shave with razor prior to surgery, tighten control of blood sugar • POSSIBLE LIVES SAVED: 8,000

A hospital is a risky place for people who have had surgery. No matter how much antibacterial solution is painted on before the first cut, opening the body invites lurking microbes. Infections at the surgery site complicate an estimated 780,000 operations a year, or more than 1 in every 40 procedures. For abdominal surgery, the likelihood is as high as 1 in 5. And the complications are tough to treat. Infected patients are two to three times more likely to die and are hospitalized an average of seven days longer than uninfected patients who had the same operation. Even before the 100K campaign got underway, IHI had been working with a group of 56 hospitals on strategies to lower the rate of surgical-site infections. Results of the yearlong effort, published last month in the American Journal of Surgery, showed a re-

**SCIP**
Surgical Care Improvement Project

- A national partnership of organizations to improve the safety of surgical care
- Goal: reduce surgical complications 25% by 2010
- Initiated in 2003 by CMS & CDC
  - Steering committee of 10 national organizations
  - >20 additional organizations provide technical expertise
- Strategy: Surgeons, anesthesiologists, periop nurses, pharmacists, infection control professionals, & hospital executives work together to improve surgical care
# SCIP Infection Prevention Measures

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Perioperative antibiotic prophylaxis</td>
</tr>
<tr>
<td></td>
<td>Antibiotic given within 1 hour prior to incision</td>
</tr>
<tr>
<td>2</td>
<td>Appropriate antibiotic selected</td>
</tr>
<tr>
<td>3</td>
<td>Antibiotic discontinued within 24 hrs of surgery end time (48 hrs for cardiac surgery)</td>
</tr>
<tr>
<td>4</td>
<td>Glycemic control</td>
</tr>
<tr>
<td></td>
<td>Cardiac surgery patients with 6 AM glucose ≤ 200 mg/dL on postop day 1 &amp; 2</td>
</tr>
<tr>
<td>5</td>
<td>Appropriate hair removal</td>
</tr>
<tr>
<td></td>
<td>No hair removal, or hair removal with clippers or depilatory</td>
</tr>
<tr>
<td>6</td>
<td>Normothermia</td>
</tr>
<tr>
<td></td>
<td>Colorectal surgery patients with T ≥ 96.8°F within the first hour after leaving the OR</td>
</tr>
<tr>
<td>7</td>
<td>Perioperative β-blockers</td>
</tr>
<tr>
<td></td>
<td>Patients on a β-blocker prior to admission who received a β-blocker 24 hrs prior to incision through discharge from PACU</td>
</tr>
<tr>
<td>8</td>
<td>DVT prophylaxis</td>
</tr>
<tr>
<td></td>
<td>Patients with recommended DVT prophylaxis ordered during the admission</td>
</tr>
<tr>
<td>9</td>
<td>Patients who received appropriate DVT prophylaxis within 24 hours prior to <em>Surgical Incision Time</em> to 24 hours after <em>Surgery End Time</em></td>
</tr>
</tbody>
</table>
Watching Them Wash: A Hand Hygiene Observation Program

• Team of roving observers (students)
• Observations across ICUs and Wards
• Each observer was trained to minimize inter-observer variability
• Data reviewed for one year of observation
• Overall program cost calculated

## Watching Them Wash: A Hand Hygiene Observation Program

<table>
<thead>
<tr>
<th>Healthcare worker</th>
<th>Total number of observations</th>
<th>% compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse</td>
<td>25,234</td>
<td>87.4%</td>
</tr>
<tr>
<td>Physician</td>
<td>4,511</td>
<td>66.3%</td>
</tr>
<tr>
<td>Radiology technician</td>
<td>314</td>
<td>67.8%</td>
</tr>
<tr>
<td>Respiratory therapy</td>
<td>829</td>
<td>87.5%</td>
</tr>
<tr>
<td>Physical therapy</td>
<td>245</td>
<td>86.5%</td>
</tr>
<tr>
<td>Other</td>
<td>1,267</td>
<td>81.7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>32,400</strong></td>
<td><strong>84.0%</strong></td>
</tr>
</tbody>
</table>

Watching Them Wash: A Hand Hygiene Observation Program

- Assessing hand hygiene compliance is important in any infection control program.
- A hand hygiene observation program can be cost-effective and generate important data.
- Using dedicated compliance monitors who are student workers allowed us to accrue large numbers of observations while keeping costs low.
  - $21,252 dollars or $0.66 per observation made

Urinary Tract Infections

Bloodstream Infections

Ventilator-Associated Pneumonia

Number of cases
2004 2005 2006 2007 2008

Deaths
$419,000 152 28

TOTAL
$49,000 0 1 4

UTI
$100,000 80 5

Pneumonia
$270,000 72 9

Estimated Impact of Infections
Defini

Assumptions:
• Each bloodstream infection on average adds 8 hospital days & $30,000 to cost of care;
20% of patients die as a direct result of the bloodstream infection
• Each case of ventilator-associated pneumonia on average adds 16 hospital days & $20,000 to cost of care; 15% of patients die directly as a result of the pneumonia
• Each urinary tract infection on average adds $700 to cost of care

Impact of Infections Acquired in MRICU, January – December 2007

Number of infections
Deaths Extra hospital days Extra cost
Bloodstream 9 2 72 $270,000
Pneumonia 5 1 80 $100,000
UTI 14 0 0 $49,000
TOTAL 28 3 115 $419,000

C-H-E-C-K It Every Day:

- Complete the insertion checklist with every central line placement
- Hand hygiene before & after patient contact
- Ensure that catheter dressings are dry & intact
- Check to see if devices can be removed
- Keep the head of bed up & the foley bag down below the level of the bladder

Device Utilization Ratios

MRSA Infections

Infection Control
828-2121
Bare Below the Elbows for Inpatient Care

- Mandate across UK hospitals
- Recommended practice at VCU MC
- Ensure good hand and wrist washing

short sleeves, no wrist watch, no jewelry avoidance of ties when carrying out clinical activity
An In vitro Model of Lab Coats in the Transmission of Nosocomial Pathogens

- **MRSA, VRE** and pan-resistant *Acinetobacter* (PRA) serially diluted and inoculated onto swatches of a clean laboratory coat
- Sanitized pigskin samples were then rubbed across the inoculated swatches
- The pigskin was inoculated on selective media to determine if the MDR organism could be re-isolated

An *In vitro* Model of Lab Coats in the Transmission of Nosocomial Pathogens

<table>
<thead>
<tr>
<th></th>
<th>Dilution of organisms with Growth on Pig Skin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>MRSA</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>+</td>
</tr>
<tr>
<td>VRE</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>+</td>
</tr>
<tr>
<td>PRA</td>
<td>+</td>
</tr>
</tbody>
</table>
An In vitro Model of Lab Coats in the Transmission of Nosocomial Pathogens

• Pathogens can be transferred from lab coat to skin in vitro
• Lab coats represent a potential transmission risk
• Our study supports the British ban on lab coats in the healthcare setting
• VCU now recommends that HCWs not wear lab coats or neckties and adhere to “bare below the elbows” in the inpatient setting
• Further research is needed to determine the impact of “bare below the elbows.”

Three easy steps to prevent infection:

1. Bare below the elbows
   • No lab coats
   • No neck ties
   • No long sleeves
   • No wristwatch or bracelets

2. Wash up
   • Wash hands with soap & water or use alcohol foam before & after patient contact

3. Wipe down
   • Wipe down your stethoscope with an antiseptic wipe or alcohol pad after each use
Contact Precautions for drug resistant pathogens

Gowns and gloves must be worn upon entry into the patient’s room

Visitors: Report to nurse before entry

Handwashing after all patient / environmental contact and glove removal.

Gloves required for all patient / environmental contact.

Long sleeved gown required for all patient / environmental contact.
## Adverse Outcomes Associated With Contact Precautions

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Significant Findings and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient-HCW contact</td>
<td>CP are associated with less patient-HCW contact</td>
</tr>
<tr>
<td>Adverse events</td>
<td>CP are associated with delays and more noninfectious adverse events- falls, pressure ulcers, fluid/electrolyte disorders, inappropriate documentation of vital signs and days without a provider note</td>
</tr>
<tr>
<td>Psychological</td>
<td>CP are associated with increased symptoms of depression and anxiety</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>CP are associated with decreased patient satisfaction with care</td>
</tr>
</tbody>
</table>


Morgan DJ, Diekema DJ, Sepkowitz K, Perencevich E. *AJIC* 37; 2009: 85-93
Limiting CP Adverse Events

- No national recommendations exists for minimizing adverse effects of CP
- Aggressively promote the least restrictive alternative (hand hygiene)
- Promote educational interventions encouraging equal attentiveness of care for all patients
- Increase staffing ratios for those in CP
- Active monitoring for CP adverse outcomes
- Increased involvement of social work, PT/OT, clinical psychology, and psychiatry services

Morgan DJ, Diekema DJ, Sepkowitz K, Perencevich E. AJIC 37; 2009: 85-93
Kirkland K. Clin Inf Diseases. 2009:48 766-71
What about active MRSA screening?

• The debate about the value of MRSA ASC continues in part because of:
  – Limited reports of success so far
  – Some reports of the failure of screening
  – The costs of screening and isolation
  – The unwanted side effects of patient isolation
  – The inability to find sufficient isolation rooms for all patients

Diekema DJ, Edmond MB. *Clin Infect Dis* 2007; 44:1101-1107
Impact of Routine ICU Surveillance Cultures and Resultant Barrier Precautions on Hospital-Wide MRSA Bacteremia

• Retrospective study of 4 major infection control interventions over 9 yrs using ITS analysis
• Researchers evaluated impact of ASC on MRSA bacteremia in an 800-bed hospital with 8 ICUs
• Segmented regression analysis used to evaluated the incidence and prevalence of MRSA bacteremia
• Methicillin-susceptible *Staphylococcus aureus* bacteremia was monitored as a control

Huang S, Yokoe DS, Hinrichsen VL et al. CID 2006:43 971-78
Impact of Routine ICU Surveillance Cultures and Resultant Barrier Precautions on Hospital-Wide MRSA Bacteremia

- During routine surveillance cultures and subsequent contact isolation precautions
  - MRSA bacteremia:
    - Decreased by 75% in ICUs ($p<0.007$)
    - Decreased by 40% in non-ICUs ($p<0.008$)
  - MSSA bacteremia rates remained stable
- The other interventions were not associated with a significant change in MRSA bacteremia

Huang S, Yokoe DS, Hinrichsen VL et al. CID 2006:43 971-78
Universal Screening for MRSA at Hospital Admission and Nosocomial Infection in Surgical Patients

- Prospective, interventional cohort study of 21,754 surgical patients with crossover design to compare 2 MRSA control strategies
  - Rapid screening on admission plus standard infection control measures vs standard infection control
- Twelve surgical wards
- Patients assigned to either the control or intervention group for 9 months followed by switch over to other group for another 9 months

## Universal Screening for MRSA at Hospital Admission and Nosocomial Infection in Surgical Patients

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Control Periods (n=10,910)</th>
<th>Intervention Periods (n=10,844)</th>
<th>Incidence Rate Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total MRSA incidence per 1000 patient days</td>
<td>0.91</td>
<td>1.11</td>
<td>1.2 (0.9-1.7)</td>
</tr>
<tr>
<td>Total Number of MRSA Infections</td>
<td>88</td>
<td>103</td>
<td>NA</td>
</tr>
<tr>
<td>Incidence of MRSA acquisition per 1000 patient days</td>
<td>1.59</td>
<td>1.69</td>
<td>1.1 (0.8-1.4)</td>
</tr>
</tbody>
</table>

MRSA Screening Flawed IC Strategy

• We favor MRSA screening as part of a larger IC plan
• Many policy makers and legislatures are promoting and mandating MRSA ASC as the only solution
• We suggest that focusing resources on a single pathogen as a sole approach to IC is inherently flawed
• MRSA ASC programs are costly, time consuming and divert money and personnel from other infection control efforts

# Comparing IC Strategy for BSIs

Assume: 10,000 hospitalizations with 500-1000 NIs=5-10% incidence

<table>
<thead>
<tr>
<th>Variable (number)</th>
<th>Assumption(s)</th>
<th>Population based approach</th>
<th>MRSA-subset approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected BSIs</td>
<td>If BSIs account for 10% of all NIs S.aureus is 20% of BSIs MRSA is 70% of all S.aureus BSIs</td>
<td>50-100</td>
<td>7-14</td>
</tr>
<tr>
<td>Expected Deaths</td>
<td>If crude mortality rate is 25%</td>
<td>13-25</td>
<td>2-4</td>
</tr>
<tr>
<td>Expected Attributable Deaths</td>
<td>If attributable mortality is 50% of crude mortality</td>
<td>7-13</td>
<td>1-2</td>
</tr>
<tr>
<td>Lives saved per hospital and nationally</td>
<td>If 50% of attributable deaths avoided with either IC intervention</td>
<td>4-7</td>
<td>1-1</td>
</tr>
</tbody>
</table>

Screening for MRSA: A Flawed Hospital Infection Control Intervention

VCU Perspective on MRSA screening

- Focusing hospital resources on a single antibiotic-resistant pathogen as a sole approach to infection control is inherently flawed.
- Emergence of MDROs as well as the recognition of team-based infection control programs supports a horizontal, population and evidence based implementation of IC best practices.

Active Surveillance Cultures Are Not Required to Control MRSA Infections in the Critical Care Setting

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rate</td>
<td>rate</td>
<td>rate</td>
<td>rate</td>
<td></td>
</tr>
<tr>
<td>MICU</td>
<td>8</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>0.007</td>
</tr>
<tr>
<td></td>
<td>1.91</td>
<td>0.70</td>
<td>1.15</td>
<td>0.19</td>
<td></td>
</tr>
<tr>
<td>SICU</td>
<td>24</td>
<td>14</td>
<td>11</td>
<td>8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>5.68</td>
<td>2.76</td>
<td>1.85</td>
<td>1.34</td>
<td></td>
</tr>
<tr>
<td>NSICU</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>0.352</td>
</tr>
<tr>
<td></td>
<td>1.23</td>
<td>1.03</td>
<td>0.23</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>22</td>
<td>18</td>
<td>12</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>2.86</td>
<td>1.55</td>
<td>1.16</td>
<td>0.76</td>
<td></td>
</tr>
</tbody>
</table>

Active Surveillance Cultures Are Not Required to Control MRSA Infections in the Critical Care Setting

Incidence of device-related HAIs due to all pathogens

<table>
<thead>
<tr>
<th>Year</th>
<th>MICU</th>
<th>SICU</th>
<th>NSICU</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>16.5</td>
<td>27.9</td>
<td>18.2</td>
</tr>
<tr>
<td>2004</td>
<td>14.3</td>
<td>25</td>
<td>10.3</td>
</tr>
<tr>
<td>2005</td>
<td>12.5</td>
<td>18.0</td>
<td>11.3</td>
</tr>
<tr>
<td>2006</td>
<td>8.9</td>
<td>12.8</td>
<td>10.5</td>
</tr>
</tbody>
</table>

P* values:
- 0.001
- <0.001
- 0.002

VCUMC Approach to MRSA Active Surveillance – select patient populations

• High risk surgeries
  – Cardiothoracic surgery
    • CABG
    • Valve replacements
  – Neurosurgeries
    • Craniotomies
    • Spinal fusion
  – Orthopedic surgery
    • Joint replacement

• Outbreak situations
  – For epidemiologic surveillance and source/cross transmission control
## Major Interventions to Reduce Healthcare Associated Infections at VCU Medical Center

<table>
<thead>
<tr>
<th>Start date</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>Concurrent surveillance for HAIs in ICUs with feedback to unit leadership</td>
</tr>
<tr>
<td>2004</td>
<td>Hand hygiene campaign</td>
</tr>
<tr>
<td>2004</td>
<td>Feedback on HAIs and practices to all ICU via quarterly posters</td>
</tr>
<tr>
<td>2006</td>
<td>Central line insertion bundle</td>
</tr>
<tr>
<td>2006</td>
<td>Mandatory housestaff education on central line insertion</td>
</tr>
<tr>
<td>2007</td>
<td>Roving hand hygiene observers</td>
</tr>
<tr>
<td>2008</td>
<td>Chlorhexidine bathing of ICU patients</td>
</tr>
<tr>
<td>2009</td>
<td>&quot;Wash up, wipe down&quot; and &quot;bare below the elbows&quot; campaigns</td>
</tr>
<tr>
<td>2009</td>
<td>Integration of antimicrobial utilization with infection prevention efforts</td>
</tr>
<tr>
<td>2009</td>
<td>Complete roll out of concurrent surveillance for device-related infections to all inpatient areas</td>
</tr>
</tbody>
</table>
# Device Associated HAIs, Adult ICUs

Infections/1000 device days

<table>
<thead>
<tr>
<th></th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>Change since 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSI</td>
<td>12.8</td>
<td>9.9</td>
<td>7.7</td>
<td>6.4</td>
<td>4.0</td>
<td>3.1</td>
<td>76% reduction</td>
</tr>
<tr>
<td>UTI</td>
<td>8.4</td>
<td>7.6</td>
<td>7.7</td>
<td>8.2</td>
<td>6.9</td>
<td>5.5</td>
<td>35% reduction</td>
</tr>
<tr>
<td>VAP</td>
<td>9.4</td>
<td>6.7</td>
<td>4.9</td>
<td>2.7</td>
<td>1.6</td>
<td>0.9</td>
<td>90% reduction</td>
</tr>
</tbody>
</table>

![Graph showing the reduction in infections](image-url)
So Can We Really Get to Zero?

- Current scientific evidence cannot prevent all HAIs
- We can only guess as to what proportion of HAIs are preventable
- Many unanswered questions remain
  - Cost effectiveness?
  - Which aspects of bundles are most important?
  - How should CP be best employed?
- Limitations of Infection Prevention Research
  - Suboptimal study designs
  - Lack of funding
Unintended consequences of "Getting to Zero"

- Unrealistic expectations & unreasonable demands
- Shift towards a punitive culture
- Disintegration of infection control from safety & quality
- Shift from interventions based on local risk assessment to a one-size-fits-all approach
- Diversion of resources to marginal improvements in healthcare quality while more people in the US lose access to care
- Demoralized health care workers

Edmond MB. Infection Control and Hospital Epidemiology 2008; 30:74-76
Conclusion

- Significant paradigm shift in HAI prevention
- Many infections are indeed preventable
- Current state of IP science is not robust enough to eliminate all HAIs
- “Getting to Zero” has unintended consequences
- Infection Prevention programs should strive for the *irreducible minimum*
Conclusion

• Implementation of infection prevention practices should be broad based, transparent, measurable, and reportable.
• Pathogen-specific interventions should occur on top of maximally implemented IP best practices.
• New technologies and perspectives continue to make infection prevention an exciting field.
• Challenges such as funding and organizational resistors/constipators will continue to limit the implementation of evidence-based IP measures.