CHG Bathing Decolonization in ICU, NonICU and Surgical Patients

Julia Moody
Clinical Director Infection Prevention
January 2013
Objectives

• Define rationale for reducing healthcare associated infections and improving patient outcomes

• Discuss conclusions from CHG bathing in ICU, non ICU and surgical patients thru 2012

• Describe outcomes and experiences of HCA initiatives and studies

- 1.7 million hospital infections
  - 1.3 million outside of ICUs
  - 9.3 infections per 1,000 patient-days
  - 4.5 per 100 admissions

- 99,000 deaths associated with infections
  - 36,000 pneumonias
  - 31,000 bloodstream infections

Estimating the Proportion of HAI s that are Reasonably Preventable* and the Related Mortality and Costs

*Infect Control Hosp Epidemiol 2011; 32:101-114

- 65-70% of cases of CLABSIs and CAUTIs are preventable
- 55% of cases of VAPs and SSIs are preventable
- CAUTIs are the most preventable HAI
- CLABSIs have highest number of preventable deaths
- CLABSIs have the highest cost impact

*Based on current evidenced-based strategies
HAIs and Readmissions

*Infect Control Hosp Epidemiol* 2012;33:539

- Study tracked 136,513 patients who were admitted to an academic, tertiary care referral center from 2001 to 2008

- Findings: Patients with positive clinical cultures for methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), or *Clostridium difficile* after more than 48 hours following hospital admission were:
  - 40% more likely to be readmitted to the hospital within a year and;
  - **60% more likely to be readmitted within 30 days** than patients with negative or no clinical cultures.
Infection Prevention Approaches

**Vertical:** Substantially reduces a pathogen specific
- Active surveillance (e.g. MRSA, *C. difficile*)
- Contact precautions (e.g. MRSA colonization or MRSA, *C. difficile* infection)
- Decolonization (e.g. MRSA)
- Vaccination (e.g. influenza, Tdap)

**Horizontal:** Substantially reduces all infections and is not pathogen specific
- Standard precautions (HH, cough etiquette, PPE)
- Environmental cleaning and disinfection
- Antimicrobial stewardship
- Bundles of care (e.g. CLABSI, SCIP)
- CHG Bathing
Chlorhexidine Uses

- Dental – gingivitis, periodontal disease
- Central line skin prep
- Surgical skin prep
- Surgical pre-operative bathing
- Wound cleanser
- Bathing to reduce microbial burden and infection
Routine CHG Bathing to Reduce HAI

• **Targeted:** Pathogen-specific (MRSA) strategies

• **Universal Strategies:** Host-specific (ICU) strategies

  – Batra et al. Clin Infect Dis 50:210-217  Single hospital; mixed ICU; daily bathing plus oral CHG; Reduced acquisition of some MRSA strains and not others
  – Bleasdale et al. Arch Int Med. 2007;167:2073-9  Single hospital ; MICU; Daily bathing, decreased BSIs and had -0- MRSA BSIs.
  – Climo et al. Crit Care Med. 2009;37(6):1858-65  MultiCenter; MICU, SICU, CVICU, CCU; Daily bathing, Reduced acquisition of MRSA and VRE
Bioburden on Inguinal Skin by Cleansing Method

Vernon et al Arch Intern Med 2006 166:306-312
# Reduction in MRSA and VRE Acquisition with Chlorhexidine Bathing

<table>
<thead>
<tr>
<th></th>
<th>Baseline Period</th>
<th>Intervention Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admissions</td>
<td>2670</td>
<td>2650</td>
</tr>
<tr>
<td>Total bed days of care</td>
<td>15,472</td>
<td>15,225</td>
</tr>
<tr>
<td>Total central venous catheter days&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10,062</td>
<td>9,633</td>
</tr>
<tr>
<td>Mean length of stay (days)</td>
<td>5.99</td>
<td>5.82</td>
</tr>
<tr>
<td>MRSA acquisition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of cases</td>
<td>67</td>
<td>45</td>
</tr>
<tr>
<td>Number of eligible patient days</td>
<td>13,300</td>
<td>13,096</td>
</tr>
<tr>
<td>Incidence rate&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.04</td>
<td>3.44&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>MRSA prevalence rate&lt;sup&gt;b&lt;/sup&gt;</td>
<td>22.80</td>
<td>21.80</td>
</tr>
<tr>
<td>VRE acquisition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of cases</td>
<td>61</td>
<td>30</td>
</tr>
<tr>
<td>Number of eligible patient days</td>
<td>13,412</td>
<td>13,610</td>
</tr>
<tr>
<td>Incidence rate&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.35</td>
<td>2.19&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>VRE prevalence rate&lt;sup&gt;d&lt;/sup&gt;</td>
<td>17.97</td>
<td>16.75</td>
</tr>
</tbody>
</table>

Chlorhexidine Impact on Central Line Blood Stream Infections

P = 0.04 by the log-rank test

CHG Bathing in ICUs: A Systematic Review
Derde et al Intensive Care Med 2012 38:931

• **Purpose:** Evaluate control of antimicrobial resistant bacteria in ICU patients
  – Exclusions: Did not used time series analysis; limited randomized control trials

• **Results:**
  – MRSA acquisition significantly reduced in 3 of 7 studies; infection reduction in 1 of 5 studies
  – VRE carriage and bacteremia significantly reduced in 1 study

• **Conclusions:**
  – May prevent carriage and possible bloodstream infections with MRSA and VRE in different ICU settings
  – Evidence reducing carriage or infections with MDRO GNB is lacking
Efficacy of CHG Daily Bathing for Reducing HAI Bloodstream Infections
Ohoro et al ICHE 2012 33:257-267

• Meta-analysis review of randomized control and quasi-experimental studies

• Populations: Medical, Surgical, Trauma and combined Medical/Surgical ICUs and LTACHs

• Conclusions:
  – Daily bathing with CHG reduced the incidence of BSIs (odd ratio 0.44, \( P < .00001 \)), including central line–associated BSIs, among patients in the medical ICU.
  – Further studies are recommended to determine the optimal frequency, method of application, and concentration of CHG
Impact of CHG Bathing on Hospital-Acquired Infections among General Medical Patients
Kassakian et al ICHE 2011 32:238

• Methods: Quasi-experimental CHG vs soap&water
  – Phase 1 Soap&water; Transition 1 month; Phase 2 CHG

• Populations: 4 adult general medical units (hem/onc and transplant units were excluded)

• Surveillance: Active screening of high risk patients for MRSA and VRE; ICU patients also screened at discharge

• Compliance with CHG bathing was estimated on the basis of the quantity of CHG clothes used.
Results

- Daily bathing with CHG clothes were associated with a 64% reduced risk of developing the primary outcome, namely the composite incidence of MRSA and VRE HAIs (hazard ratio 0.36 [95% CI 0.2-0.8]; \( P = .01 \))

- No change in the incidence of *C. difficile* HAIs (\( P = 0.6 \))  
  *Note: expected because CHG is not sporidical*

- Colonization with MRSA was associated with an increased risk of developing a MRSA HAI (hazard ratio, 8 [95% CI, 3-19] \( P < .001 \))
Conclusion

• Daily CHG bathing was associated with a reduced HAI risk, using a composite endpoint of MRSA and VRE HAIs in a general medicine ward inpatient population, but not with MRSA or VRE alone.

• The findings are preliminary and involves only 1 medical center(academic).

• The generalizability of this finding needs further study.
Effect of Hospital-Wide CHG bathing on HAIs
Rupp et al, ICHE 2012 33:1094-1100

• Design: Quasi-experimental with wash out

• Populations: Academic medical center excluding neonates, infants and Labor and delivery

• Intervention: CHG bathing 3 days per week or daily; monitored bathing compliance and HAIs

• Conclusions:
  – ICU bathing had higher compliance >90% than nonICU 57.7%
  – Associated with a significant decrease in C. difficile infections
  – Consistent effect of CHG bathing on other HAIs was not observed
Daily CHG Bathing Reduces CLABSI

- Design: Observational cohort using historical controls
- Population: Academic medical center, 9 bed SICU
- Intervention: CHG daily bathing combined with QI improvement of bundle prevention practices
- Outcomes:
  - 3 month effectiveness study showed CLABSI rates decreased 74% from 12 to 3 CLABSI per 1000 device days
Is there unintended consequences of CHG use like Bacterial Resistance to CHG?
CHG Mechanism of Action

- Binds to negatively charged microbial membrane

- Low concentrations: Alteration of bacterial membrane integrity and cell osmotic equilibrium

- High concentrations: Precipitation of cell contents and cell death
Bacterial Resistance to CHG

• No standard definition of CHG resistance
• Accepted definition: MIC > 4 μg/mL based on precedent in published literature
  – 2% CHG = 20,000 μg/mL
• Increased CHG MICs associated with presence of energy-dependent export systems (efflux pumps) in S. aureus qacA and qacB genes
  – qacA Active against CHG; CHG MICs 1–32 μg/mL
  – qacB Limited activity against CHG; CHG MICs 1–8 μg/mL
Prevalence of QAC A/B Gene in MRSA

- Geographic variability in prevalence of qacA/B
  - 2% (Toronto, Canada) - 33% Taiwan
  - 63% (Europe) - 80% Brazil

- Prevalence of qacA or qacB in MRSA isolates in USA is low

- Clinical significance of CHG resistance in MRSA uncertain

CSG Infection Prevention Team

From left: Jason Hickok, Sara Bienvenu, Julia Moody Ed Septimus
CSG’s BEST team!
HCA Overview

- 18 million patient contacts / year
- Nearly 5% of all US hospital services

<table>
<thead>
<tr>
<th>Category</th>
<th>HCA*</th>
<th>% National*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliveries</td>
<td>226,735</td>
<td>5.14%</td>
</tr>
<tr>
<td>CABG</td>
<td>10,087</td>
<td>5.63%</td>
</tr>
<tr>
<td>CHF</td>
<td>38,565</td>
<td>4.37%</td>
</tr>
<tr>
<td>Oncology</td>
<td>28,633</td>
<td>3.82%</td>
</tr>
<tr>
<td>Total Inpatients</td>
<td>1,775,780</td>
<td>4.82%</td>
</tr>
</tbody>
</table>

*4Q10-3Q11

- 164 hospitals
  - In 20 US states (158) and England (6)
  - From complex tertiary referral & academic medical centers to urban and suburban community medical centers

- Approximately 125 free-standing surgery centers and > 550 physician practices
- ~ 35,000 affiliated physicians
- ~ 200,000 employees
HCA Hospitals and Adult ICU NHSN Types

• Majority of hospitals are community nonacademic
• Average licensed beds: 250
• Average Adult ICU admissions: >250,000 annually
• Adult ICU NHSN classification:
  – 60% Medical/Surgical
  – 20% Surgical or Cardiothoracic
  – 11% Medical or Medical Cardiac
  – 9% Other (Burn, Trauma, etc.)
HCA’s MRSA Solution: The A, B, Cs...

- **A** Active Surveillance of high risk patients
- **B** Barrier Precautions
- **C** Compulsive Hand Hygiene
- **D** Disinfection / Environmental Cleaning
- **E** Executive Championship
Active Surveillance Testing for MRSA

Nares Screening for High Risk Patient Populations

- Open heart surgery
- Total knee joint replacement
- Total hip joint replacement
- Open spine surgery
- ICU admission
- Transfer from another healthcare facility (hospital, skilled nursing facility, etc.)

Why? Patients are at increased risk for MRSA colonization and subsequent infections
### Infection Prevention Practices in HCA Adult ICUs

<table>
<thead>
<tr>
<th>MRSA Contact Precautions Practice</th>
<th>% Performing Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active surveillance screening on admission to ICU</td>
<td>100%</td>
</tr>
<tr>
<td>Contact Precautions if MRSA</td>
<td>99%</td>
</tr>
<tr>
<td>Private room whenever possible</td>
<td>94%</td>
</tr>
<tr>
<td>Cohort patients with same MDRO</td>
<td>34%</td>
</tr>
<tr>
<td><strong>Glove use</strong></td>
<td></td>
</tr>
<tr>
<td>Gloves to enter room</td>
<td>86%</td>
</tr>
<tr>
<td>Gloves only if patient contact anticipated</td>
<td>14%</td>
</tr>
<tr>
<td><strong>Gown use</strong></td>
<td></td>
</tr>
<tr>
<td>Gown to enter</td>
<td>76%</td>
</tr>
<tr>
<td>Gown only if patient contact anticipated</td>
<td>24%</td>
</tr>
<tr>
<td><strong>Masks used for all MRSA+ patients</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Masks used in patients with respiratory symptoms</strong></td>
<td></td>
</tr>
<tr>
<td>Use of disposable patient care equipment</td>
<td>87%</td>
</tr>
<tr>
<td>Have a policy for discontinuing precautions</td>
<td>68%</td>
</tr>
</tbody>
</table>

*Moody et al AJIC 2012*
Reduction in Healthcare-Associated MRSA CLABSI and VAP in Adult ICUs

<table>
<thead>
<tr>
<th>Timeperiod of MRSA ABCs Program</th>
<th>CLABSI</th>
<th>VAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = Pre intervention Q206 to Q406</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B = Post intervention 3Q07 to 2Q08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C = Post intervention 2009 all 4 Q</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D = 2010 all 4 Q</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E = 2011 pending</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pending 2013 J Healthcare Quality
The REDUCE MRSA Trial

Randomized Evaluation of Decolonization vs. Universal Clearance to Eliminate MRSA

Susan S. Huang, MD MPH
Edward Septimus, MD
for the REDUCE MRSA Trial Team
# The REDUCE MRSA Trial

## Hospital Participants

<table>
<thead>
<tr>
<th>Arm 1 Facilities</th>
<th>Arm 2 Facilities</th>
<th>Arm 3 Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Alaska Regional Hospital, AK</td>
<td>1. Blake Medical Center, FL</td>
<td>1. Brandon Regional Hospital, FL</td>
</tr>
<tr>
<td>2. Capital Regional Medical Center, FL</td>
<td>2. Centennial Medical Center, TN</td>
<td>2. Coliseum Northside Hospital, GA</td>
</tr>
<tr>
<td>3. Cartersville Medical Center, GA</td>
<td>3. Clear Lake Regional Medical Center, TX</td>
<td>3. Community Hospital, FL</td>
</tr>
<tr>
<td>4. CJW Medical Center, VA</td>
<td>4. Coliseum Medical Center, GA</td>
<td>4. Garden Park Medical Center, MS</td>
</tr>
<tr>
<td>5. Doctors Hospital of Sarasota, FL</td>
<td>5. Del Sol Medical Center, TX</td>
<td>5. Largo Medical Center, FL</td>
</tr>
<tr>
<td>6. Eastern Idaho Regional Medical Center, ID</td>
<td>6. Grand Strand Regional Medical Center, SC</td>
<td>6. Las Palmas Medical Center, TX</td>
</tr>
<tr>
<td>7. Fawcett Memorial Hospital, FL</td>
<td>7. Lee’s Summit Medical Center, MO</td>
<td>7. Menorah Medical Center, KS</td>
</tr>
<tr>
<td>8. LewisGale Hospital - Alleghany, VA</td>
<td>8. LewisGale Hospital - Pulaski, VA</td>
<td>8. Methodist Hospital, TX</td>
</tr>
<tr>
<td>9. LewisGale Hospital - Montgomery, VA</td>
<td>9. Los Robles Hospital, CA</td>
<td>9. OU Medical Center, OK</td>
</tr>
<tr>
<td>10. Medical Center of Aurora, CO</td>
<td>10. Memorial Hospital of Jacksonville, FL</td>
<td>10. Parkland Medical Center, NH</td>
</tr>
<tr>
<td>11. Medical Center of Plano, TX</td>
<td>11. Overland Park Regional Medical Center, KS</td>
<td>11. South Bay Hospital, FL</td>
</tr>
<tr>
<td>12. Mountainview Hospital, NV</td>
<td>12. Parkridge Medical Center, TN</td>
<td>12. St. David’s Medical Center, TX</td>
</tr>
<tr>
<td>13. Orange Park Medical Center, FL</td>
<td>13. Regional Medical Center of Bayonet Point, FL</td>
<td>13. Westside Regional Medical Center, FL</td>
</tr>
<tr>
<td>14. Palms West Hospital, FL</td>
<td>14. Stonecrest Medical Center, TN</td>
<td></td>
</tr>
<tr>
<td>15. Plantation General Hospital, FL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Research Belton Hospital, MO</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
REDUCE MRSA: Cluster Randomized Trial

Randomized all ICUs in participating hospitals to:

• **Arm 1: Routine Care**
  – Screened all patients; isolated known MRSA+

• **Arm 2: Targeted Decolonization**
  – Screened all patients; isolated if known MRSA+
  – Decolonized if MRSA+

• **Arm 3: Universal Decolonization**
  – No screening; isolated if known MRSA+
  – Decolonized all
REDUCE MRSA: Decolonization Regimens

- **Arm 2: Targeted Decolonization**
  - Nasal mupirocin bid for 5 days
  - Chlorhexidine baths daily for 5 days

- **Arm 3: Universal Decolonization**
  - Nasal mupirocin bid for 5 days
  - Chlorhexidine baths daily for ICU duration
REDUCE MRSA Trial
Main Outcomes

Primary Outcome
• Any clinical MRSA isolate attributed to an ICU

Secondary Outcomes
• MRSA bloodstream infections attributed to an ICU
• All bloodstream infections attributed to an ICU

Outcomes defined by
• Microbiology cultures alone
• > 2d after ICU admit through 2d beyond ICU discharge
Baseline and Intervention Periods

Baseline
12 month

Jan 2009

Phase
In

Jan 2010 Apr 2010

Intervention
18 month

Sep 2011
REDUCE MRSA ICUs and Patients

- 43 HCA hospitals with 74 ICUs
  - 74,256 patients, 283,000 ICU patient days
  - 42 community hospitals
  - 3 providing bone marrow transplant, 5 solid organ transplant

<table>
<thead>
<tr>
<th>Arm 1</th>
<th>Arm 2</th>
<th>Arm 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 Hospitals (23 ICUs)</td>
<td>14 Hospitals (22 ICUs)</td>
<td>13 Hospitals (29 ICUs)</td>
</tr>
<tr>
<td>N = 23,480</td>
<td>N = 24,752</td>
<td>N = 26,024</td>
</tr>
</tbody>
</table>

As Randomized

As Treated

1 Hospital (2 ICUs) withdraws
The REDUCE MRSA Trial
Statistical Analysis

• Main trial results
  — As-randomized, unadjusted analyses

• Compared baseline and intervention rates

• Proportional hazards models with shared frailties to account for clustering within hospital
  — Trial success: significant difference between arms in change in baseline and intervention hazards

• Sensitivity Analyses
  — As treated
  — Adjusted models (MRSA importation, LOS, comorbidities)
Select Population Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Arm 1</td>
</tr>
<tr>
<td>ICU Stay in Days (Mean)</td>
<td>4.3</td>
</tr>
<tr>
<td>Age (Mean)</td>
<td>63.1</td>
</tr>
<tr>
<td>Comorbidities (%)</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>31.8</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>20.3</td>
</tr>
<tr>
<td>Cancer</td>
<td>9.9</td>
</tr>
<tr>
<td>Liver Failure</td>
<td>4.0</td>
</tr>
<tr>
<td>History of MRSA (%)</td>
<td>9.7</td>
</tr>
<tr>
<td>Surgery During Admission (%)</td>
<td>38.7</td>
</tr>
</tbody>
</table>

No important differences between Baseline, Intervention Periods
REDUCE MRSA Trial Outcomes
IDWeek2012 Abstract

<table>
<thead>
<tr>
<th>Strategy</th>
<th>ICU-Attributed MRSA Clinical Cultures</th>
<th>ICU-Attributed Bloodstream Infections (all pathogens)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline*</td>
<td>Intervention*</td>
</tr>
<tr>
<td>Screening and Isolation</td>
<td>13.7</td>
<td>11.9</td>
</tr>
<tr>
<td>Targeted Decolonization</td>
<td>16.1</td>
<td>12.2</td>
</tr>
<tr>
<td>Universal Decolonization</td>
<td>13.8</td>
<td>8.3</td>
</tr>
<tr>
<td>P-value§</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

* Events per 1,000 patients
^ HR = Hazard Ratio from primary unadjusted analysis; model estimates are not equal to ratio of raw risk due to differential length-of-stay and effect of clustering within hospital
^ HRadj = Hazard Ratio from secondary adjusted analysis
§ P-value from proportional hazards model

Note: Reductions were found in gram positive skin commensule (2 cultures within 2 calendar days), gram negatives and Candida BSI rates based on EHR surveillance of microbiology results per 1000 ICU attributable days.
Conclusions for ICU Settings

• **Universal decolonization**
  – 37% reduction in MRSA carriage
  – 44% reduction in all-cause bloodstream infection
  – Required no screening
  – May reduce need for contact precautions

• **Targeted decolonization**
  – 22% reduction in all-cause bloodstream infection
Pragmatic Trial: Notable features

- Research as part of usual care
- Implementation led by Quality and Infection Prevention teams, with ICU directors and staff
- Contributions from nursing, pharmacy, supply chain, microbiology lab, others
- IT capabilities were critical to success
- Exemplar of the Learning Health System
Limitations

• Results may not generalize beyond ICUs
• Cost effectiveness analysis is needed
• Potential to elicit resistance to mupirocin and/or chlorhexidine
HCA Next Steps: Implement Universal Decolonization in Adult ICUs

• Stop routine MRSA screening for ICU admissions for specific high risk groups admitted to the ICU setting such as transfers from acute care settings, long term care or nursing home residents.

• Continue to screen patients for MRSA colonization:

  (1) Targeted surgeries (e.g. open heart, hip or knee joint replacement and open spine procedures);

  (2) Prior history of MRSA to evaluate the current status for the potential to discontinue precautions (per hospital policy)

  (3) State regulations or quality initiatives which require screening (e.g. Virginia)

  (4) Professional practice protocols (e.g. dialysis or burn patients).
HCA Next Steps: Implement Universal Decolonization in Adult ICUs

- The REDUCE MRSA Arm#3 stopped screening and implemented decolonization practices which were more effective in reducing not only MRSA as well as all pathogen causes of bacteremia.

- Universal decolonization can replace screening (which is expensive and time consuming) as a reasonable and possibly superior method for preventing MRSA disease.

- Screening is costly and results do not return immediately. Screening for all antibiotic-resistant or MDRO pathogens is not feasible and that a different strategy should be entertained.

- Placing more and more people on contact precautions raises unintended consequences such as issues about patients feeling isolated and having less visits by clinical staff.
ABATE Infection Trial
Active Bathing to Eliminate Infection
Central Line Associated Bloodstream Infection
ICU vs non-ICU Components

Definitive trials needed to impact this setting

2001:
43,000

Hand hygiene
Antimicrobial lines
CHG dressings
CHG skin prep
CHG bathing
MRSA screening

2009:
18,000

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6008a4.htm
Chlorhexidine Bathing in Non-Critical Care Areas

- Rhode Island Hospital
- Single hospital study, four general medicine units, 2008-10
- 64% reduction in MRSA, VRE healthcare-associated infections

Kassakian et al. ICHE 2011;32(3):238-43
ABATE Infection Trial: Goals

• Find effective HAI strategies for non-critical care areas
  – Prevent hospital-associated infections
  – Prevent readmissions

• Conduct a definitive and pragmatic trial for best practice
  – Large scale cluster randomized trial
  – Learning during usual medical care
  – HCA hospitals
ABATE Infection Trial
Active Bathing to Eliminate Infection

Proposal
Large scale definitive trial to assess the value of chlorhexidine bathing and MRSA decolonization in non-critical care units

Design
Two-arm cluster randomized trial of hospitals

Hypothesis
Routine CHG bathing and MRSA decolonization will reduce
• Acquisition of multi-drug resistant organisms & C. difficile (primary aim)
• Bloodstream infections due to all pathogens
• Urinary tract infections due to all pathogens
• Infectious readmissions
ABATE Infection Trial
Active Bathing to Eliminate Infection

Trial Design

- 50 HCA hospitals
- All or most adult non-critical care units participating
- Includes: adult medical, surgical, step down, oncology
- Excludes: pediatrics, rehab, psych, peri-partum, BMT

Arm 1: Routine Care

- Routine policy for showering/bathing

Arm 2: Decolonization

- Daily CHG shower or CHG cloth bathing routine for all patients
- Mupirocin x 5 days for those MRSA+ by history or screen
ABATE Infection Trial
Active Bathing to Eliminate Infection

All outcomes obtained via the HCA data warehouse

Key Outcomes

• Unit-associated acquisition of MDROs and \( C \text{ difficile} \)
• Bloodstream infections: all pathogens

Additional Outcomes

• Urinary tract infections: all pathogens
• Blood contamination
• Infectious readmissions: all pathogens
• Emergence of resistance among key pathogens
• Cost assessment
Evidence Associated with CHG Presurgical Bathing for Cardiac and Orthopedic Patients
SHEA Compendium SSI
Unresolved Issues *ICHE* 2008; 29:S51-S61

- Pre-operative bathing with CHG
- Routine screening for MRSA or routine attempts to decolonize surgical patients with an anti-staph agent (mupiricin) in the pre-operative setting
- Maintain oxygenation with supplemental oxygen during and following colorectal procedures
- Maintain normothermia (>36°C) immediately following colorectal surgery

The conclusion of their analysis suggested that preoperative bathing or cleansing with CHG does not result in a significant reduction in infection involving clean surgical procedures (ie, class I).
Limitations

- The seven studies cited, there was no documentation of a uniform standard of practice (i.e., some patients showered multiple times, other patients showered only once with an antiseptic soap.

- There is no evidence that an attempt was made to standardize a timed duration of the antiseptic shower or cleansing process.

- The surgical population was highly heterogeneous and included patients undergoing elective clean, clean-contaminated, and contaminated surgical procedures.

- There was no indication whether an effort was made to assess patient compliance with the study protocols.
Limitations continued

- The authors of the review point out that community (i.e., postdischarge) follow-up did not occur in three of seven of the studies reviewed.

- Finally, skin antisepsis (i.e., preadmission bathing, perioperative skin prepping) is an adjunctive component of an overall thoughtful interventional process; the Cochrane analysis provides no data as to what other interventional practices may or may not have been in place at the time the surgical procedures were performed.
A preoperative decolonization protocol for *S. aureus* prevents orthopedic infections

*(Clin Orthop Relat Res 2008; 466:1343)*

✓ Patients with positive nasal swab cultures for either MSSA or MRSA were treated with:

– Mupirocin nasal ointment to both nares, bid, for 5 days, prior to surgery

– **Daily chlorhexidine baths for 5 days, prior to surgery**

✓ Peri-operative antibiotic prophylaxis:

– MSSA-positive patients: Cefazolin – 2G, 30 to 60 minutes before the surgery followed by 1G q8h/24h

– MRSA-positive patients: Vancomycin – 1G, 60 minutes before the surgery followed by 1G q12h/24h
Comparison of Infections in the Study Group (Clin Orthop Relat Res 2008; 466:1343)

Infections by Pathogens
Pre-intervention
October 04-05

Infections by Pathogens
Post-intervention
October 05-06

1 MSSA infection – negative screen
Randomized, double-blinded, placebo-controlled multicenter study of 6,771 patients in The Netherlands (Bode, *NEJM* 2010)

- Rapid screening for MSSA/MRSA on admission
- Carriers randomized to **mupirocin/CHG soap** vs. placebo/bland soap x 5 days
• **Results:** CHG bathing + mupirocin group had significantly lower SSI rates than the placebo group

• **Conclusion:** Preoperative identification of *S. aureus* carriers followed by 5 days of intranasal mupirocin plus CHG bathing reduced *S. aureus* SSIs by ~60%

<table>
<thead>
<tr>
<th>Localization of infection</th>
<th>Mupir + CHG</th>
<th>Placebo</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep surgical site</td>
<td>4 (0.9)</td>
<td>16 (4.4)</td>
<td>0.21 (0.07-0.62)</td>
</tr>
<tr>
<td>Superficial surgical site</td>
<td>7 (1.6)</td>
<td>13 (3.5)</td>
<td>0.45 (0.18-1.11)</td>
</tr>
</tbody>
</table>
Evidence for Using Chlorhexidine Gluconate Preoperative Cleansing to Reduce the Risk of Surgical Site Infection

CHARLES E. EDMISTON, JR, PhD, CIC, FIDSA; OBI OKOLI, MD; MARY BETH GRAHAM, MD, FIDSA; SHARON SINSKI, RN, CNOR; GARY R. SEABROOK, MD, FACS

AORN J 2010; 92:509-518
November 2010
### CHG subgroups

<table>
<thead>
<tr>
<th>Group</th>
<th>Pilot (4% CHG soap)</th>
<th>A (4% CHG soap)</th>
<th>B (2% CHG wipes)</th>
<th>[C&lt;sup&gt;CHG&lt;/sup&gt;/MIC&lt;sub&gt;90&lt;/sub&gt;]</th>
<th>P&lt;sup&gt;e&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;f&lt;/sup&gt;</td>
<td>3.7 ± 2.5</td>
<td>24.4 ± 5.9</td>
<td>436.1 ± 91.2</td>
<td>0.7 v 4.9 v 87.2</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>2&lt;sup&gt;g&lt;/sup&gt;</td>
<td>7.8 ± 5.6</td>
<td>79.2 ± 26.5</td>
<td>991.3 ± 58.2</td>
<td>1.5 v 15.8 v 198.3</td>
<td>&lt; .0001</td>
</tr>
<tr>
<td>3&lt;sup&gt;h&lt;/sup&gt;</td>
<td>9.9 ± 7.1</td>
<td>126.4 ± 19.5</td>
<td>1745.7 ± 204.3</td>
<td>1.9 v 25.3 v 349.1</td>
<td>&lt; .0001</td>
</tr>
</tbody>
</table>

CHG = chlorhexidine gluconate; MIC<sub>90</sub> = minimal inhibitory concentration required to inhibit or kill 90% of staphylococcal clinical isolates.

a. Mean CHG concentrations (± standard deviation) = mcg/mL, derived from 5 separate anatomic sites including right and left arms (ie, antecubital fossa), right and left legs (ie, popliteal fossa), and abdomen.

b. In the pilot study, 4% CHG group (n = 30) randomized to groups 1-3, 10 participants per group; no showering or cleansing instructions were given to volunteers.

c. N = 60 participants randomized to groups 1-3, 20 participants per group.

d. [C<sup>CHG</sup>/MIC<sub>90</sub>] = ratio of skin surface mean CHG concentrations [ie, C<sup>CHG</sup>] in the pilot study; subgroups A and B compared with CHG concentration [ie, MIC<sub>90</sub>] required to inhibit or kill 90% of staphylococcal skin or surgical isolates, including methicillin-resistant *S. aureus* (MIC<sub>90</sub> = 5 mcg/mL); data obtained from Table 2.

e. P value = comparison of CHG skin surface concentration between pilot study groups and subgroups A and B (ie, two sample t test and analysis of variance).

f. Showering/cleansing with CHG once (ie, evening before surgery).

g. Showering/cleansing with CHG once (ie, morning of surgery).

h. Showering/cleansing with CHG twice (ie, evening before surgery, morning of surgery).
OPEN ENROLLMENT:

STOP SSIs Project

Study To Optimally Prevent SSIs in Select Cardiac and Orthopedic Procedures
Eligible Patient Populations

• Adult patients (18 y/o and older)

• Cardiac operations: CAGB +/- Valves performed by sternotomy approach

• Orthopedic operations
  – Hip (total and partial) arthroplasty
  – Knee (total and partial) arthroplasty

• Algorithm: Screening for MRSA and MSSA, decolonization (5 days CHG bathing +/- mupirocin and surgical antimicrobial prophylaxis)
## Complex SSI Pathogens NHSN 2006-2009*

<table>
<thead>
<tr>
<th></th>
<th>CABG</th>
<th>Arthoplasty</th>
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<tbody>
<tr>
<td>MSSA</td>
<td>19%</td>
<td>MSSA</td>
</tr>
<tr>
<td>MRSA</td>
<td>17%</td>
<td>MRSA</td>
</tr>
<tr>
<td>Coag-neg Staph</td>
<td>17%</td>
<td>Coag-neg Staph</td>
</tr>
<tr>
<td>Gram-negative</td>
<td>34%</td>
<td>Gram-negative</td>
</tr>
<tr>
<td><em>Enterococcus</em> sp</td>
<td>6%</td>
<td><em>Enterococcus</em> sp</td>
</tr>
</tbody>
</table>

*IDSA 2011
ICHE 2013  1:1-14
CHG Bathing Unresolved Questions

• Differences in outcomes based on product (liquid or cloths)???

• Differences between patient self performed bathing and bathing performed by trained staff???

• Influence of highly compliant practices – is bathing done consistently???

• How many days is required to reduce risk???