Universal Decolonization
Horizontal vs Vertical Interventions
to Reduce Healthcare-Associated Infections

Ed Septimus, MD, FACP, FIDSA, FSHEA
Medical Director, Infection Prevention and Epidemiology
Clinical Services Group, HCA
CI Professor Internal Medicine Texas A&M Medical School
Professor, Distinguished Senior Fellow, School of Public Health, George Mason University
edward.septimus@hcahealthcare.com
Disclosures

Conducting clinical trials and studies in which participating hospitals are receiving contributed product from Sage Products, Clorox, and Molnlycke
Introduction
Healthcare Associated Infections (HAIs)

In 2000, HAIs became a national priority

- 1.7 million HAI cases/year
- 100,000 deaths/year
- Top 10 cause of death in US
- $6.5-10 billion annually
- Most preventable

“The greatest danger for most of us is not that our aim is too high and we miss it, but that our aim is too low and we reach it.”

• Michelangelo
Agenda

• Introduction: Overview of impact and trends in HAIs
• Infection prevention approaches
• Vertical vs Horizontal Approaches to HAI Prevention
• Rationale and impact of CHG bathing on HAIs
## HAI and Cost

<table>
<thead>
<tr>
<th>HAI Infections(^1) (percent)</th>
<th>Estimated Costs(^2) ($)</th>
<th>LOS(^2) (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia (21.8)(^†)</td>
<td>40,144 (VAP)</td>
<td>13.1</td>
</tr>
<tr>
<td>Surgical-site infection (21.8)</td>
<td>20,785</td>
<td>11.2</td>
</tr>
<tr>
<td>GI infection (^‡) (17.1)</td>
<td>11,285 (C. difficile)</td>
<td>3.3</td>
</tr>
<tr>
<td>UTI (12.9)(^¥)</td>
<td>896 (CAUTI)</td>
<td>Not reported</td>
</tr>
<tr>
<td>Primary BSI (9.9)(^§)</td>
<td>45,814 (CLABSI)</td>
<td>10.4</td>
</tr>
</tbody>
</table>


\(^†\) 39.1 % associated with mechanical ventilation

\(^‡\) 70.9% C. difficile

\(^¥\) 67.7 % associated with a catheter

\(^§\) 84% associated with a central catheter

Annual cost 9.8 billion
Top 5 HAI\(s\) \(^2\)
“Many infections are inevitable; some might be preventable”

“Each infection is potentially preventable, unless proven otherwise”
The Art of the Possible

• **IT IS POSSIBLE to reduce HAIs**
  – 2003: The irreducible minimum by current knowledge: **20%** ¹
  – 2011: The estimated limit of HAI preventability: **55-70%** ²

<table>
<thead>
<tr>
<th>Infection</th>
<th>Preventability</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLABSI</td>
<td>65-70%</td>
</tr>
<tr>
<td>CAUTI</td>
<td>65-70%</td>
</tr>
<tr>
<td>SSI</td>
<td>55%</td>
</tr>
<tr>
<td>VAP/VAE</td>
<td>55%</td>
</tr>
</tbody>
</table>

• **We must achieve much more**
  – *C. difficile*
  – Can we eradicate MDROs?
  – Antibiotic stewardship

² Umscheid et al. ICHE 2011;32(2):101-114
CMS is implementing three distinct independent programs that have payment tied to the clinical performance of the hospital.

- Value–Based Purchasing Program
- Readmissions Reduction Program
- Hospital Acquired Conditions Reduction Program
Infection Prevention Approaches

- **Vertical:** Substantially reduces a pathogen specific
  - Active surveillance (e.g. MRSA, *C. difficile*, MDRO)
  - Contact precautions (e.g. MRSA colonization or MRSA, *C. difficile* infection, MDRO)
  - 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, universal gloving)
  - Environmental cleaning and disinfection
  - Antimicrobial stewardship
  - Bundles of care (e.g. CLABSI, SCIP, Vent)
  - CHG bathing
  - Selective digestive tract decontamination
  - Behavior modification

*Modified Int J of Infect Dis. 1 4S4;2010: S3*
HCA Journey

- ABCs MRSA
- REDUCE MRSA
- Research agenda-ABATE
Hospital Corporation of America Health System

STATISTICS

18 MILLION PATIENT CONTACTS PER YEAR

APPROXIMATELY 5% OF MAJOR HOSPITAL SERVICES IN THE U.S.

- ADMISSIONS < 1.5 MILLION
- PATIENT DAYS < 7.6 MILLION
- DELIVERIES < 0.23 MILLION
- TOTAL SURGERIES < 1.3 MILLION
- ED VISITS < 6 MILLION

166 HOSPITALS

124 FREESTANDING SURGERY CENTERS

>550 PRACTICES IN

23 STATES AND ENGLAND

HOSPITALS RANGE FROM COMPLEX TERTIARY REFERRAL AND ACADEMIC MEDICAL CENTERS TO URBAN AND SUBURBAN COMMUNITY MEDICAL CENTERS

197,000 EMPLOYEES

35,000 AFFILIATED PHYSICIANS

MORE THAN 38,000 LICENSED BEDS
HCA’s MRSA Solution: The A,B,Cs…

- **A**ctive Surveillance of high risk patients
- **B**arrier Precautions
- **C**ompulsive Hand Hygiene
- **D**isinfection / Environmental Cleaning
- **E**xecutive Championship
Reduction in Healthcare-Associated MRSA
Central Line Associated Blood Stream Infections in
Adult ICUs

Hospital Acquired BSI per 1,000 line
days

Pre-Intervention (2Q06 - 4Q06)  
Intervention period (1Q07 - 2Q07) HCA MRSA Campaign
Post-Intervention (3Q07 - 2Q08)
Facilities Not Surveyed (3Q08 - 4Q08)
2009 Survey (1Q09 - 4Q09)

P <.001
38% decrease

P <.001
62% decrease

J Healthcare Quality 2013; 35:57
Reduction in Healthcare-Associated MRSA Ventilator Associated Pneumonia in Adult ICUs

Hospital Acquired VAP per 1,000 ventilator days

- Pre-Intervention (2Q06 - 4Q06)
- Intervention period (1Q07 - 2Q07) HCA MRSA Campaign
- Post-Intervention (3Q07 - 2Q08)
  - P < .001
- Facilities Not Surveyed (3Q08 - 4Q08)
- 2009 Survey (1Q09 - 4Q09)
  - P < .001

54% decrease
51% decrease

J Healthcare Quality 2013: 57:57
HCA’s MRSA Solution: The A,B,Cs…

- **Active Surveillance of high risk patients-**vertical
- **Barrier Precautions-**±vertical
- **Compulsive Hand Hygiene-**horizontal
- **Disinfection / Environmental Cleaning-**horizontal
- **Executive Championship-**horizontal
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
CHG Impact on Skin, Environment, Staff Contamination and VRE Acquisition

Chlorhexidine Cloth
- Skin Contamination
- Environmental Contamination
- Worker Hand Contamination
- Patient Acquisition

Nonmedicated Cloth
- Skin Contamination
- Environmental Contamination
- Worker Hand Contamination
- Patient Acquisition

Risk Ratio
0 0.5 1.0 1.5 2.0 2.5
Favors Cleansing by Cloth Favors Soap and Water Bath

Arch Intern Med 2006; 166:306-12.
Chlorhexidine Prevention of Bloodstream Infections

2% Chlorhexidine gluconate cloths

Soap and Water

Soap and Water

2% Chlorhexidine gluconate cloths

MICU A

MICU B

“Wash-out” period

28 weeks

2 weeks

24 weeks

(June 8-December 20, 2005)

(January 5-June 21, 2006)
Chlorhexidine Impact on Central Line Bloodstream Infections

P = 0.04 by the log-rank test
All patients daily whole-body disinfection with 4% CHG

Of 320 patients at admission, 55 (17%) ACBA-positive skin swabs

Prevalence of ACBA skin colonization among remaining patients was 5.5% at 24h and 1% at 48h ($P = 0.002$, OR: 2.4)

ACBA-BSIs decreased from 4.6 to 0.6 per 100 patients ($P \leq 0.001$; OR: 7.6)

Daily whole-body CHG disinfection significantly reduced ACBA skin colonization and BSIs
Reduction in MRSA and VRE Acquisition with Chlorhexidine Bathing

- 4 Center pre-post evaluation of adult ICUs
- 6 months of routine soap → 6 months of 4% CHG liquid

<table>
<thead>
<tr>
<th></th>
<th>Baseline Period</th>
<th>Intervention Period</th>
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<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 (p = 0.046)&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 (p = 0.008)&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>

<sup>a</sup> Apgar score of 5 or less

<sup>b</sup> Per 1,000 patient days

<sup>c</sup> Significance levels indicated by p-values

Bioburden on Inguinal Skin by Cleansing Method

- Soap and water
- Non-medicated cloths
- Chlorhexidine cloths

Mean log_{10} colonies

T1: pre bath
T2: 0-2 h
T3: 3-5 h
T4: 6-8 h

- Vancomycin-resistant enterococci
- Gram-positive bacteria
- Gram-negative bacteria
- Yeast

ICHE 2012;33(9):889-896
Recent Cluster Randomized Trials

• **Adult ICUs**
  - Academic teaching centers (Climo et al)
  - Community hospitals HCA (Huang et al)
  - 13 European ICUs (Derde et al)
  - Single site academic center (Noto et al)

• **Pediatric ICUs**
  - Academic teaching centers (Milstone et al)
Decolonization in Academic Adult ICUs

- Multicenter, cluster-randomized, nonblinded crossover trial. Nine intensive care and bone marrow transplantation units in six hospitals were randomly assigned to bathe patients either with no-rinse 2% chlorhexidine–impregnated cloths or with nonantimicrobial washcloths for a 6-month period, exchanged for the alternate product during the subsequent 6 months.
- All units performed active surveillance testing for MRSA and VRE throughout the study period.
- The intervention was associated with a significant reduction in hospital-acquired bloodstream infections (28% lower with CHG $P=0.007$) and reduced acquisition of VRE, but not MRSA.
- The effect was greater in patients who were in the unit longer.
- A total of 7727 patients were enrolled during the study.
Decolonization in Academic PICUs

• 10 Pediatric ICUs, 5 academic medical centers, 4957 patients
  o Randomized cross-over design (6 months each) CHG cloths vs. routine bathing
  o Excluded those with
    o Anticipated LOS < 2 days
    o Lumbar drains
    o Severe skin issues

• Outcome
  o Incidence of bacteremia was significantly lower with CHG bathing ($P=0.044$)
  o Bacteremia secondary to a central line was significantly lower with CHG bathing ($P=.021$)

*Lancet*. 2013; 381:1099-1106
Decolonization in 13 European ICUs in 8 Countries

• Three phase study:
  – Phase 1-6 month baseline
  – Phase 2-interrupted time series analysis of universal daily 4% CHG combined with HH for 6 months
  – Phase 3-12-15 month cluster randomized trial comparing conventional screening or rapid screening with contact precautions for identified carriers. (MRSA, VRE, and highly-resistant Enterobacteriaceae)

• Results 8976 patients eligible
  – HH compliance increased from 52% phase 1, 69% phase 2, and 77% in phase 3
  – Improved hand hygiene and chlorhexidine bathing are associated with a reduction in acquisition, mainly through reduced acquisition of MRSA
  – Screening and isolation of carriers did not further reduce acquisition of multidrug-resistant bacteria, whether screening was done with rapid testing or conventional testing.

• Horizontal>Vertical

Lancet Infect Dis 2014; 14:31-39
Targeted versus Universal Decolonization to Prevent ICU Infection


- Hospital Corporation of America
- Harvard Pilgrim Healthcare Institute/Harvard Medical School
- University of California Irvine
- Rush University
- CDC Prevention Epicenters Steering Committee
Trial Rationale

• MRSA important in healthcare associated infections
  – MRSA and MSSA #1 cause of HAIs in US
  – Risk of *S. aureus* HAI 3-12 fold higher in carriers
  – Dual objective for reduced MRSA: preventing infections in carriers and reduce cross-transmission

• Many quality improvement strategies
  – Screen and isolate
  – Screen, isolate, decolonize
  – Universal decolonization

• No head-to-head comparisons

• Debate of high risk pathogen vs high risk populations

*ICHE* 2009;30:623-32  
*CID* 2007;44:178-85  
*CID* 2010;50:210-217  
*Arch Int Med.* 2006;166:306-12  
*Arch Int Med.* 2007;167:2073-9  
*ICHE* 2013;34:1-14  
*J Hosp Infect* 2013; 84:13-21
Cluster Randomized Trial

Randomized hospitals and all their adult ICUs 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+ or other MDRO
  - Decolonized all
Decolonization Regimens

- **Arm 2: Targeted Decolonization**
  - Nasal mupirocin twice daily for 5 days
  - 2% chlorhexidine cloth baths daily for 5 days

- **Arm 3: Universal Decolonization**
  - Nasal mupirocin twice daily for 5 days
  - 2% chlorhexidine cloth baths daily for ICU duration
Decolonization in Community ICUs

- 74 adult ICUs, 43 hospitals, 74,256 patients
  - 1 academic center, 42 community hospitals
  - 3-arm cluster randomized trial of hospitals
  - 3 hospitals provide bone marrow transplants
  - 5 hospitals provide solid organ transplants

Timeline:
- Baseline: Jan 2010
- Intervention: Sep 2011
- Phase In: Apr 2010
- 12 month
- 18 month
Outcomes

- **Primary**
  - Any MRSA clinical isolate attributed to ICU
- **Secondary**
  - MRSA bloodstream isolate attributed to ICU
  - Any bloodstream isolate attributed to ICU

- **Outcome Definitions**
  - Microbiology results alone
  - > 2d after ICU admit → 2d after ICU discharge
Apply Chlorhexidine WITH FIRM MASSAGE to remove bacteria

USE ALL 6 CHG CLOTHS
Avoid EYES & EAR CANAL

1. FACE, NECK SHOULDERS & CHEST
2. BOTH ARMS & HANDS
3. ABDOMEN, GROIN & PERINEUM
4. RIGHT LEG & FOOT
5. LEFT LEG & FOOT
6. BACK, THEN BUTTOCKS

- Clean 6 inches of all tubes, lines, and drains closest to patient with CHG
- Safe on superficial wounds, rash, burns

Skin may feel sticky for a few minutes after CHG application.
Do NOT wipe off. Allow to air dry.

THIS IS a PROTECTIVE BATH
Do not use soap which can inactivate CHG

Conclusions for ICU Settings

• Universal decolonization
  – 37% reduction in MRSA clinical isolates
  – 44% reduction in all-cause bloodstream infection
  – Trend in reduction of MRSA bacteremia which was not statistically significant*
  – Required no screening
  – May reduce need for contact precautions

• Targeted decolonization
  – 22% reduction in all-cause bloodstream infection

• Horizontal vs Vertical Approaches
  – Universal better than targeted

*trial was powered to have 80% power to detect a 40% reduction in MRSA bacteremia in arm2 and 60% relative reduction in arm 3
Elevated baseline bloodstream rate in Arm 3 maybe related to higher acuity. Arm 3 had 2 of 3 BMT units in the trial, and 3 of 5 solid organ transplant units.
Secondary Analyses

- Blood contamination
- Urinary tract infections
- Cost effectiveness analysis
- Emergence of resistance to mupirocin/chlorhexidine
Does Chlorhexidine Bathing in Adult Intensive Care Units Reduce Blood Culture Contamination? A Pragmatic Cluster-Randomized Trial

Edward J. Septimus, MD; Mary K. Hayden, MD; Ken Kleinman, ScD; Taliser R. Avery, MS; Julia Moody, MS; Robert A. Weinstein, MD; Jason Hickok, MBA, RN; Julie Lankiewicz, MPH; Adriana Gomboshev, BS; Katherine Haffenreffer, BS; Rebecca E. Kaganov, BA; John A. Jernigan, MD, MS; Jonathan B. Perlin, MD, PhD; Richard Platt, MD, MS; Susan S. Huang, MD, MPH

Infect Control Hosp Epidemiol 2014;35(S3):S17-S22
Logistic regression models demonstrated a significant difference across the arms when comparing the reduction in contamination between baseline and intervention periods in both unadjusted ($P=0.02$) and adjusted ($P=0.02$) analyses. Arm 3 resulted in the greatest reduction in blood culture contamination rates, with an unadjusted odds ratio (OR) of 0.56 (95% confidence interval [CI], 0.044–0.71) and an adjusted OR of 0.55 (95% CI, 0.43–0.71).
The REDUCE MRSA Trial: Impact of Decolonization on Urinary Tract Infection in ICUs

• Universal decolonization reduced candiduria and bacteriuria
  ➢ 22-27% in men
  ➢ No affect in women

• Anatomic differences likely explained by ability to clean
  ➢ Perineal cleaning and cleaning of catheters is key

Lancet Infect Dis 2016; 16:70-79
Cost Impact

Cost Savings of Universal Decolonization to Prevent Intensive Care Unit Infection: Implications of the REDUCE MRSA Trial

Susan S. Huang, MD, MPH; Edward Septimus, MD; Taliser R. Avery, MPH; Grace M. Lee, MD, MPH; Jason Hickok, MBA, RN; Robert A. Weinstein, MD; Julia Moody, MS; Mary K. Hayden, MD; Jonathan B. Perlin, MD, PhD; Richard Platt, MD, MS; G. Thomas Ray, MBA

Infect Control Hosp Epidemiol 2014;35::S23-S31
Take Away Points: Cost Impact

• Universal Decolonization was the dominant strategy
  ➢ Lowest intervention costs
  ➢ Lowest total ICU costs

• For every 1,000 admissions, Universal Decolonization
  ➢ Saved $171,000
  ➢ Prevented 9 bloodstream infections

• Lowest cost strategy
  ➢ Across a range of MRSA prevalence
  ➢ Regardless of type of screening (PCR or chromogenic agar)
  ➢ Across a wide range of bloodstream infection costs
The REDUCE MRSA Trial: Impact of Decolonization on Urinary Tract Infection in ICUs

• Universal decolonization reduced candiduria and bacteriuria
  ➢ 22-27% in men
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• Anatomic differences likely explained by ability to clean
  ➢ Perineal cleaning and cleaning of catheters is key
Impact on Resistance

ID Week
October 10, 2014
Oral Abstract # 636
Laboratory Methods

- MRSA isolates identified at local hospital clinical laboratories
- Shipped to central laboratory (Rush, Chicago)
  - Confirmed as MRSA by standard microbiologic methods

- CHG susceptibility
  - Microtiter dilution
    - Non-susceptible: MIC > 4 mg/L
  - qacA/B carriage by qPCR*

- Mupirocin susceptibility
  - E-test® (bioMérieux)
    - High-level (HL) resistance: MIC>256 mg/L
    - Low-level (LL) resistance: MIC 8-64 mg/L

*This study
CHG MIC Distributions of all Qualifying MRSA (n=3362)

Arm 1
Screening and Contact Precautions

Arm 3
Universal Decolonization
Mupirocin Resistance: All Clinical Isolates (n=853)

- No significant difference in change in % resistant isolates in intervention vs baseline period, across arms, (p=0.083)
Noto et al., JAMA Article on CHG Bathing

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Chlorhexidine Bathing and Health Care–Associated Infections
A Randomized Clinical Trial

Michael J. Noto, MD, PhD; Henry J. Domenico, MS; Daniel W. Byrne, MS; Tom Talbot, MD, MPH; Todd W. Rice, MD, MSc; Gordon R. Bernard, MD; Arthur P. Wheeler, MD

IMPORTANCE Daily bathing of critically ill patients with the broad-spectrum, topical antimicrobial agent chlorhexidine is widely performed and may reduce health care–associated infections.

OBJECTIVE To determine if daily bathing of critically ill patients with chlorhexidine decreases the incidence of health care–associated infections.

DESIGN, SETTING, AND PARTICIPANTS A pragmatic cluster randomized, crossover study of 9340 patients admitted to 5 adult intensive care units of a tertiary medical center in Nashville, Tennessee, from July 2012 through July 2013.

INTERVENTIONS Units performed once-daily bathing of all patients with disposable cloths impregnated with 2% chlorhexidine or nonantimicrobial cloths as a control. Bathing treatments were performed for a 10-week period followed by a 2-week washout period during which patients were bathed with nonantimicrobial disposable cloths, before crossover to the alternate bathing treatment for 10 weeks. Each unit crossed over between bathing.

CONCLUSION AND RELEVANCE In this pragmatic trial, daily bathing with chlorhexidine did not reduce the incidence of health care–associated infections including CLABSIs, CAUTIs, VAP, or C difficile. These findings do not support daily bathing of critically ill patients with chlorhexidine.
• Does not compare to prior large multi-center trials
• Small study: single center, 5 adult ICUs, 2 of units already had implemented CHG bathing
• Short study: 10 week cross over study of CHG vs usual care
• Assurance of training, compliance, application unclear
• Compatibility assessment unknown
• The primary outcome infection rate (a composite outcome of central line-associated bloodstream infections, catheter-associated urinary tract infections, ventilator-associated pneumonia, and C. difficile infections)-CHG unlikely to influence VAP or C. difficile
• The study was underpowered to detect differences due to the rarity of events, which limits the generalizability of the results
Chlorhexidine daily bathing: Impact on healthcare-associated infections caused by gram-negative bacteria

- From March 2012-May 2013, investigators enrolled 325 patients with at least 1 prior episode of suspected sepsis in the ICU, during two 6-month periods. The intervention group was subjected daily to skin cleansing with 2% CHG impregnated cloths, whereas the control group was bathed daily with soap and water. HAI included bloodstream infections, ventilator-associated pneumonia, and urinary tract infections. Incidence rates corresponded to the number of infections per 1,000 patient days.
- Incidence of HAI was significantly decreased in the intervention group (29 vs 56; P=.01).
- The incidence rate of clinical cultures positive for gram-negative bacteria, including Enterobacteriaceae and nonfermenting bacilli, decreased in the intervention group (risk ratio=0.588; 95% CI, 0.346-0.978; P=.04)

Am J Infect Control 2015; in press
Rapid Adoption of Universal Decolonization

Closing the Translation Gap: Toolkit Based Implementation of Universal Decolonization in Adult Intensive Care Units Reduces Central Line Associated Bloodstream Infections in 95 Community Hospitals

Septimus E.¹,², Hickok J.¹, Moody J.¹, Kleinman K.³, Avery T.R.³, Huang S.S.⁴, Platt R.³, Perlin J.¹

Clinical Infectious Diseases Advance Access published May 3, 2016
A Gap Between Evidence and Practice

• One of the most consistent findings from clinical and health services research is the failure to translate research into practice and policy.\(^1\)
• Improving population health outcomes relies on implementation of findings from clinical and health services research.\(^2\)

It takes an average of 17 years for research to reach clinical practice\(^3\)

Time Line: Rapid Adoption

Baseline (Pre) | Ramp-up | Full Implementation (Post)

Presented at ID Week
Published in N Engl J Med

137 ICUs from 95 hospitals
Universal ICU Decolonization: An Enhanced Protocol

Introduction and Welcome

This enhanced protocol is based on materials successfully used in the REDUCE MRSA Trial (Randomized Evaluation of Decolonization vs. Universal Clearance to Eliminate Methicillin-Resistant Staphylococcus aureus), which found that universal decolonization was the most effective intervention. Universal decolonization led to a 37 percent reduction in MRSA clinical cultures and a 44 percent reduction in all-cause bloodstream infections.

Post-Trial Roll Out HCA

23.5% (9.8%-35.1%) P=0.001

Clin Infect Dis online May 3, 2016
(SIR) decreased 21.5% ($p = 0.004$, 95% CI [7.5%, 33.5%])
ABATE Infection Trial
Active Bathing to Eliminate Infection

Adult NonCritical Care Patient Wards
ABATE Infection Trial
Active Bathing to Eliminate Infection

Trial Design
- 53 and 191 units all HCA hospitals, 14 states
- 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
Outcomes obtained from the HCA data warehouse

Primary Outcomes
• Unit-attributable clinical cultures with MRSA and VRE

Additional Outcomes
• Unit-attributable clinical cultures with GNR MDRO
• Unit-attributable clinical cultures with *C. difficile*
• Bloodstream infections: all pathogens
• Bloodstream contaminants
• Urinary tract infections: all pathogens
• 30 day readmissions (total and infectious)
• Emergence of resistance (strain collection)
• Cost effectiveness
ABATE Lab Strain Collection

• Collecting MRSA & select GNR isolates
  • Acinetobacter, Burkholderia, E. coli, Klebsiella, Proteus, Pseudomonas, Serratia, Stenotrophomonas
• Adult Non-ICU patients
  • Adult medical, cardiac/telemetry, mixed medical/surgical, surgical, orthopedic, step-down, oncology units
• Only one per species per patient per hospital admission
• Collaborate with hospital infection preventionist or epidemiologist to confirm isolates to save for shipment
ABATE Current Status

Study Start: June 2014

Study Ended: February 2016

Progress

• Will have full baseline data to confirm outcome rates
• Allows us to confirm study end in November or determine if one more quarter is needed

June 2015: Reevaluation of Power
## Intervention Data

<table>
<thead>
<tr>
<th></th>
<th>Arm 1</th>
<th>Arm 2</th>
</tr>
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<tbody>
<tr>
<td># of Hospital Admissions</td>
<td>274,961</td>
<td>321,591</td>
</tr>
<tr>
<td># of Unit Admissions</td>
<td>295,848</td>
<td>349,416</td>
</tr>
<tr>
<td># of Unit Patient Days*</td>
<td>1,359,725</td>
<td>1,657,262</td>
</tr>
<tr>
<td># of Completed Bathing Responses</td>
<td>619,106</td>
<td>984,136</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Arm 2 % Bathing</th>
<th>Arm 2 % Showering</th>
</tr>
</thead>
<tbody>
<tr>
<td>65%</td>
<td>17%</td>
</tr>
</tbody>
</table>

*Represents total patient days. Attributed patient days pending.
# REDUCE vs ABATE

<table>
<thead>
<tr>
<th></th>
<th>REDUCE</th>
<th>ABATE</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Hospitals</td>
<td>43</td>
<td>53</td>
</tr>
<tr>
<td># of Units</td>
<td>74</td>
<td>191</td>
</tr>
<tr>
<td># of Admissions</td>
<td>74,256</td>
<td>596,552</td>
</tr>
<tr>
<td># Patient Days</td>
<td>~282,000</td>
<td>~3,000,000</td>
</tr>
</tbody>
</table>
Infection Prevention Approaches

• **Vertical:** Substantially reduces a pathogen specific
  • Active surveillance (e.g. MRSA, *C. difficile*, MDRO)
  • Contact precautions (e.g. MRSA colonization or MRSA, *C. difficile* infection, MDRO)
  • 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, ? universal gloving)
  • Environmental cleaning and disinfection
  • Antimicrobial stewardship
  • Bundles of care (e.g. CLABSI, SCIP, Vent)
  • CHG bathing
  • Selective digestive tract decontamination
  • Behavior modification

*Modified Int J of Infect Dis. 1 4S4;2010: S3*
SHOULD CHG BATHING BE STANDARD OF CARE?

Horizontal > Vertical

Bath ICU patients > 2 months of age with CHG on a daily basis quality of evidence 1

The role of chlorhexidine bathing in non-ICU patients remains to be determined¹

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¹ Strategies to Prevent Central Line–Associated Bloodstream Infections in Acute Care Hospitals: 2014 Update

Infect Control Hosp Epidemiology 2014; 35:753-771
Background

• Mupirocin (antibiotic) use can cause resistance
• Iodophor (antiseptic) has no resistance after decades of use

2-Arm Randomized Trial

• **Routine care arm**: ICU nasal mupirocin and CHG bathing
• **Swapout arm**: ICU nasal iodophor and CHG bathing

Study Population

• Adult ICUs

Outcomes

• *S. aureus* cultures
• All cause bacteremia
• Emergence of resistance to mupirocin and iodophor
• Recommendations

– Use robust quality improvement methods to ensure reliable performance of basic infection prevention practices known to mitigate transmission of MDROs and the infections they cause

– Ensure adherence to evidence based universally applied HAI prevention strategies including hand hygiene, antimicrobial stewardship, and adequate environmental cleaning

– Applying other evidence-based, horizontal strategies such as universal decolonization in settings where benefits are likely to outweigh risks and costs

– Use active surveillance testing and other vertical approaches selectively when epidemiologically important pathogens are newly emerging and rare to a given institution or region or to control outbreaks of specific pathogens
Ben Zoma says: Who is wise? He who learns from others. Who is a rich? He who is happy with his portion. Who is honored? He who honors others.
REDUCE MRSA and ABATE

University of California Irvine
- Susan Huang
- Adriana Gombosev
- Eric Cui
- Leah Terpstra
- Lauren Heim

Harvard Pilgrim Health Care Institute
- Richard Platt
- Ken Kleinman
- Taliser Avery
- Julie Lankiewicz
- Katie Haffenreffer
- Rebecca Kaganov
- Fallon Onufrek
- Rebecca Kaganov
- Lauren Shimelman

Hospital Corporation of America
- Ed Septimus
- Julia Moody
- Jason Hickok
- Chris Bushe
- Jonathan Perlin
- Jane Englebright

CDC
- John Jernigan

Rush University
- Mary Hayden
- Robert Weinstein
- Karen Lolans

Washington University St. Louis
- Victoria Fraser
THANKS