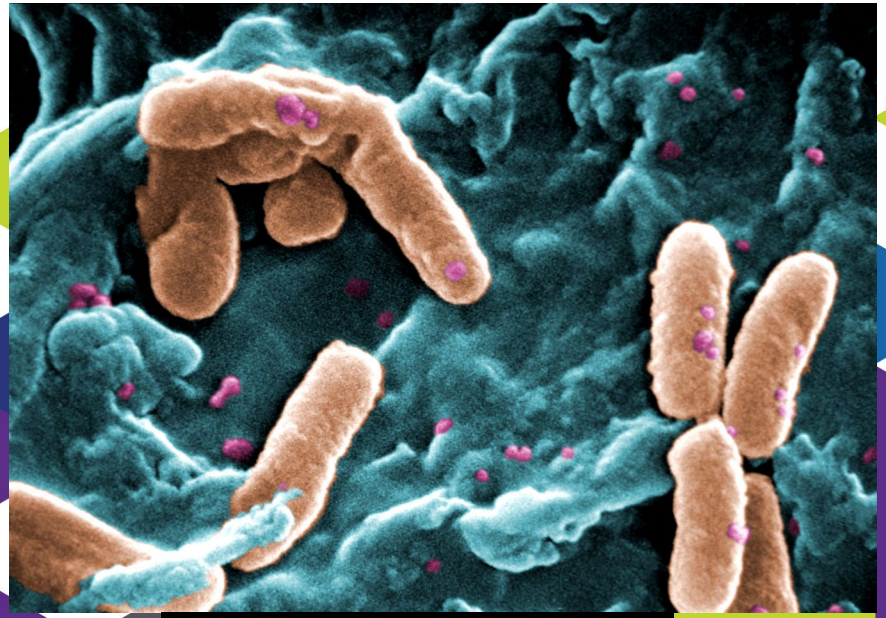

Bugs Be Gone: Strategies for Reducing Bacterial Load and HealthCare Acquired Infections in Your Unit

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Disclosures

- Subject matter expert for CAUTI, CALBSI, CDI, Sepsis, HAPI and culture of Safety for AHA
- Consultant and speaker bureau:
  - Stryker Sage
  - Potrero Medical
  - Baxter Healthcare
  - Asepticscope

Session Objectives

- Identify modes of transmission for the spread of microorganism in the healthcare environment and recommend method of surveillance.
- Analyze key evidence-based practices on how they can reduce bacterial load and/or prevent the development of health care acquired infections
- Define key program steps for creating a source control program within your unit.

CDC Estimates of Annual US Cases of MDRO

Table 1
CDC estimates of annual US cases of multidrug resistant pathogens[3]

Pathogen	Annual cases in hospitalized patients	Annual mortality	Costs ($)
Carbapenem Resistant Enterobacteriaceae (CRE)	13,100	1,100	130,000,000
Carbapenem Resistant Acinetobacter (CRAB)	8,500	700	281,000,000
Clostridioides difficile (C difficile)	223,900	12,800	1,000,000,000
Extended spectrum beta lactamase (ESBL) producing Enterobacteriaceae	197,400	9,100	1,200,000,000
Methicillin-resistant *Staphylococcus Aureus* (MRSA)	323,700	10,600	1,700,000,000
Vancomycin-resistant *enterococcus* (VRE)	54,500	5,400	539,000,000
TOTALS	**821,100**	**39,700**	**4.85 billion**

Peacock WF. Am J Infect Control. 2022 Nov 6:S0196-6553(22)00757-X. PMID: 36351475.

Health Care Acquired Infections

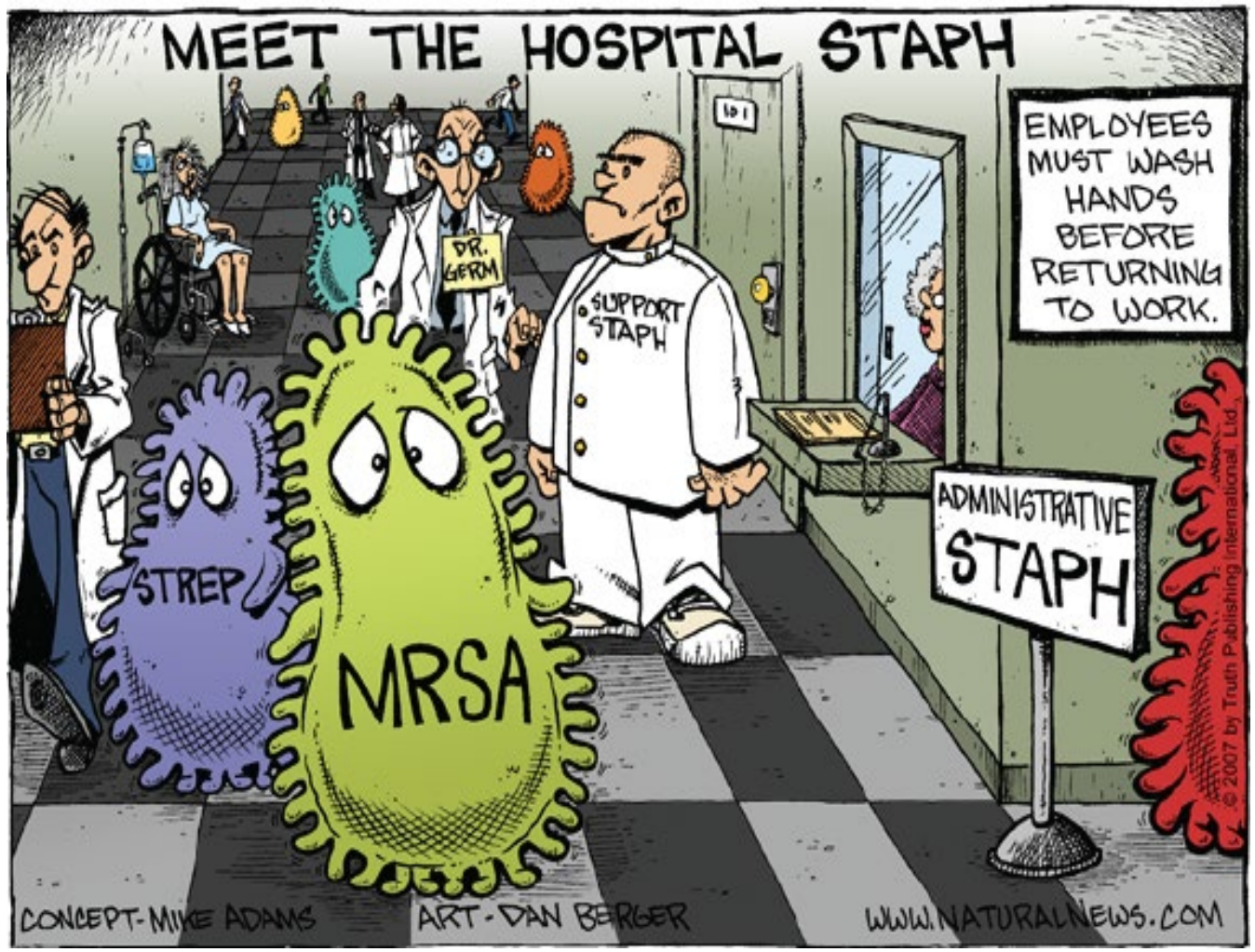
- Pandemic Level Infections
  - CLABSI ↑ 60%
  - MRSA ↑ 37%
  - VAE ↑44%
  - CAUTI ↑ 19%
- Any given day 31 hospitalized patients will develop an HAI
- HAIs are avoidable adverse event
  - Morality rate in US (100,000/year) comparable to a large jet airliner falling out of the sky with no-survivors every day
  - Avoidable adverse event with estimated annual cost $147 billion
  - HAI's lead to ↑ LOS, ↑morbidity/mortality, ↑ Healthcare cost

Peacock WF. Am J Infect Control. 2022 Nov 6:S0196-6553(22)00757-X. PMID: 36351475.

Independent Predictors of Acquiring an MDRO Infection

- Prolonged prior hospital or ICU stay
- Recent surgery or procedure
- Presence of invasive devices
- Recent exposure to antibiotics

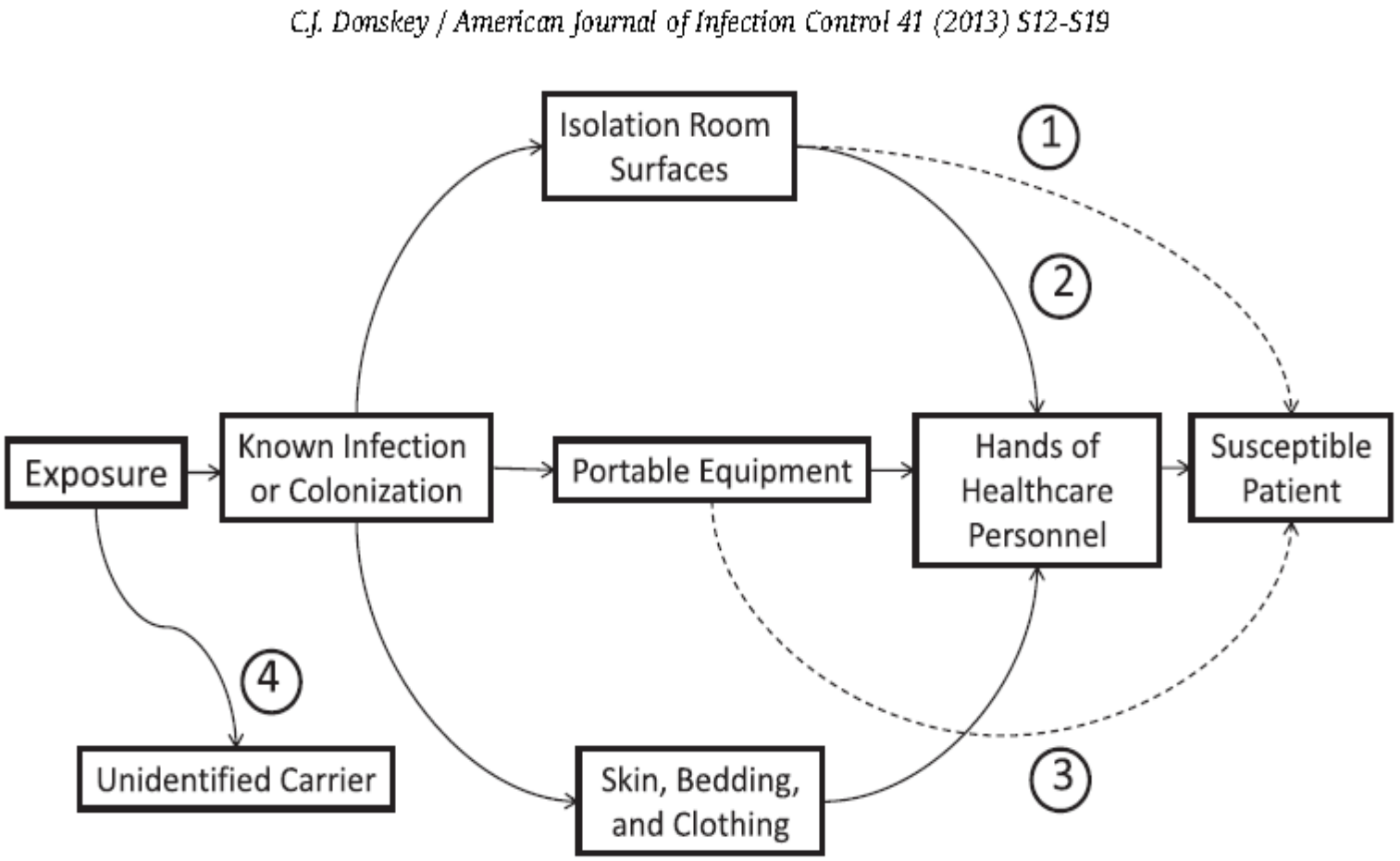
Mills JP, et al. Infect Dis Clin N AM 2021;35:969-994



Concept: Mike Adams
Artwork: Dan Berger
www.naturalnews.com

https://www.naturalnews.com/023156_mrsa_staph_infections.html/see note page

Common Routes of Transmission



HAI in the ICU was the patients' endogenous flora (40%-60%); cross-infection via the hands of health care personnel (HCP; 20%-40%); antibiotic-driven changes in flora (20%-25%); and other(including contamination of the environment; 20%). Weinstein RA.. Am J Med 1991;91(Suppl):179S-184S.

Vertical vs. Horizontal

- Vertical approach refers to a narrow-based program focusing on a single pathogen (selective of the specific MDRO)
  - AST to identify carriers
  - Implementation of measures aimed at preventing transmission from carriers to other patients
    - Isolation
    - Hand hygiene

- Horizontal approach to infection prevention and control measures refers to broad-based approaches attempting reduction of all infections due to all pathogens
  - no screening
  - Universal nasal coverage
  - Bathing
  - No isolation
  - Limit lines/tubes
  - Hand hygiene

Wenzel RP and Edmond MB.. International Journal of Infectious Diseases 14S4 (2010) S3–S5

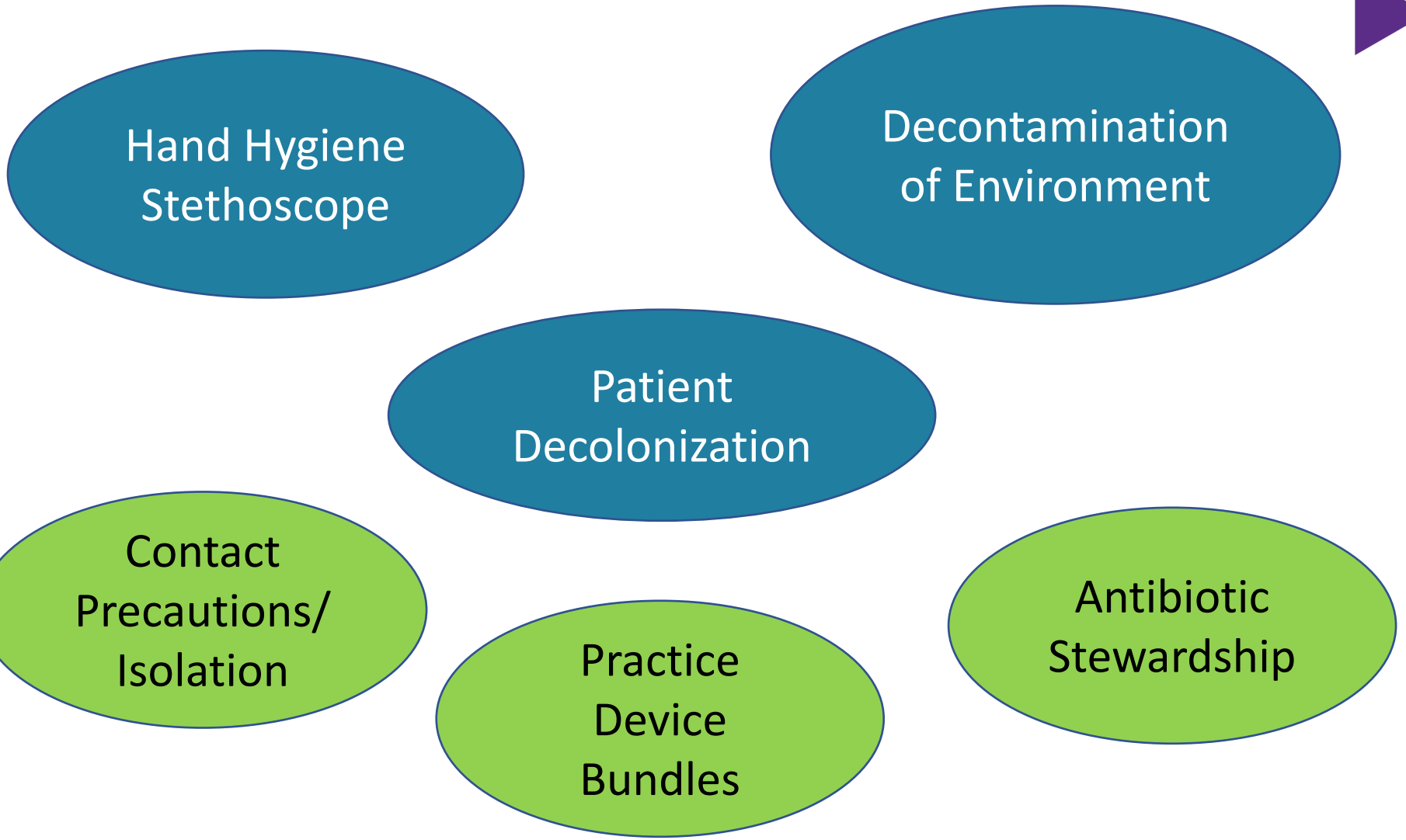
Active Surveillance-When

- Prior to surgical procedures to determine carriage or active infection
- Use AST -Active surveillance testing
  - Based on locations or populations of patients with unacceptably high rates of MRSA despite basics MRSA transmission prevention strategies in place
  - A comparative effectiveness review of universal MRSA screening revealed a low strength of evidence associating universal screening with reductions in HAI MRSA infection; this same review did not reveal other screening strategies to be effective
- Screening for CRE among high-risk populations is recommended based on regional epidemiology
  - LTAC, prior travel to foreign countries with high rates, transferred from another hospital, recent hospital stay

Purchased from Shutterstock

Calfee DP, et al. Infect Control Hosp Epidemiol, 2014;35(7):772-796
Mills JP, et al. Infect Dis Clin N AM 2021;35:969-994
Glick SB, et al. Am J Infect Control. 2014; 42(2):148–55. d

Reducing Hospital Acquired Infections/MDRO's



Calfee DP, et al. Infect Control Hosp Epidemiol, 2014;35(7):772-796
Huang SS, et al. New Engl J of Med, 2013;368(24):2255-65
Health Research & Educational Trust (2017). MDRO Change Packect. Accessed at www.hret-hiin.org.

Hand Hygiene

"I use so much alcohol-based hand sanitizer, my hands had to join a 12-step program!"

Question

- What is the average number of times a clinician should be cleaning their hands in a shift?

  A. 35

  B. 50

  C. 75

  D. 100

Hand Hygiene is the Single Most Important Factor in Preventing the Spread of Infection

Healthcare providers clean their hands less than half of the times they should!!

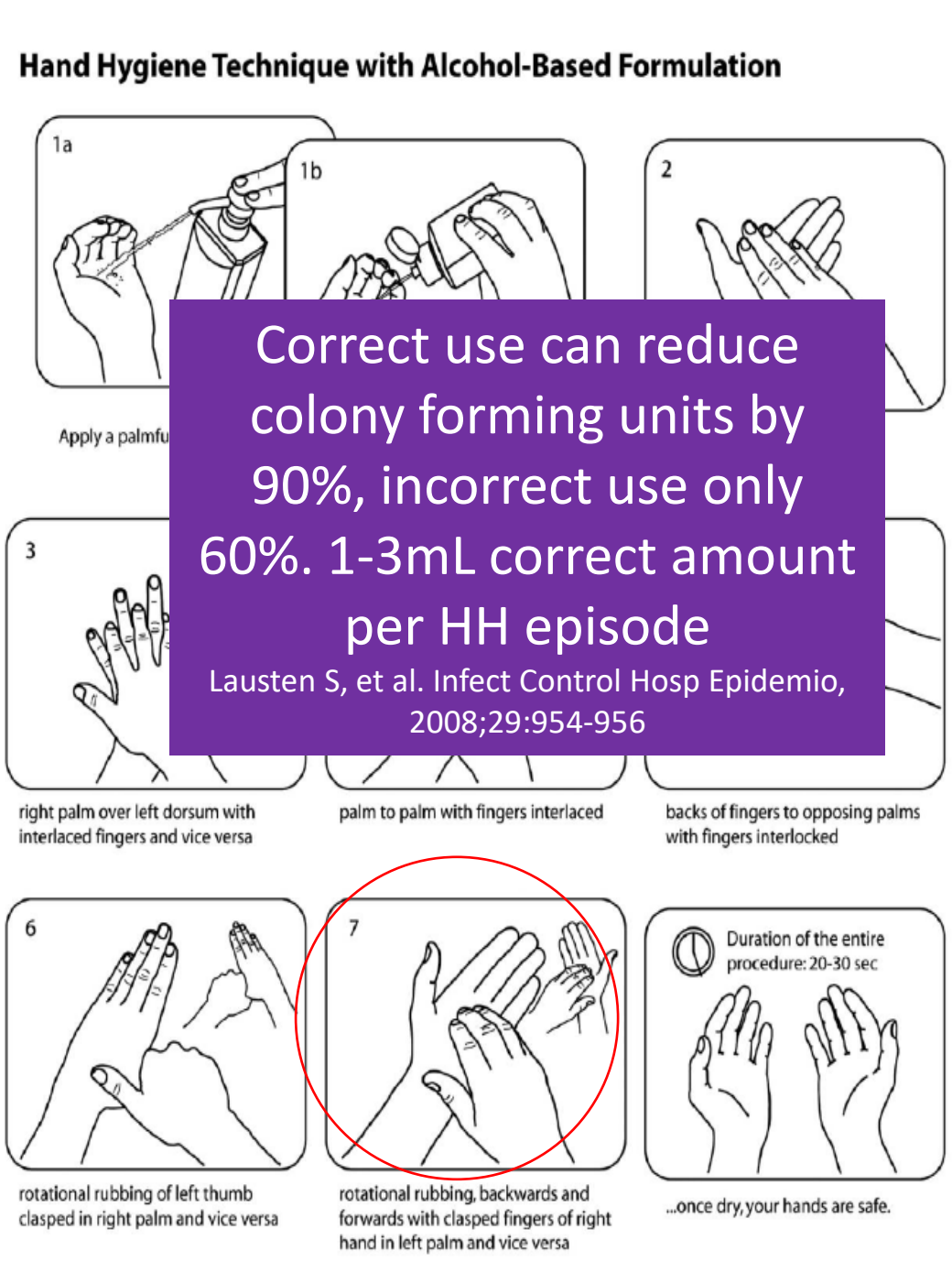
www.cdc.gov/handhygiene

Most Efficient Measure in Reducing MDRO-GNB in ICU

Guidelines for Hand Hygiene in Health Care Settings

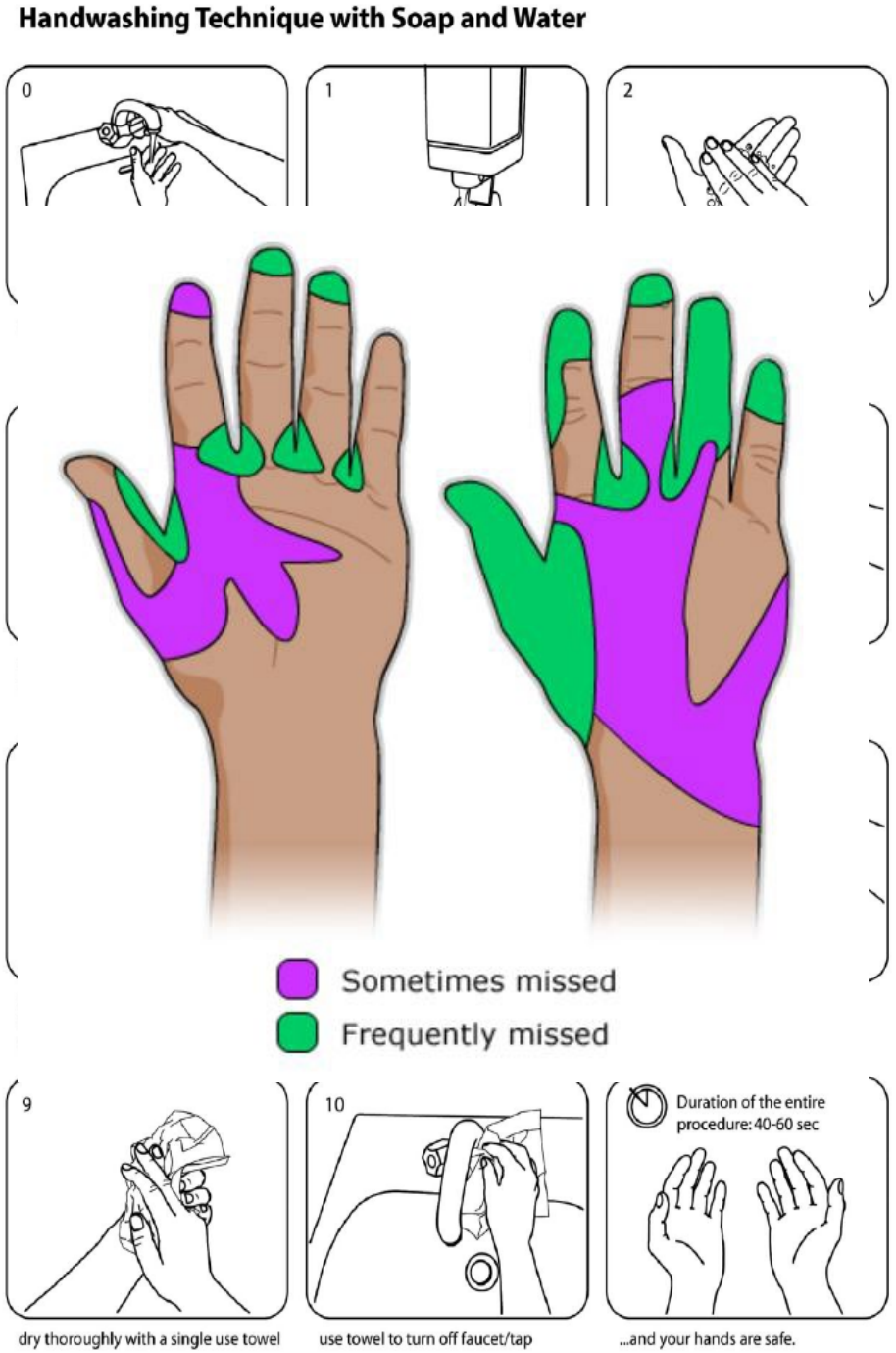
- Alcohol-based hand rub frontline method for decontaminating hands (20-30 seconds)
- Visibly soiled or exposure to potential spore forming organisms, wash with a non-antimicrobial or antimicrobial soap & water (40-60 seconds)
- Do not use Triclosan containing soaps
- Decontaminate hands before & after use of gloves
- Provide HCW with hand lotions & creams to minimize occurrence of irritant contact dermatitis
- Use multidimensional strategies to improve hand hygiene practice
- Do not wear artificial fingernails or extenders

CDC. Hand Hygiene Guidelines: MMWR 2002; 51(No. RR-16):[1-45]
WHO Hand Hygiene Guidelines 2009
Ellingson K, et al. Infect control & Hosp Epidemiology, 2014;35(2): S155-S178
/https://www.cdc.gov/hicpac/pdf/DRAFT-2024-Guideline-to-Prevent-Transmission-of-Pathogens-2023-10-23-508.pdf



Correct use can reduce colony forming units by 90%, incorrect use only 60%. 1-3mL correct amount per HH episode

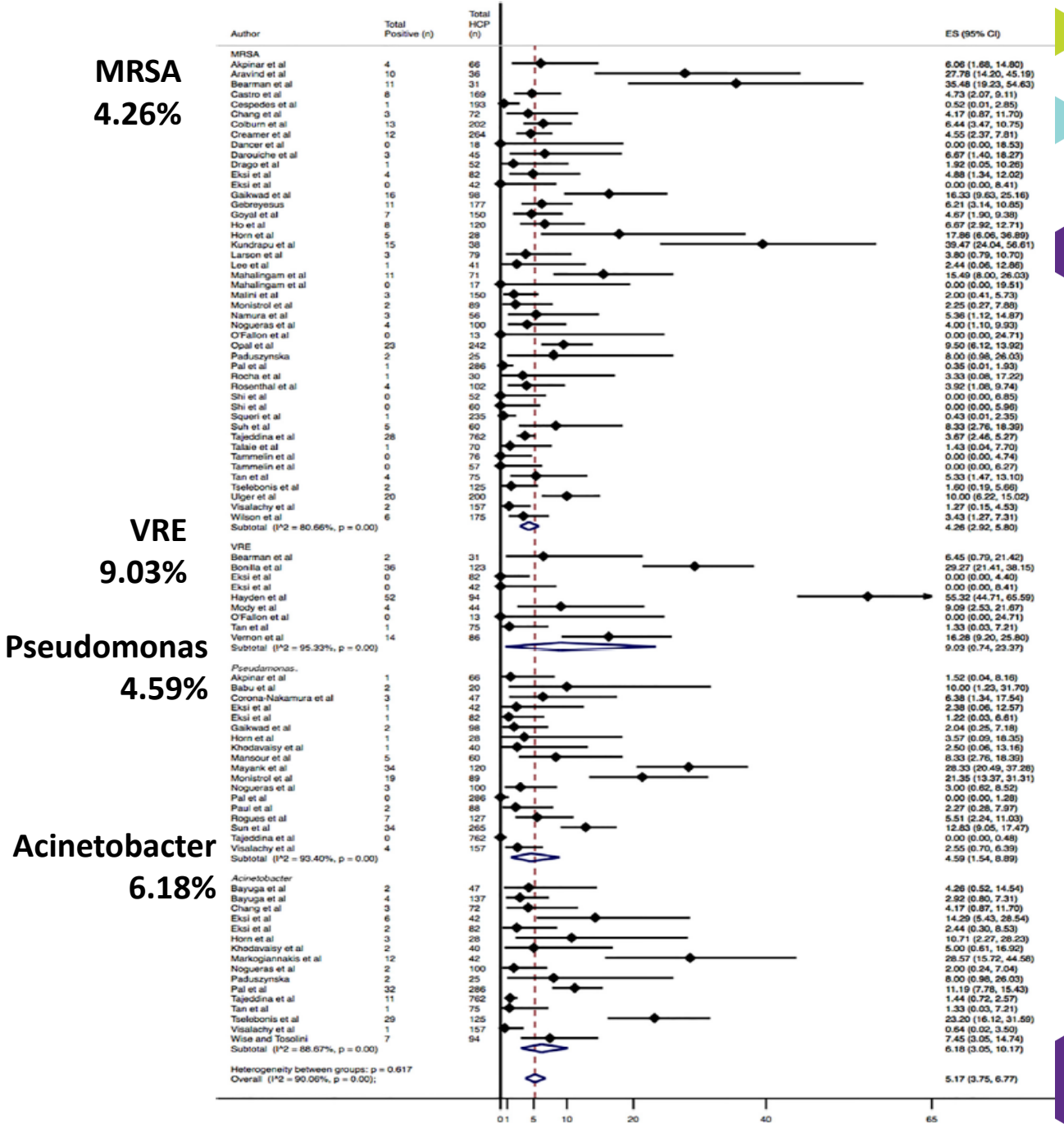
Lausten S, et al. Infect Control Hosp Epidemio, 2008;29:954-956



Images WHO

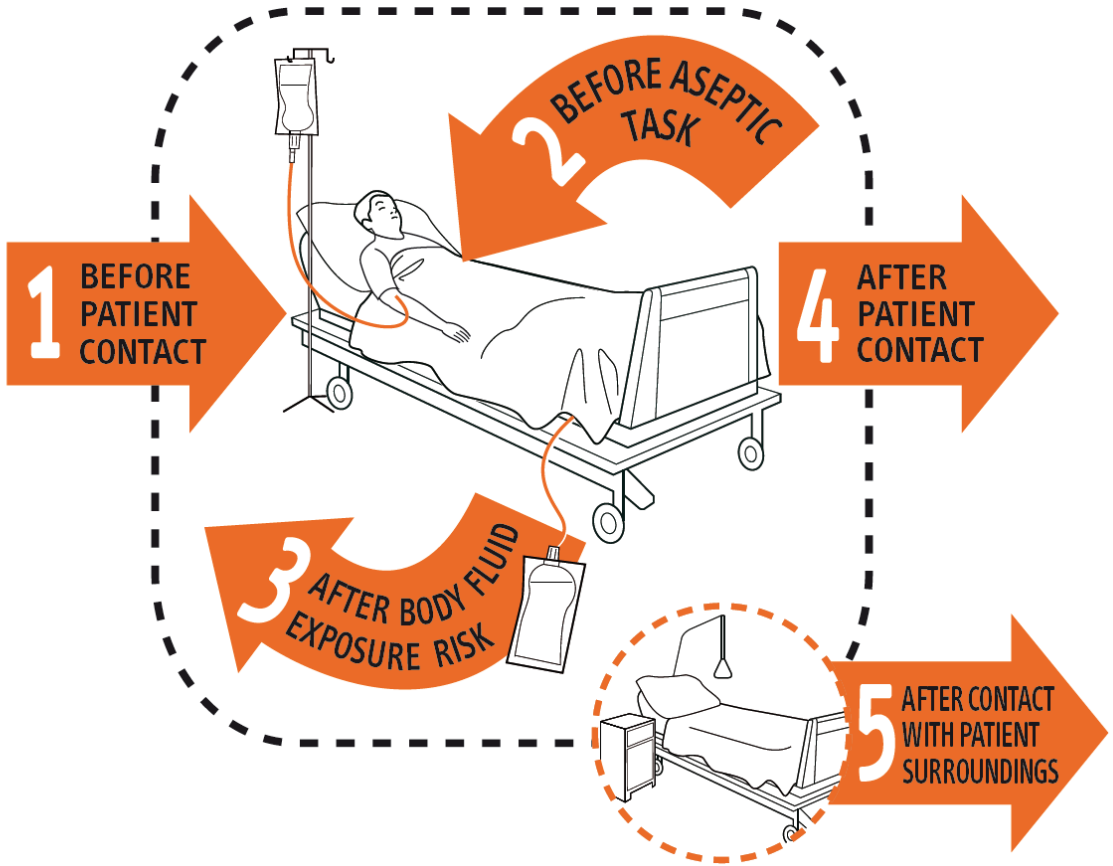
MDRO on Hands of HCW

- Determine prevalence of MDRO on HCP hand in adult acute care
- 59 article-6840 hand cultures
- 47.5% of samples taken during direct pt care
- North America higher rates of MRSA
- ICU's slightly higher Pseudomonas and trend for ↑ Acinetobacter



Montoya, et al. AJIC, 20919;47:693-703

When to Wash



Similar rates of HH compliance

Sunkesula VCK, et al AJIC, 2015;43:16019

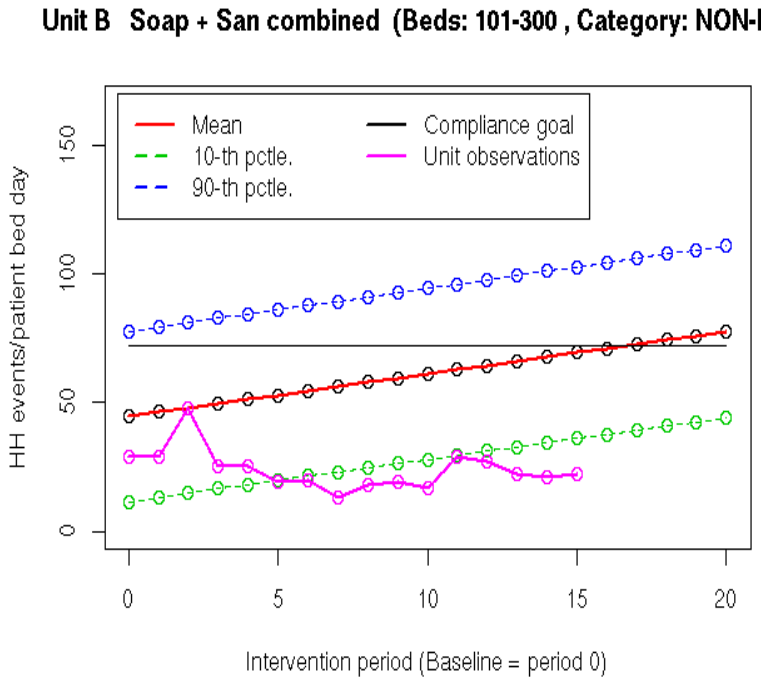
https://cdn.who.int/media/docs/default-source/integrated-health-services-(ihs)/infection-prevention-and-control/your-5-moments-for-hand-hygiene-poster.pdf?sfvrsn=83e2fb0e_6

Pittet D. Infect Control Hosp Epidemiol, 2009;30(7):611-622
WHO Hand Hygiene Guidelines 2009
Ellingson K, et al. Infect control & Hosp Epidemiology, 2014;35(2): S155-S178

Hand Hygiene Measurement Methods

- Direct Observation
- Product Usage/Volume
- Automation monitoring can improve compliance
  - Electronic versus direct observation more accurate in measuring compliance

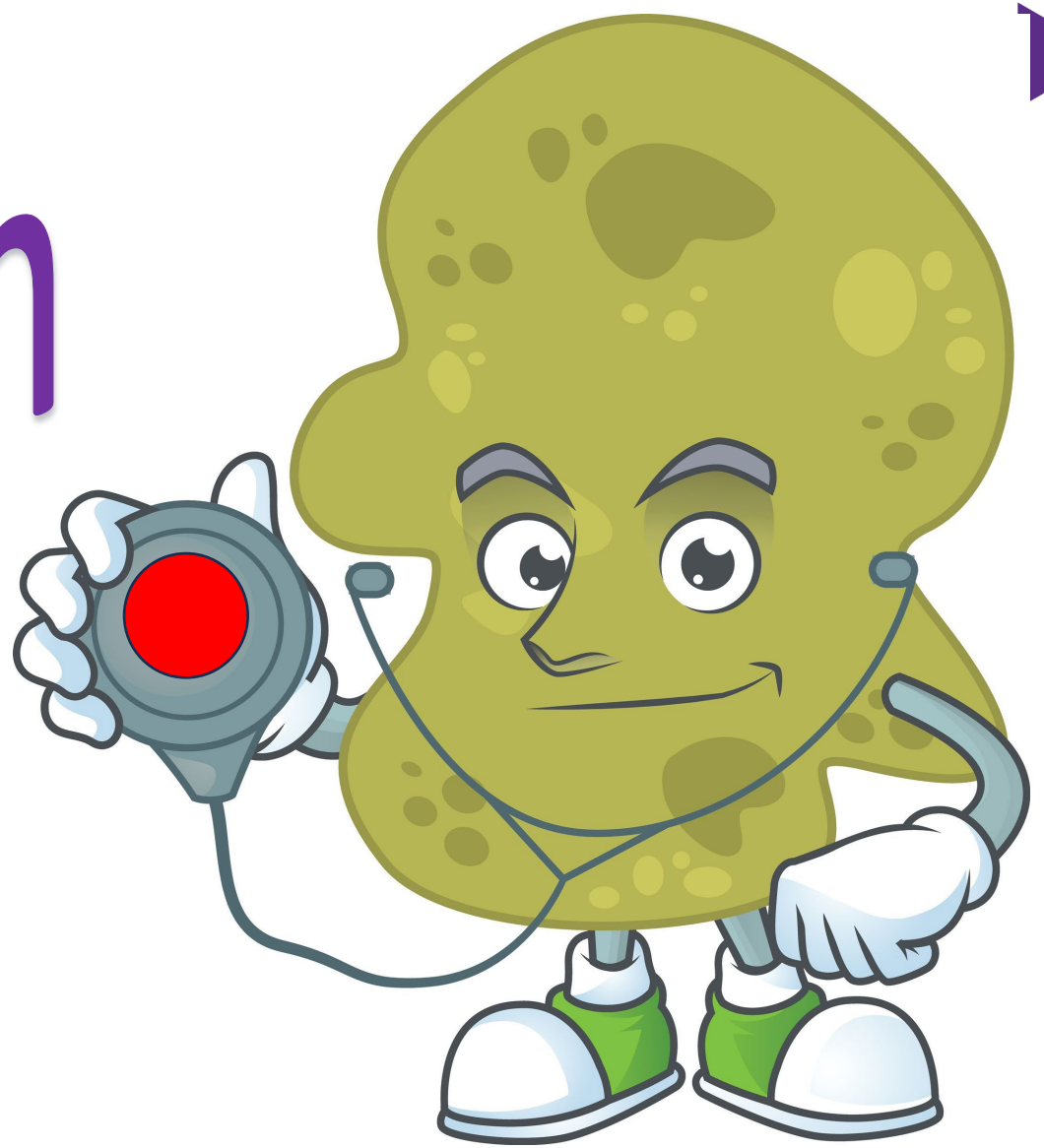
Morgan DJ, et al. AJIC, 2012;40:955-959



Increase use of alcohol hand rub (measure by volume use) correlated significantly (p=0.014) with improvement in MRSA rates Sroka S, et al. J of Hosp Infect, 2010;74:704-211

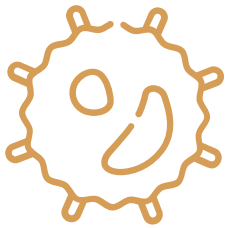
Haas and Larson Journal of Hospital Infection 2007;66:6-14
Polgreen PM, et al. Infect Control & Hosp Epidemiol, 2010;31:1294-1297
Ellingson K, et al. Infect Control & Hosp Epidemiol, 2014;35(S2):S155-178

5.5 Billion



Stethoscope, the Clinician's Third Hand

85% of stethoscopes are contaminated with identical pathogens as the hands

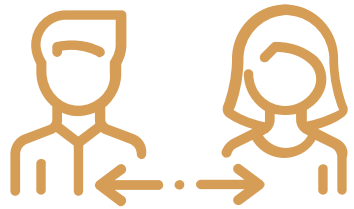


Pathogen
Volume & Diversity

The stethoscope diaphragm carries the same volume and diversity of pathogens **as the hand.**

Patient Contact

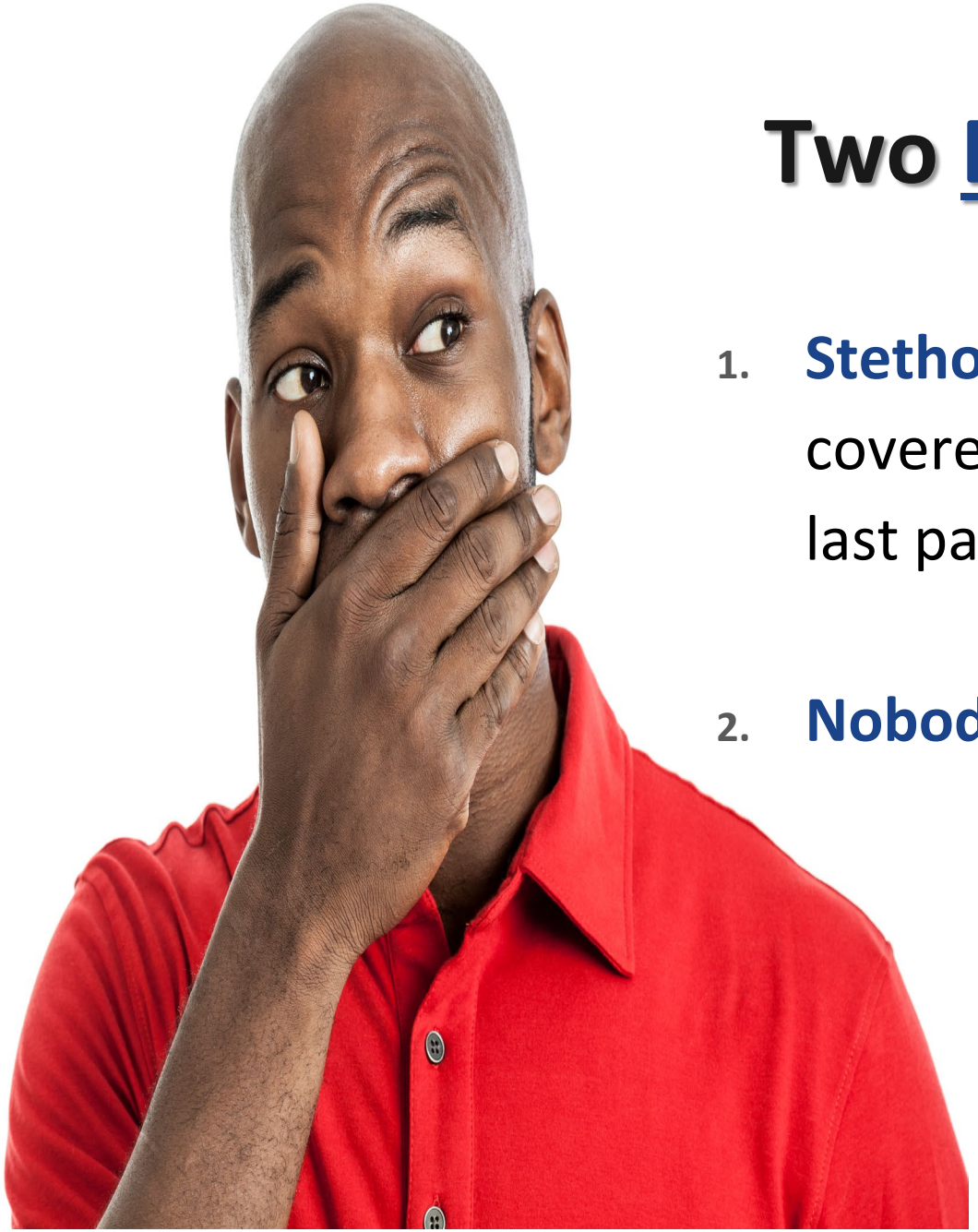
The stethoscope diaphragm often comes into direct physical contact with the patient, **just as the hands do.**



Transmission Vector

The stethoscope diaphragm is therefore a potent vector of pathogens, and for this reason can be **considered the clinician's third hand.**

Peacock WF, et al. *Am J Infect Control*. 2023;51(1):114-118.



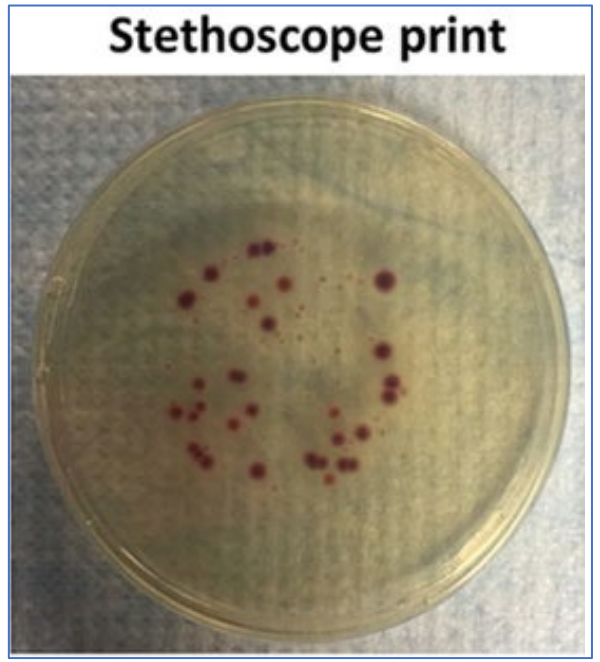
Two Dirty Secrets

1. **Stethoscopes** are nasty and covered in bugs from the last patient

2. **Nobody** cleans them

Clinical Data: Routes of Transmission

- Known MRSA infected patients
- 3-month observational study
  - Patient contact: Gloved hands, stethoscope diaphragm, and clothing touched patient, then cultured
    - 52% Gloved hand
    - 48% Clothing
    - **40% stethoscope diaphragm**



Thakur M, et al. *Infect Control Hosp Epidemiol*. 2021;42(3):274-279.

In direct observational studies, stethoscope cleaning between patients occurs less than 4% of the time.

American Journal of Infection Control 47 (2019) 238–242

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Contemporary stethoscope cleaning practices: What we haven't learned in 150 years

David Boulée MPAS, PA-C [a,*], Sarathi Kalra MD, MPH [b], Alison Haddock MD, FACEP [c,d], T. David Johnson PhD [a], W. Frank Peacock MD, FACEP, FACC [c,d]

[a] School of Health Professions, Baylor College of Medicine, Houston, TX
[b] University of South Alabama College of Medicine, Department of Emergency Medicine, Mobile, AL
[c] Department of Emergency Medicine, Baylor College of Medicine, Houston TX
[d] Harris County Hospital, Houston, TX

Key Words:
Stethoscope
Hand
Cleaning
Observation
Disinfection
Infection

Background: Stethoscopes can be microorganism reservoirs. The US Centers for Disease Control and Prevention (CDC) has published medical equipment disinfection guidelines to minimize infection transmission risk, but studies of guideline adherence have been predominately survey based, with little direct observation of disinfection practices.
Methods: We performed an observational, cross-sectional, anonymous study of patient-provider interactions, assessing practitioners' frequency and methods of stethoscope and hand disinfection practices.
Results: Stethoscopes were disinfected in 18% of 400 observed interactions, with less than 4% verified as conforming to CDC guidelines. None was disinfected before patient examinations involving open chest or abdominal wounds, as recommended by the CDC. Hands were cleaned before and after encounters 27 times (6.8%) but were not cleaned at all in 231 (58%) encounters, although gloves were worn in 197 (85.3%) of these cases.
Discussion: Stethoscope disinfection is grossly overlooked, possibly jeopardizing patient safety, particularly in acute care interactions. Periodic stethoscope disinfection, although inconvenient, helps reduce bacterial contamination and may reduce health care–associated infections.
Conclusions: Stethoscopes were disinfected per CDC guidelines in less than 4% of encounters and were not disinfected at all in 82% of encounters. Although hands were rarely cleaned (6.8%) per CDC guidelines, gloves were usually worn, but no convenient stethoscope equivalent exists. Stethoscope cleanliness must be addressed.

American Journal of Infection Control 47 (2019) 234–237

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

Observation of stethoscope sanitation practices in an emergency department setting

Rajiv S. Vasudevan BS [a,*], Sean Mojaver BS [a], Kay-Won Chang MD [a], Alan S. Maisel MD [a], W. Frank Peacock MD [b], Punam Chowdhury MD [a,c]

[a] Division of Cardiovascular Medicine, University of California, San Diego, La Jolla, CA
[b] Department of Emergency Medicine, Baylor College of Medicine, Houston, TX
[c] Department of Emergency Medicine, VA San Diego Healthcare System, La Jolla, CA

Key Words:
Stethoscope
Hygiene
Hospital-acquired infection
Emergency department

Background: Stethoscopes harbor pathogens that can be transferred to patients when proper sanitary measures are not taken. Our aim was to assess medical provider stethoscope cleaning and hand hygiene in an emergency department setting.
Methods: The frequency and methods of stethoscope cleaning during and after provider-patient encounters were observed anonymously in an emergency department of the VA San Diego Healthcare System.
Results: Among the total of 426 encounters, 115 (26.9%) involved the use of a personal stethoscope. In 15 of these 115 encounters (13.0%), the provider placed a glove over the stethoscope before patient contact. In 13 of these 115 encounters (11.3%), the provider cleaned the stethoscope with an alcohol swab after patient interaction. Stethoscope hygiene with water and a hand towel before patient interaction was observed in 5 of these 115 encounters (4.3%). Hand sanitizer use or handwashing was observed in 213 of the 426 encounters (50.0%) before patient interaction. Gloves were used before patient interaction in 206 of these 426 encounters (48.4%). Hand sanitizer or handwashing was used in 332 of the 426 encounters (77.9%) after patient interaction.
Conclusions: Rates of stethoscope and hand hygiene performance were lower than expected. Further investigation of stethoscope contamination and the associated risk of nosocomial infection are needed. Perhaps clearer guidelines on proper stethoscope cleaning would reduce this risk.

If You Clean Your Stethoscope with Alcohol is That Sufficient to Remove C-Diff & Other Pathogens?

- Yes
- No

If Cleaning Occurs, Does it Even Work?

Infection Control & Hospital Epidemiology (2019), **40**, 171–177
doi:10.1017/ice.2018.319

Original Article

Molecular analysis of bacterial contamination on stethoscopes in an intensive care unit

Vincent R. Knecht[1], John E. McGinniss[1], Hari M. Shankar[1], Erik L. Clarke[2], Brendan J. Kelly[3], Ize Imai[1], Ayannah S. Fitzgerald[1], Kyle Bittinger[4,5], Frederic D. Bushman PhD[2] and Ronald G. Collman[1,2]

[1]Pulmonary, Allergy and Critical Care Division, Department of Medicine, University of Pennsylvania Perelman School of Medicine, Philadelphia, Pennsylvania, [2]Department of Microbiology, University of Pennsylvania Perelman School of Medicine, Philadelphia, Pennsylvania, [3]Division of Infectious Diseases, University of Pennsylvania Perelman School of Medicine, Philadelphia, Pennsylvania, [4]Department of Pediatrics, University of Pennsylvania Perelman School of Medicine, Philadelphia, Pennsylvania and [5]The Children's Hospital of Philadelphia, Philadelphia, Pennsylvania

Abstract

Background: Culture-based studies, which focus on individual organisms, have implicated stethoscopes as potential vectors of nosocomial bacterial transmission. However, the full bacterial communities that contaminate in-use stethoscopes have not been investigated.
Methods: We used bacterial 16S rRNA gene deep-sequencing, analysis, and quantification to profile entire bacterial populations on stethoscopes in use in an intensive care unit (ICU), including practitioner stethoscopes, individual-use patient-room stethoscopes, and clean unused individual-use stethoscopes. Two additional sets of practitioner stethoscopes were sampled before and after cleaning using

"Commonly used cleaning practices reduce contamination but are only partially successful at modifying or eliminating these communities"

Knecht, Infection Control & Hospital Epidemiology (2018), 0,1-7
doi:10.1017/ice.2018.319

A PROSPECTIVE, RANDOMISED, DOUBLE-BLIND STUDY OF COMPARATIVE EFFICACY OF IMMEDIATE VERSUS DAILY CLEANING OF STETHOSCOPE USING 66% ETHYL ALCOHOL

RAMESH C. PARMAR, CHAYYA C. VALVI, POONAM SIRA, JAISHREE R. KAMAT

ABSTRACT

OBJECTIVE: *Studies have demonstrated frequent contamination of stethoscope and usefulness of different disinfectants. Albeit, studies on the precise mode of cleaning and frequency of cleaning are lacking. This study was carried out to determine efficacy of 66% ethyl alcohol as disinfectant, rate of recontamination without cleaning and benefits of daily versus immediate cleaning.* ***METHODOLOGY:*** *Prospective, randomised,*

- **Prospective randomized double blind study**
  - **Cultures taken from 100 stethoscopes used by medical personnel**

Strategy	(+) Culture Rates (95% CI)
Before cleaning	90% (86.5-93.5%)
Immediately after cleaning with 65% isopropyl alcohol	28% (19.4-33.0%)
After 5 days without cleaning	95% (90.6-99.4%)
After 5 days of cleaning daily	25% (16.4-36.4%)

Parmar, RC, et al. Indian J Med Sci 2004: 58:423-30.

Disk Cover Acoustic Performance Study

Aseptic Disposable Stethoscope Barrier:
Acoustically Invisible and Superior to Disposable Stethoscopes

Disk Cover Protected Stethoscope:

100% Diagnostic Accuracy

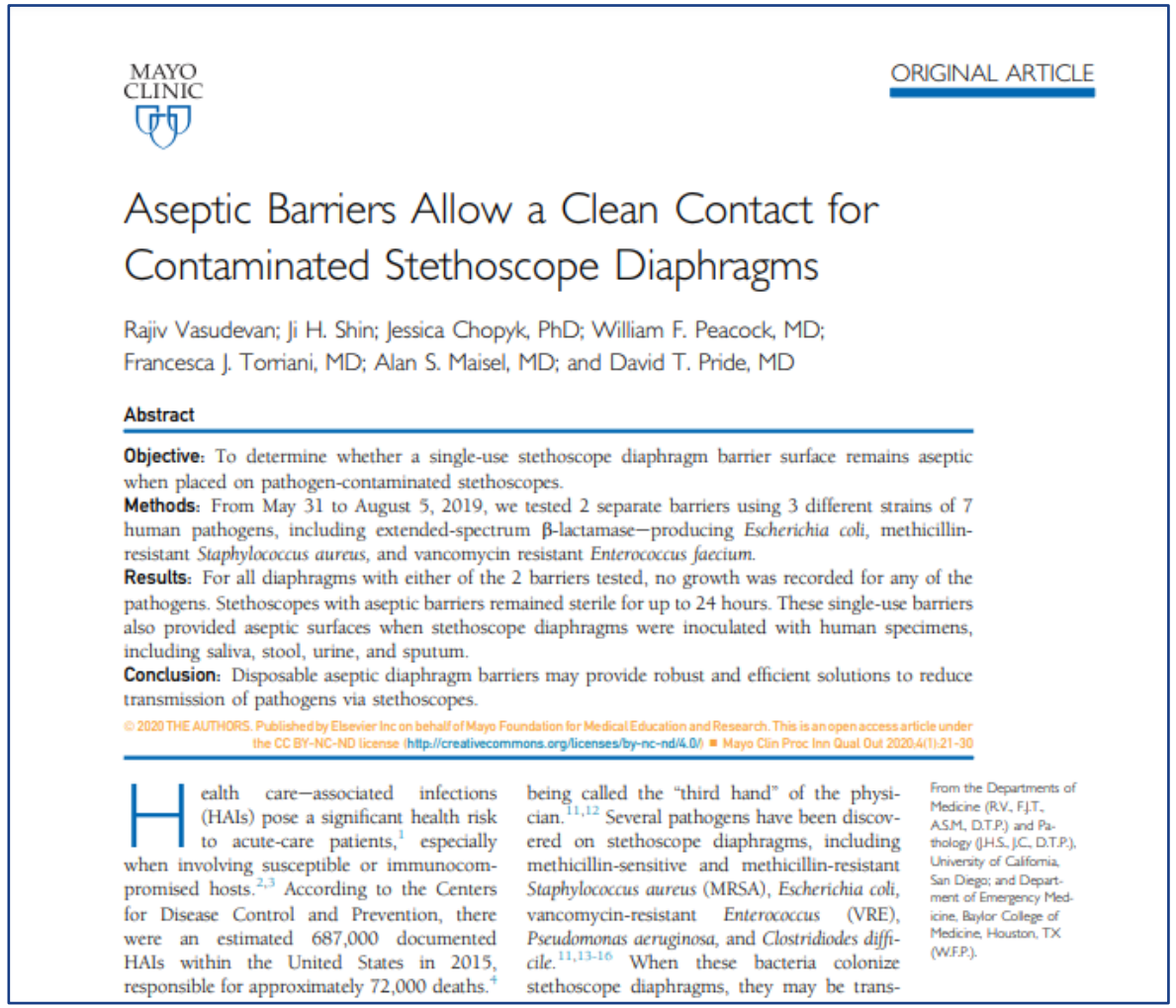
Disposable Stethoscope:

89.1% Diagnostic Accuracy

(Auscultation Error Rate of **10.9%**)

Kalra S, Garri RF, Shewale JB. Aseptic Disposable Stethoscope Barrier: Acoustically Invisible and Superior to Disposable Stethoscopes. *Mayo Clin Proc*. 2021;96(1):263-264.

Disk Cover System makes it Touch-Free Barrier



MAYO CLINIC

ORIGINAL ARTICLE

Aseptic Barriers Allow a Clean Contact for Contaminated Stethoscope Diaphragms

Rajiv Vasudevan; Ji H. Shin; Jessica Chopyk, PhD; William F. Peacock, MD; Francesca J. Torriani, MD; Alan S. Maisel, MD; and David T. Pride, MD

Abstract

Objective: To determine whether a single-use stethoscope diaphragm barrier surface remains aseptic when placed on pathogen-contaminated stethoscopes.

Methods: From May 31 to August 5, 2019, we tested 2 separate barriers using 3 different strains of 7 human pathogens, including extended-spectrum β-lactamase–producing *Escherichia coli*, methicillin-resistant *Staphylococcus aureus*, and vancomycin resistant *Enterococcus faecium*.

Results: For all diaphragms with either of the 2 barriers tested, no growth was recorded for any of the pathogens. Stethoscopes with aseptic barriers remained sterile for up to 24 hours. These single-use barriers also provided aseptic surfaces when stethoscope diaphragms were inoculated with human specimens, including saliva, stool, urine, and sputum.

Conclusion: Disposable aseptic diaphragm barriers may provide robust and efficient solutions to reduce transmission of pathogens via stethoscopes.

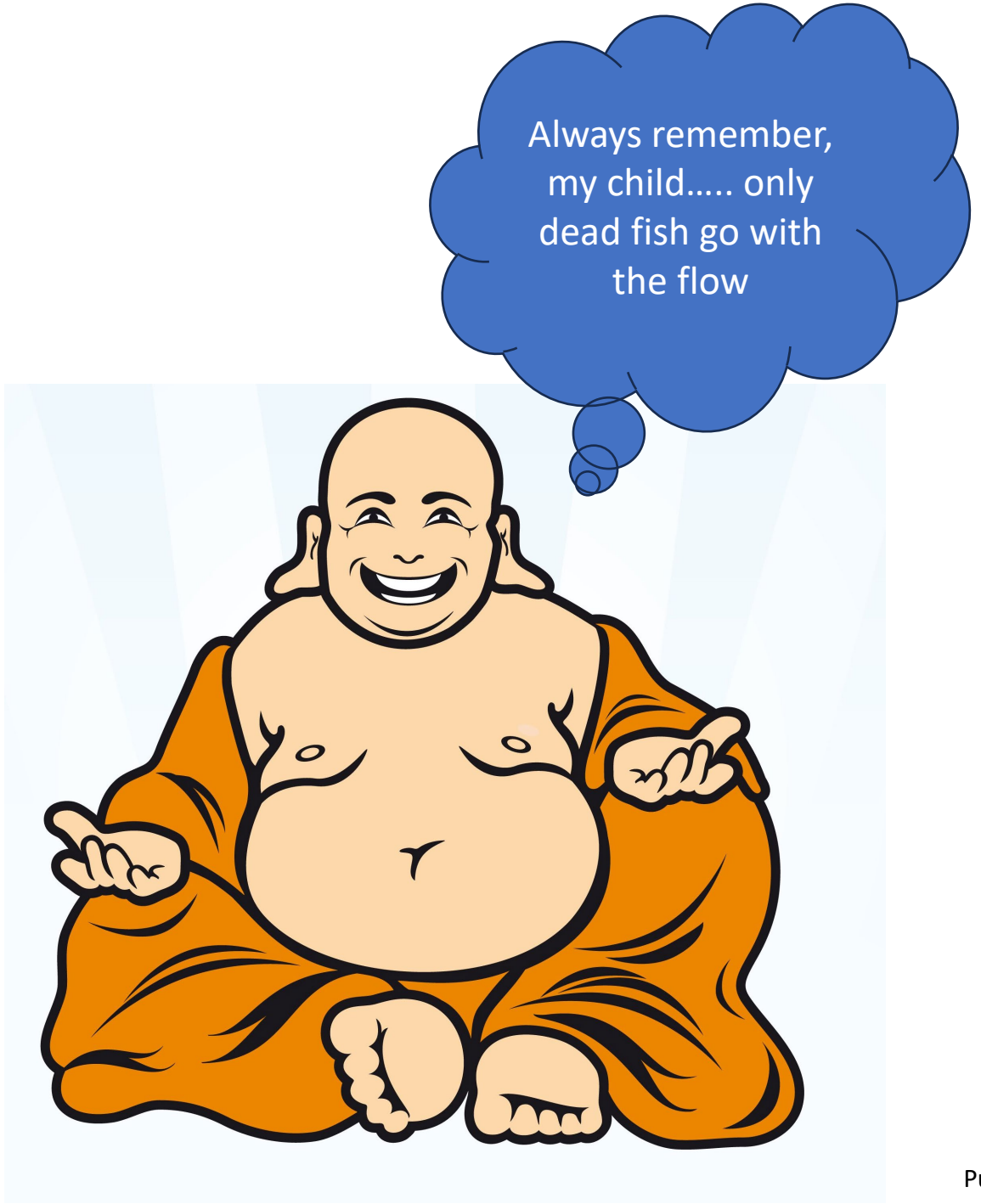
 ■ Mayo Clin Proc Inn Qual Out 2020;4(1):21-30

Health care–associated infections (HAIs) pose a significant health risk to acute-care patients,[1] especially when involving susceptible or immunocompromised hosts.[2,3] According to the Centers for Disease Control and Prevention, there were an estimated 687,000 documented HAIs within the United States in 2015, responsible for approximately 72,000 deaths.[4] being called the "third hand" of the physician.[11,12] Several pathogens have been discovered on stethoscope diaphragms, including methicillin-sensitive and methicillin-resistant *Staphylococcus aureus* (MRSA), *Escherichia coli*, vancomycin-resistant *Enterococcus* (VRE), *Pseudomonas aeruginosa*, and *Clostridiodes difficile*.[11,13-16] When these bacteria colonize stethoscope diaphragms, they may be trans-

From the Departments of Medicine (R.V., F.J.T., A.S.M., D.T.P.) and Pathology (J.H.S., J.C., D.T.P.), University of California, San Diego; and Department of Emergency Medicine, Baylor College of Medicine, Houston, TX (W.F.P.).

Conclusion:

Disposable aseptic diaphragm barriers may provide robust and efficient solutions to reduce transmission of pathogens via stethoscopes.



Decontamination of Environment

The Environment

"Substantial scientific evidence has accumulated that contamination of environmental surfaces in hospital rooms plays an important role in the transmission of several key health care–associated pathogens"

Weber DJ, AMIC, 2016;44:77-84

The Environment: What is the Problem?

A patient is at increased risk of picking up pathogens like, MRSA, VRE, & C. diff. when admitted to room where prior patient had one of these

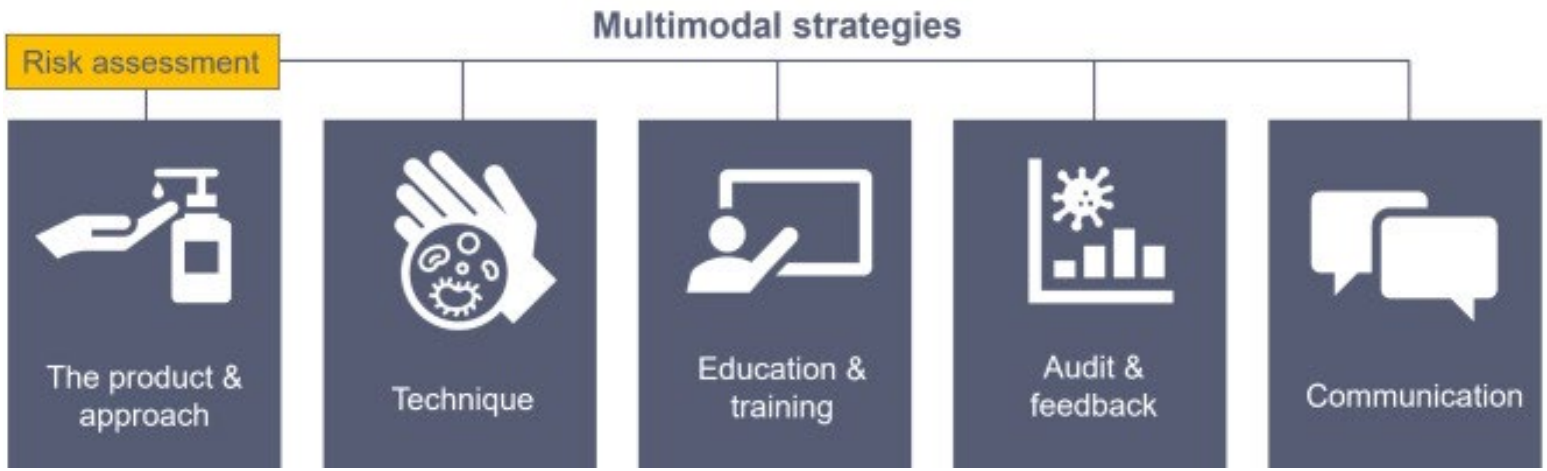
- Huang SS (2006)[1]
- Drees M (2008)[2]
- Zhou Q (2008)[3]
- Moore C (2008)[4]
- Hamel M (2010)[5]
- Shaughnessy et al. 2011

5-6 fold increase[6]

"The patient in the next bed is highly infectious. Thank God for these curtains."

1.Huang SS, et al. *Arch Intern Med*. 2006;166(18):1945-1951.
2.Drees M, et al. *Clin Infect Dis*. 2008;46(5):678-685.
3.Zhou Q, et al. *Infect Control Hosp Epidemiol*. 2008;29(5):398-403
4.Moore C, et al. *Infect Control Hosp Epidemiol*. 2008;29(7):600-606.
5.Hamel M, et al. *Am J Infect Control*. 2010;38(3):173-181.
6.Cohen et al. ICHE 2018;39:541-546

Application of Recommendations for Environmental Cleaning



- Resources to ensure effective cleaning and decontamination
- Daily disinfection of non-critical surfaces vs. just visibly soiled
- Feedback method using removal of intentional applied marks visible only under UV light
- Wipes that keep the surface wet for 1-2 minutes

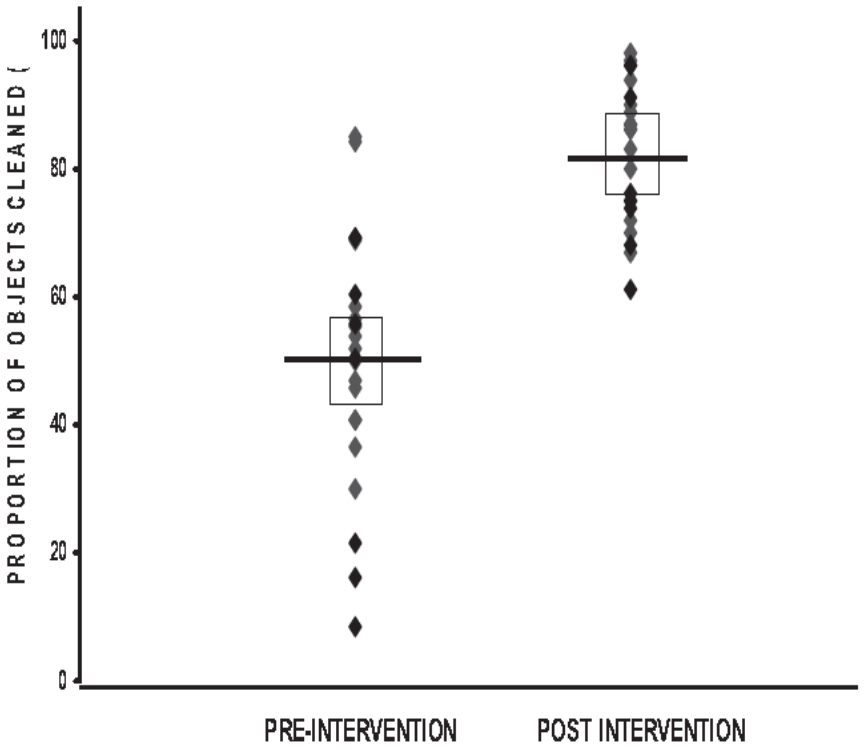
Weber DJ, AJIC, 2016;44:77-84
Mills JP, et al. Infect Dis Clin N AM 2021;35:969-994
Rutala & Weber. AJIC 2019;47A96-A105
Browne K, Mitchell BG.. *Antimicrob Resist Infect Control*. 2023;12(1):83. Published 2023 Aug 23.

Improving Environmental Hygiene In 27 ICUs Decreased MDRO Transmission

- 27 acute care hospitals (25 beds to 709 beds)
- Fluorescent targeting method
- Systematic covert monitoring was performed

Results:

- 3532 environmental surfaces were assessed after terminal cleaning in 260 ICU unit rooms
- 49.5% of services cleaned it baseline
- Post-intervention with multiple cycles of objective performance feedback resulted in 82% of environmental services cleaned ($p < .0001$)



Carling PC, et al. Crit Care Med, 2010;38:1054-1059

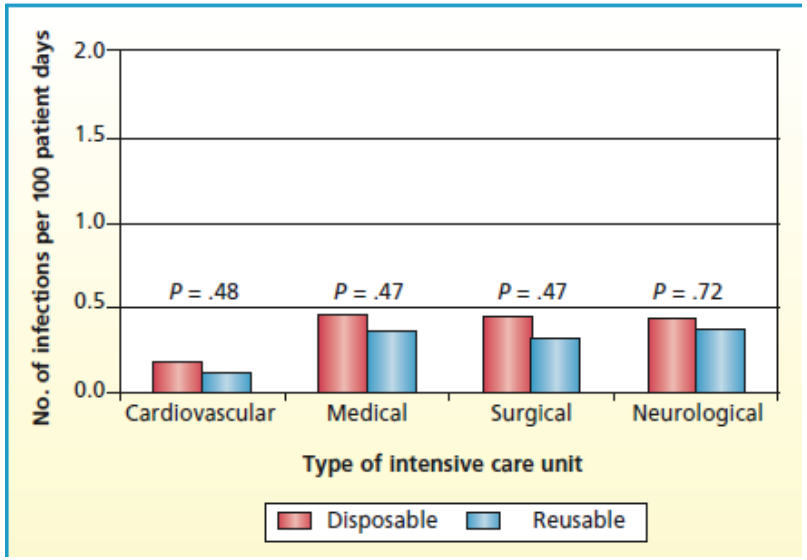
No Touch Cleaning

- Use of a no touch method leads to a decreased rate of infection in patients subsequently admitted to a room where the prior occupant was colonized or infected.
- Use of a no touch method leads to a decreased rate of facility-wide colonization and infection.
- Hydrogen peroxide vapor & aerosolized significantly reduce MDRO load in terminal cleaning. (vapor:1.5 to 2.5hrs, aerosolized: 2-3hrs)
  - Aerosolized not well studied versus vapor
  - Contaminated surfaces reduced to 0% to <5%
- Ultraviolet–C to kill pathogens.
  - 10-45 minutes of use, *C. difficile* spores
  - 10-25 minutes for non-spore forming bacteria
  - Contaminated surfaces reduced <1% to <11%

Nerandzic MM, et al. *BMC Infect Dis* 2010 Jul 8;10:197
Havill NL et al. Infect Control Hosp Epidemiol, 2012;33:507-512
Sattar SA, et al. AJIC, 2013;S97-104
Passaretti Cl, et al. Clin Infect Dis,2013;56:37-35
Weber DJ, AJIC, 2016;44:77-84
Mills JP, et al. Infect Dis Clin N AM 2021;35:969-994Rutala & Weber. AJIC 2019;47A96-A105

Reducing the Load in the Environment: Additional Factors

- Hospital curtains **potential** source of transmission[1]
  - Novel curtains increase time to first contamination (7x longer)[2]
- Daily cleaning of high touch surfaces[3]
- Disinfecting surfaces (copper/silver coating)[4]
- ECG disposable or reusable?[5]
  - Cluster-randomized controlled design
  - Match ICU's randomized to get disposable or reusable ECG
  - Measured infection rates

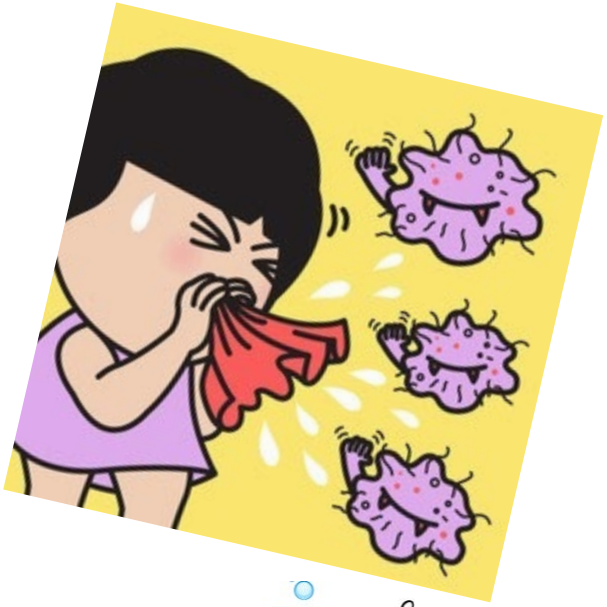


1.Trillis F, et al. Infect Control Hosp Epidemiol, 2008;29(11):1074-1076
2.Schweizer M et al. Infect Control Hosp Epidemiol 2012;33:1081-1085
3.Kundrapu S, et al. Infect Control Hosp Epidemiol 2012;33(10):1039-42
4. Salgado CD, et al. Infect Control Hosp Epidemiol 2013;34:479-86
5.Ablert NM, et al. Amer J of Critical Care, 2014;23:460-468

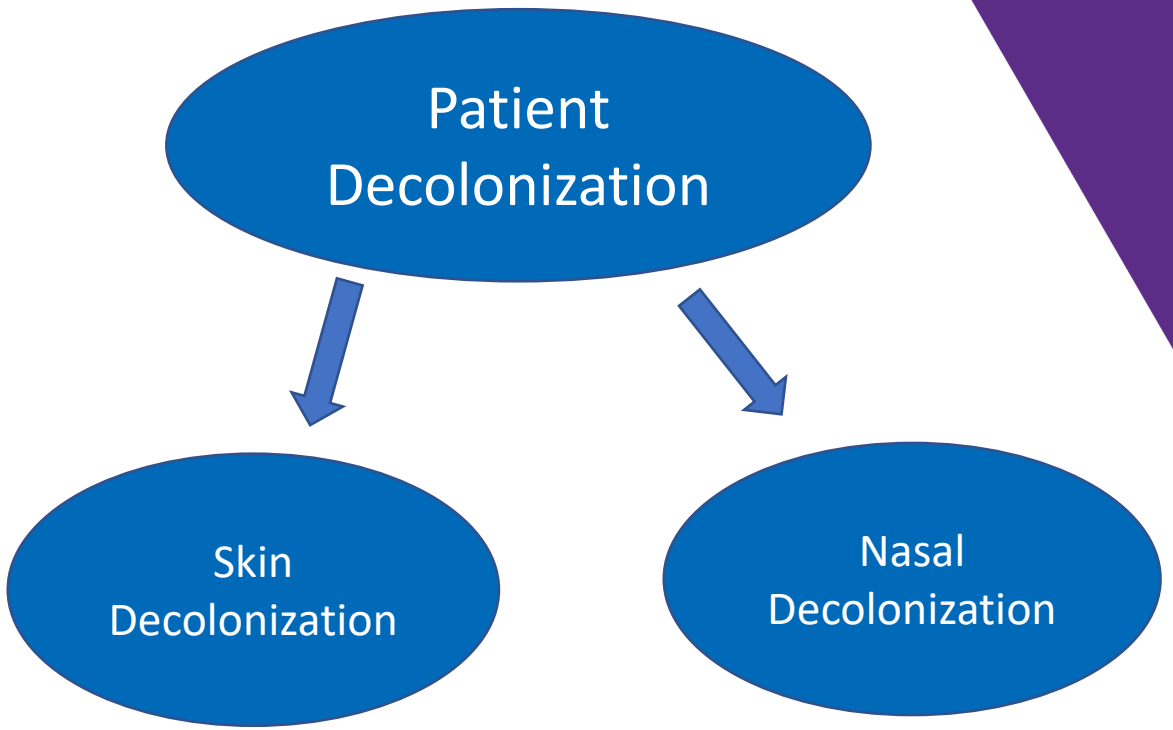
Even if you are on the right track, you will get run over if you just sit there.

Will Rogers

Reducing Bacterial Load on the Patient: A Horizontal Strategy



Purchased from Shutterstock



Question

- Based on the current evidence, what type of daily bathing should be performed with Critically ill patients

  A. Soap and water bath

  B. CHG bathing

  C. Packaged bath cloths

  D. Package cloths that are activated by water

Traditional Bathing

Soap and water basin bath was an independent predictor for the development of a CLABSI

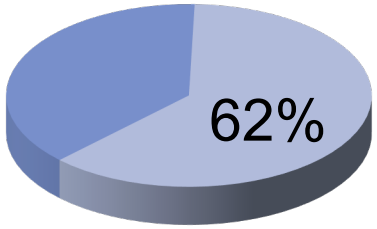
Bleasdale SC, e tal. Arch Intern Med. 2007;167(19):2073-2079

Bath Basins:
Potential Source of Infection

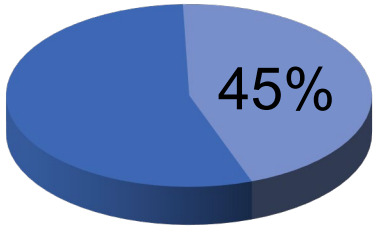
- Large multi-center study evaluates presence of multi-drug resistant organisms

Total hospitals: **88**

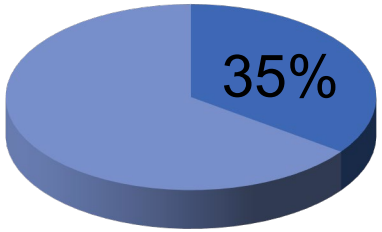
Total basins: **1,103**



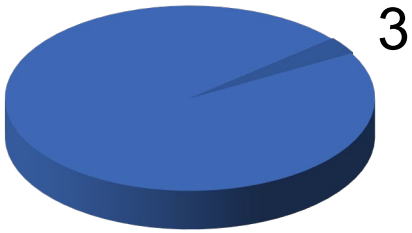
Contaminated
686 basins/88 Hospital



Gram negative bacilli
495 basins/86 hospitals



Colonized w/ VRE
385 basins/ 80 hospitals



MRSA
36 basins/28 hospitals

Marchaim D, et al. *Am J of Infect Control*. 2012;40(6):562-564

Mechanisms of Contamination

- Skin flora
- Multiple-use basins
  - Incontinence cleansing
  - Emesis
  - Product storage
- Bacterial biofilm from tap water

Permission from Sage Products

Shannon RJ, et al. *J Health Care Safety Compliance Infect Control*. 1999;3:180-184.
Larson EL, et al. *J Clin Microbiol*. 1986;23(3):604-608.
Johnson D, et al. *Am J Crit Care*, 2009;18(1):31-38, 41.
Marchaim D, et al. *Am J Infect Control*. 2012;40(6):562-564.

Understanding Water

- All water with the exception of sterile water and filtered water is contaminated with microbes (eg, potable water, tap water, showers, and ice).
- In healthy persons, contact or ingestion of such water rarely leads to infection.
- However, contact or ingestion of such water may cause infection in immunocompromised persons or when applied to non-intact skin
- Transmission of these pathogens from a water reservoir may occur by direct and indirect contact, ingestion and aspiration of contaminated water, or inhalation of aerosols*
- Compared sink & water based care activities to non sink and non water based care activities on GNB colonization in ICU. Found rate dropped from 26.1 to 21.6 colonization pre 1000 ICU days. Greater reduction with longer ICU LOS's

Kanamori H, Weber DJ, Rutala WA. 2016;62(11):1423-1435.
*Decker BK, et al. Opin Infect Dis 2013; 26:345–51
Hopman, J., et al. Antimi*crob Resist Infect Control* **6,** 59 (2017).

Waterborne Infection

Hospital Tap Water

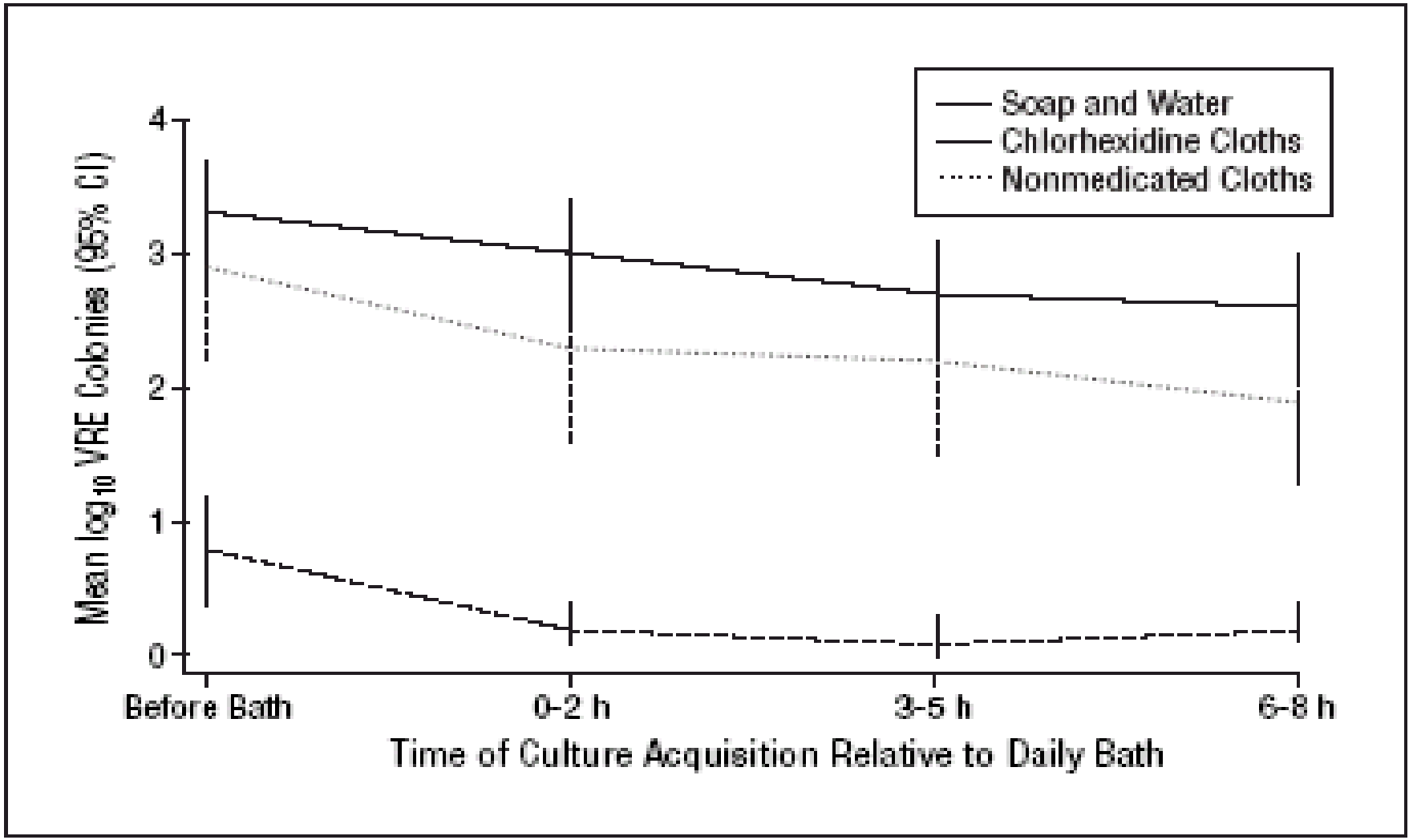
- Bacterial biofilm
- Most overlooked source for pathogens
- 29 studies demonstrate an association with HAIs and outbreaks
- Transmission:
  - Drinking
  - Bathing
  - Rinsing items
  - Contaminated environmental surfaces
- Immunocompromised patients at greatest risk

Anaissie EJ, et al. *Arch Intern Med*. 2002;162(13):1483-1492.
Cervia JS, et al. Arch Intern Med, 2007;167:92-93
Trautmann M, et al. Am J of Infect Control, 2005;33(5):S41-S49,
https://www.pinterest.com/pin/332914597437828576/?l=t

Bathing with CHG Basinless Cloths

- Prospective sequential group single arm clinical trial
- 1787 patients bathed
  - Period 1: soap & water
  - Period 2: CHG basinless cloth bath
  - Period 3: non-medicated basinless cloth bath

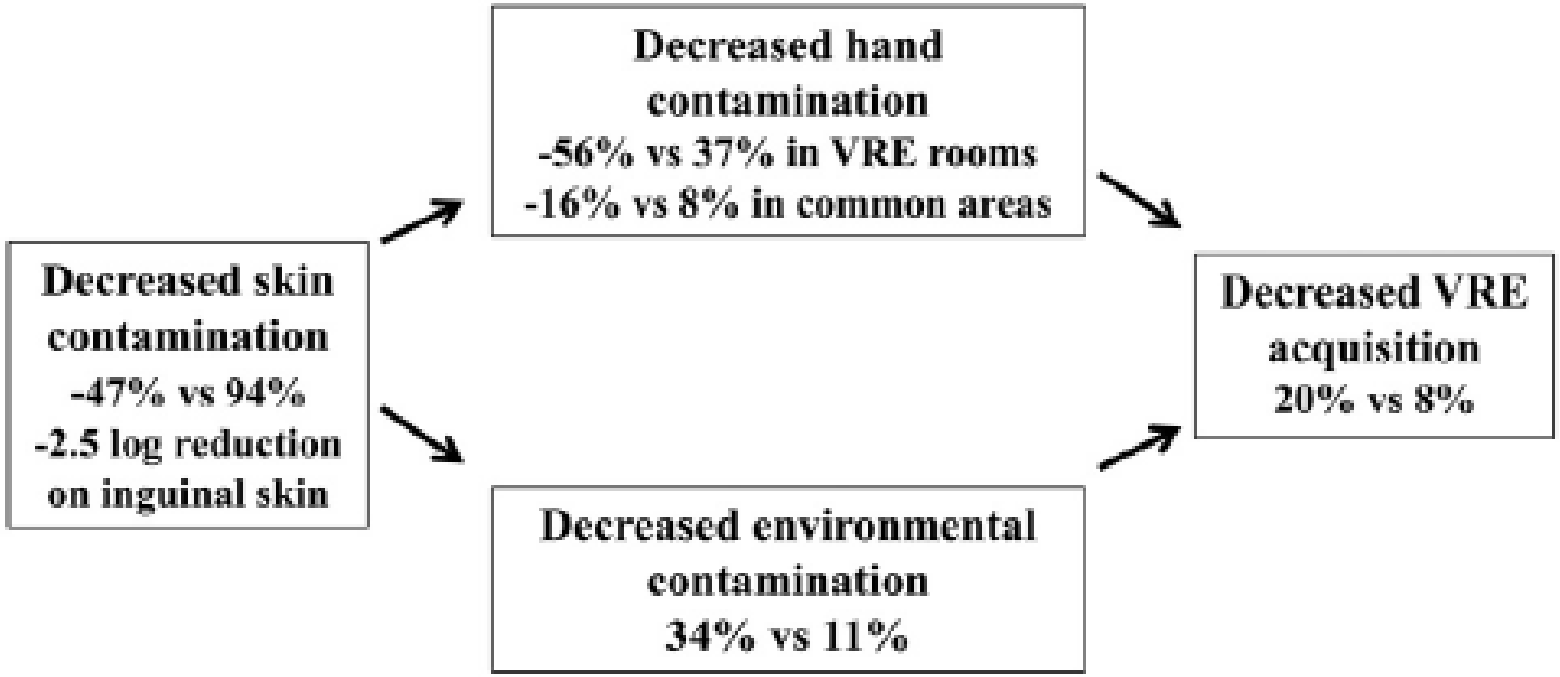
Veron MO et al. Archives Internal Med 2006;166:306-312



26 colonization's with VRE per 1000 patients days vs. 9 colonization's per 1000 patient days with CHG bath

Veron MO et al. Archives Internal Med 2006;166:306-312

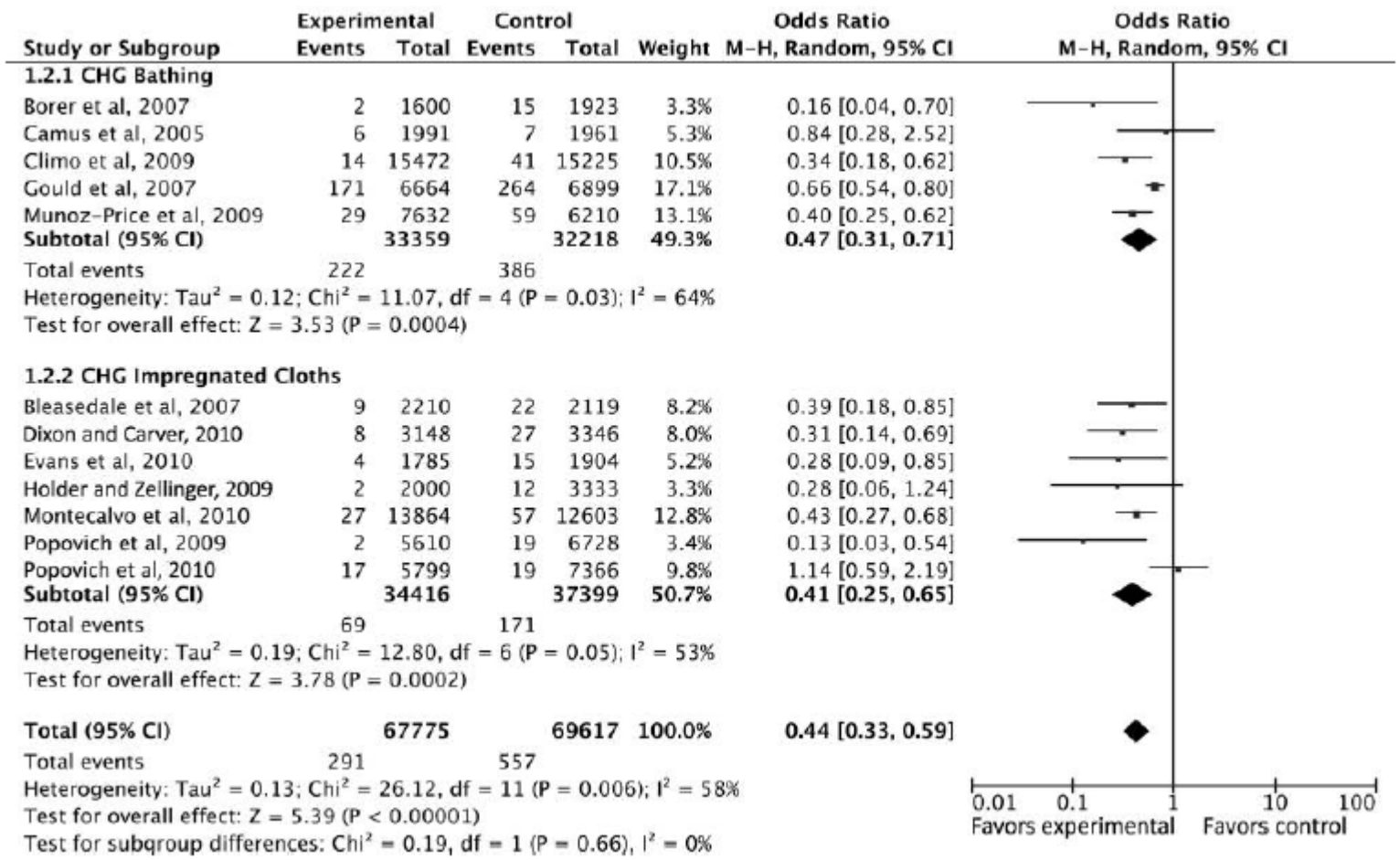
Impact on VRE with 2% CHG Cloth Bathing



Veron MO et al. Archives Internal Med 2006;166:306-312

The Efficacy of Daily Bathing with Chlorhexidine for Reducing Healthcare-Associated Bloodstream Infections: A Meta-analysis

John C. O'Horo, MD;[1] Germana L. M. Silva, MD;[2] L. Silvia Munoz-Price, MD;[3] Nasia Safdar, MD, PhD[4]



Study or Subgroup	Experimental Events	Experimental Total	Control Events	Control Total	Weight	Odds Ratio M-H, Random, 95% CI
1.2.1 CHG Bathing						
Borer et al, 2007	2	1600	15	1923	3.3%	0.16 [0.04, 0.70]
Camus et al, 2005	6	1991	7	1961	5.3%	0.84 [0.28, 2.52]
Climo et al, 2009	14	15472	41	15225	10.5%	0.34 [0.18, 0.62]
Gould et al, 2007	171	6664	264	6899	17.1%	0.66 [0.54, 0.80]
Munoz-Price et al, 2009	29	7632	59	6210	13.1%	0.40 [0.25, 0.62]
Subtotal (95% CI)		**33359**		**32218**	**49.3%**	**0.47 [0.31, 0.71]**
Total events	222		386			
Heterogeneity: $Tau^2 = 0.12$; $Chi^2 = 11.07$, df = 4 (P = 0.03); $I^2 = 64\%$						
Test for overall effect: Z = 3.53 (P = 0.0004)						
1.2.2 CHG Impregnated Cloths						
Bleasedale et al, 2007	9	2210	22	2119	8.2%	0.39 [0.18, 0.85]
Dixon and Carver, 2010	8	3148	27	3346	8.0%	0.31 [0.14, 0.69]
Evans et al, 2010	4	1785	15	1904	5.2%	0.28 [0.09, 0.85]
Holder and Zellinger, 2009	2	2000	12	3333	3.3%	0.28 [0.06, 1.24]
Montecalvo et al, 2010	27	13864	57	12603	12.8%	0.43 [0.27, 0.68]
Popovich et al, 2009	2	5610	19	6728	3.4%	0.13 [0.03, 0.54]
Popovich et al, 2010	17	5799	19	7366	9.8%	1.14 [0.59, 2.19]
Subtotal (95% CI)		**34416**		**37399**	**50.7%**	**0.41 [0.25, 0.65]**
Total events	69		171			
Heterogeneity: $Tau^2 = 0.19$; $Chi^2 = 12.80$, df = 6 (P = 0.05); $I^2 = 53\%$						
Test for overall effect: Z = 3.78 (P = 0.0002)						
Total (95% CI)		**67775**		**69617**	**100.0%**	**0.44 [0.33, 0.59]**
Total events	291		557			
Heterogeneity: $Tau^2 = 0.13$; $Chi^2 = 26.12$, df = 11 (P = 0.006); $I^2 = 58\%$						
Test for overall effect: Z = 5.39 (P < 0.00001)						
Test for subgroup differences: $Chi^2 = 0.19$, df = 1 (P = 0.66), $I^2 = 0\%$						

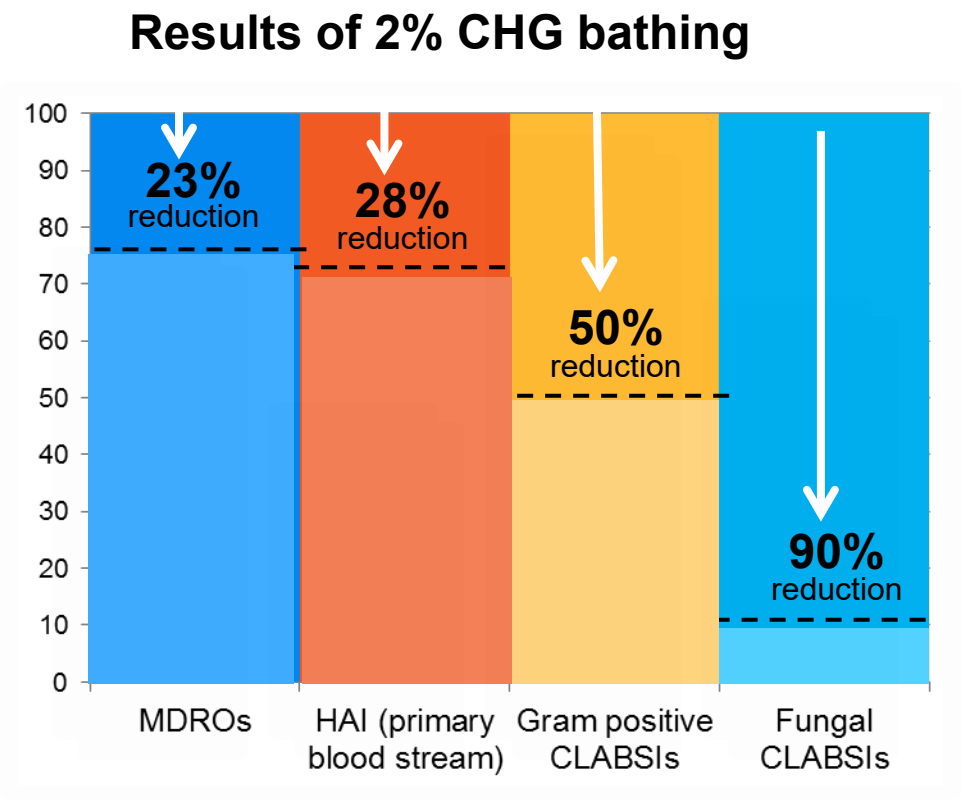
Infect Control Hosp Epidemiol 2012;33(3):257-267

The Evidence: Impact of Antisepsis Bathing

Evaluate effect of daily bathing with CHG on acquisition of multidrug resistant organism's (MDRO's) and incidence of CLABSI

9ICU's and Bone Marrow Transplant unit
Randomly assigned 7727 patient:

a. No-rinse, Antisepsis washcloths
b. Non-antimicrobial, no-rinse bath cloths



Climo, M et al, *N Engl J Med*, 2013;368:533-542

Impact of Antisepsis Baths

Study to determine the best method for reducing spread of methicillin-resistant Staphylococcus aureus (MRSA) and MDROs

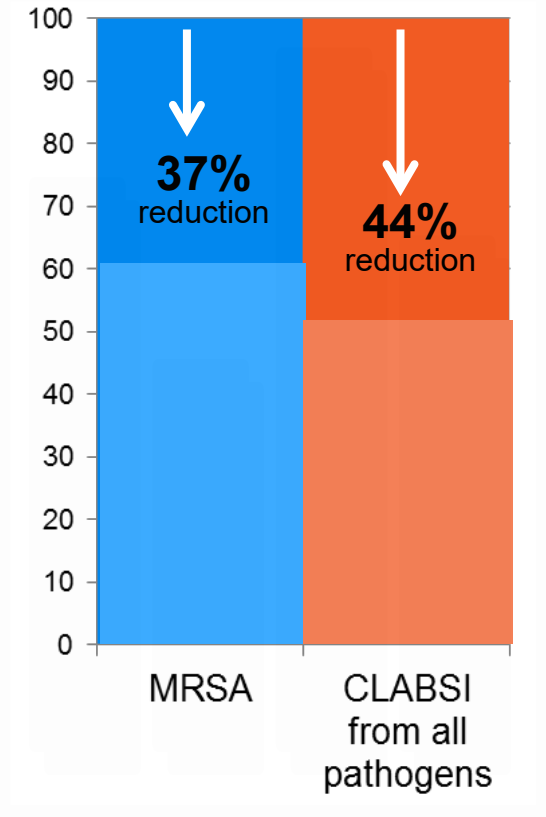
3 protocols tested:

a) Swab for MRSA on admission to ICU
- △ Isolate if positive

b) Swab for MRSA on admission to ICU
- △ Isolate if positive
- △ Nasal mucopiricin x 5 days
- △ antisepsis bathing for entire ICU stay

c) No swab
- △ Nasal mucopiricin x 5 days
- △ Antisepsis bath for entire ICU stay

Results: No Swab Group Universal Decolonization Demonstrated



Huang SS, et al. New Engl J of Med, 2013;368(24):2255-65.

Antisepsis vs. Routine Bathing to Prevent MDRO and CLABSI in General Medical and Surgical Units

- 53 hospitals in 14 states
- Compared routine bathing (non-medicated disposable cloth or showering) to decolonization with universal chlorhexidine and targeted nasal mupirocin in non-critical-care units.
- 12-month baseline period, 2 month phase and 21 month intervention

Decolonization with universal chlorhexidine bathing and targeted mupirocin for MRSA carriers did not significantly reduce multidrug-resistant organisms in non-critical-care patients

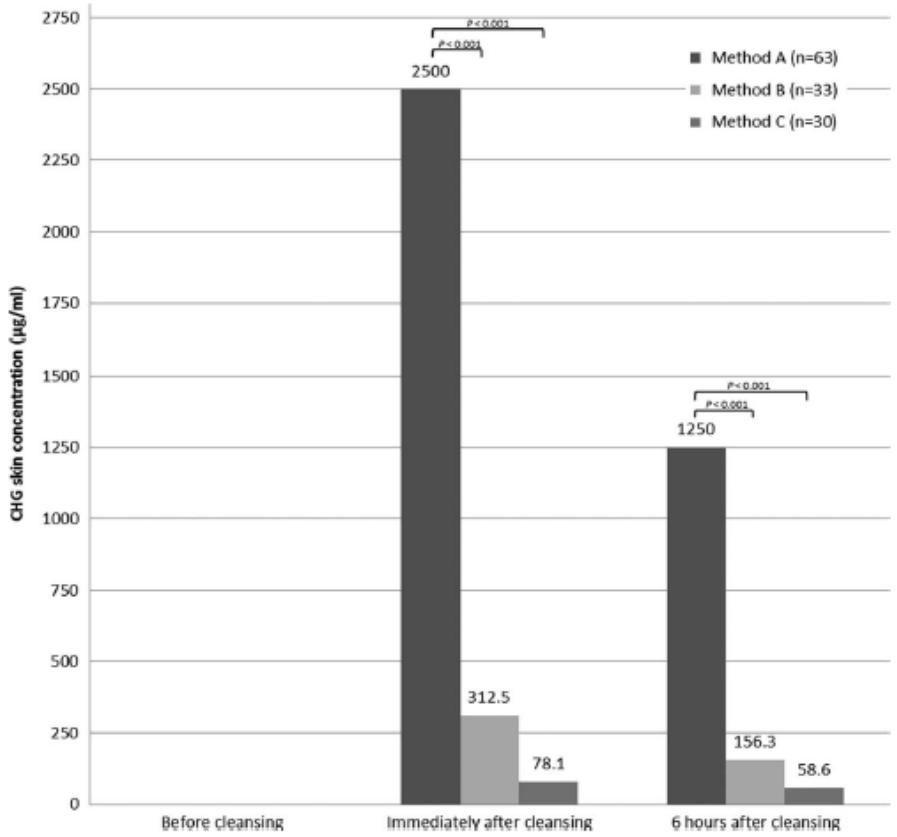
Patients with medical devices had a 32% greater reduction in all cause bacteremia and a 37% greater reduction in MRSA or VRE clinical cultures compared with the routine care group

Huang SS, et al. Lancet. 2019 March 23rd; 393

Differential Effects of Antisepsis Skin Cleansing Methods

Rhee Y, et al. Infect Control Hosp Epidemiol 2018;39:405–411

- Prospective, randomized 2-center study with blinded assessment.
- To determine whether 3 different CHG skin cleansing methods yield similar residual CHG concentrations and bacterial densities on skin.



Method A- 2% CHG cloth
Method B- 4% CHG liquid poured onto non-medicated cloth
Method C-4% CHG liquid on cotton wash cloth

Nasal Iodophor Vs. Nasal Mupirocin & CHG Bathing to Prevent Infections in Adult ICU's

- To compare the effectiveness of iodophor vs. mupirocin nasal decolonization in combination with CHG bathing
- Pragmatic clustered randomized trial
- 137 hospitals, 233 ICU's
- Hospitals switch to iodophor or continued with mupirocin
- Measured:
  - ICU attributable S aureus clinical cultures
  - ICU attributable MRSA clinical cultures
  - ICU attributable Bloodstream infections

Table 2. Group Comparisons for As-Randomized Outcomes of the Mupirocin-Iodophor Swap Out Trial[a]

	Iodophor-chlorhexidine, 69 hospitals			Mupirocin-chlorhexidine, 68 hospitals			Hazard ratio difference-in-differences	
	Raw events/1000 ICU-attributable days (No. of events/ No. of ICU-attributable days)			Raw events/1000 ICU-attributable days (No. of events/ No. of ICU-attributable days)				
	24-mo Baseline period	18-mo Intervention period	Clustered hazard ratio (95% CI)[b]	24-mo Baseline period	18-mo Intervention period	Clustered hazard ratio, (95% CI)[b]	Trial result main analysis[c]	*P* value
Primary outcome								
ICU-attributable *Staphylococcus aureus* clinical cultures	4.3 (4133/968 280)	5.0 (3563/710 051)	1.17 (1.12 to 1.23)	4.0 (3569/885 660)	4.1 (2708/663 439)	0.99 (0.94 to 1.04)	Mupirocin-CHG: 18.4% (95% CI, 10.7% to 26.6%) significant decrea over Iodophor-CH	<.001
Secondary outcomes								
ICU-attributable MRSA clinical cultures	2.1 (2036/987 177)	2.3 (1682/727 397)	1.13 (1.06 to 1.20)	2.0 (1829/899 953)	2.0 (1377/674 161)	0.99 (0.92 to 1.06)	Mupirocin-CHG: 14.1% (95% CI, 3.7% to 25.5%) significant decrea over Iodophor-CH	.007
ICU-attributable bloodstream infections	2.7 (2668/982 886)	2.7 (1956/727 346)	1.00 (0.94 to 1.06)	2.6 (2330/895 263)	2.6 (1766/672 092)	1.01 (0.95 to 1.07)	0.86% (95% CI, −8.95% to 7.96%) no difference between groups	.84

18% ↓

14% ↓

Huang SS, et al. JAMA. 2023;330(14): 1337-1347

Reducing MDRO's

- Contact precautions for MRSA colonized & MRSA infected patients and VRE
  - Slower time from ER to inpatient bed (1 hr)
  - Slower to discharge to extended care facility (1.7 days)
  - Delays in diagnostic imaging
  - Visited by healthcare workers 20-30% less
  - Greater patient dissatisfaction, depression and anxiety.

Calfee DP, et al. Infect Control Hosp Epidemiol, 2014;35(7):772-796
Huang SS, et al. New Engl J of Med, 2013;368(24):2255-65
Health Research & Educational Trust (2017). MDRO Change Packect. Accessed at www.hret-hiin.org.
Morgan JD, et al. JAMA 2017;318(4):329-330
Granzotto EM, *Infect Dis Health*. 2020;25(3):133-139.

Organizations Journey of Discontinuing Contact Precautions (CP) for MRSA & VRE

- 865-bed, safety-net, academic medical center.
- Quasi-experimental, before-and-after study (30 months)
- Discontinuing CPs for MRSA or VRE colonized/infected patients
- During intervention period: hand hygiene, daily chlorhexidine bathing of all inpatients (except infants) & bare below the elbows protocol for inpatient care.
- **Results:**
  - No difference in MRSA and VRE rates before & after discontinuation of CP
  - Lower CLABSI rates after discontinuation of CP

Edmond MB, et. al. Infect. Control Hosp. Epidemiol. 2015;36(8):978–980

Impact of D/C Contact Precautions for MRSA & VRE

- Quasi-experimental (2011-2016), Interrupted time series, CP changes April 2013
- Outcomes: HAI rates

CDC continues to recommend the use of CP for MRSA/VRE-colonized or infected patients because studies are single center. Data showes as proportion of CP >40% in a unit, ↓ in compliance with HH and CP

Process of	liance in ICUs	% Compliance Hospital-wide (Observations in Compliance/ Observations)
Contact pr		
Daily CH		
Central-li		
Bare belo		)
Hand hy		)
Daily ur		
Disinfe		

Variable		P	*P* Value
MRSA device associated infection rate per 100,000 patient days	5.19		.026
VRE device associated infection rate per 100,000 patient days	9.82		.003
Cumulative MRSA and VRE device associated infection rate per 100,000 patient days	15.01	8.50	<.001
All pathogen device associated infection rate per 1,000 patient days	1.20	0.89	<.001

CP indicated for CRE, CRPA, CRAB

Bearman G, et al. Infect Control Hosp Epidemiol 2018;39:676–682

PPE Compliance: Is There a Better Way to Measure this Bedside Direct Observation?

- In short, probably not
- Need to identify not only if used but used correctly
- Need to track compliance, feedback to end-users/leadership
- Any other types of audits or a better way?????

Contact Precautions/ Isolation

HIIN 2018; Discovery and Direction Series: Horizontal Practices accessed at http://www.hret-hiin.org/resources/display/discovery-and-direction-series-horizontal-practices

Improve Accuracy of Doffing Process

- Novel gown to increase compliance with effective of gown renewal
- Outcomes
  - Reduce waste,
  - Improve cleanliness of the environment
  - Prevent contamination of staff and environment

Used with permission from Inventor Ginny Porowski

Personal communication Sharon Dickinson

Practice
Device
Bundles

1 in 31
hospitalized
patients with
develop a HAI

- Evidence- based strategies for reducing the risk of CAUTIs
- Evidence-based strategies for reducing the risk of CLABSI’s
- Evidence-based strategies for reducing the risk of VAP/Non-vent HAP

https://www.cdc.gov/hai/data/portal/progress-report.html

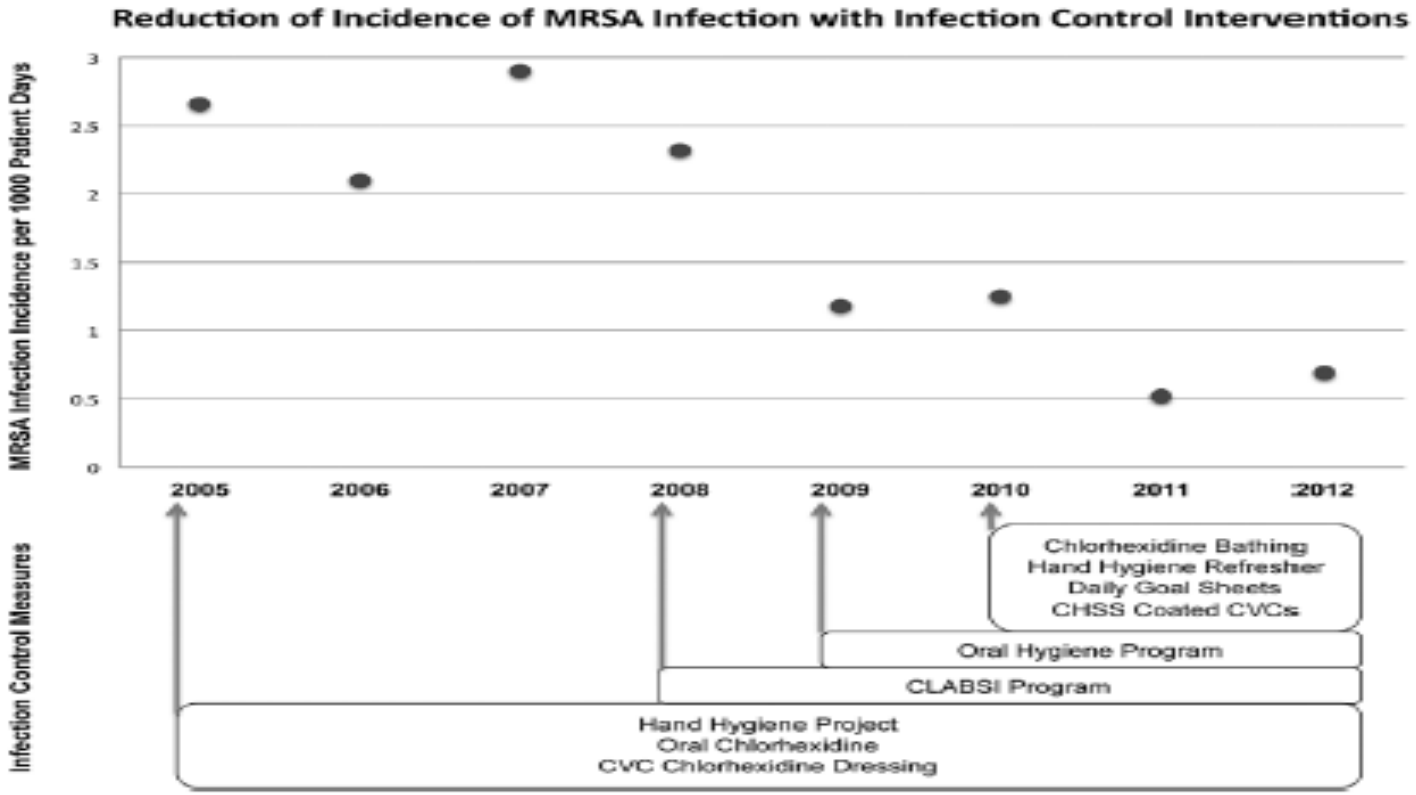
Antibiotic Stewardship

- Core measure in prevention of MDR-GNB
- 30-50% of the antibiotics prescribed are unnecessary
- 2.8 million antibiotic resistant infections occur in US & 35,000 people die as a result
- Antibiotic Stewardship Programs (ASPs) can help clinicians improve clinical outcomes and minimize harms by improving antibiotic prescribing
- Metanalysis 32 studies showed 51% risk reduction of MDR-GNB acquisition with AMS
- Core Elements of Hospital Antibiotic Stewardship Programs
  - 2018, 85% of acute care hospitals reported having all seven of the Core Elements in place, compared to only 41% in 2014

Mills JP, et al. Infect Dis Clin N AM 2021;35:969-994
Baur D, et al. *The Lancet Infectious Diseases.* 2017;17(9):990-1001.
https://www.cdc.gov/antibiotic-use/core-elements/hospital.html (Accessed 03 12 2024)

Horizontal Approach: It Works

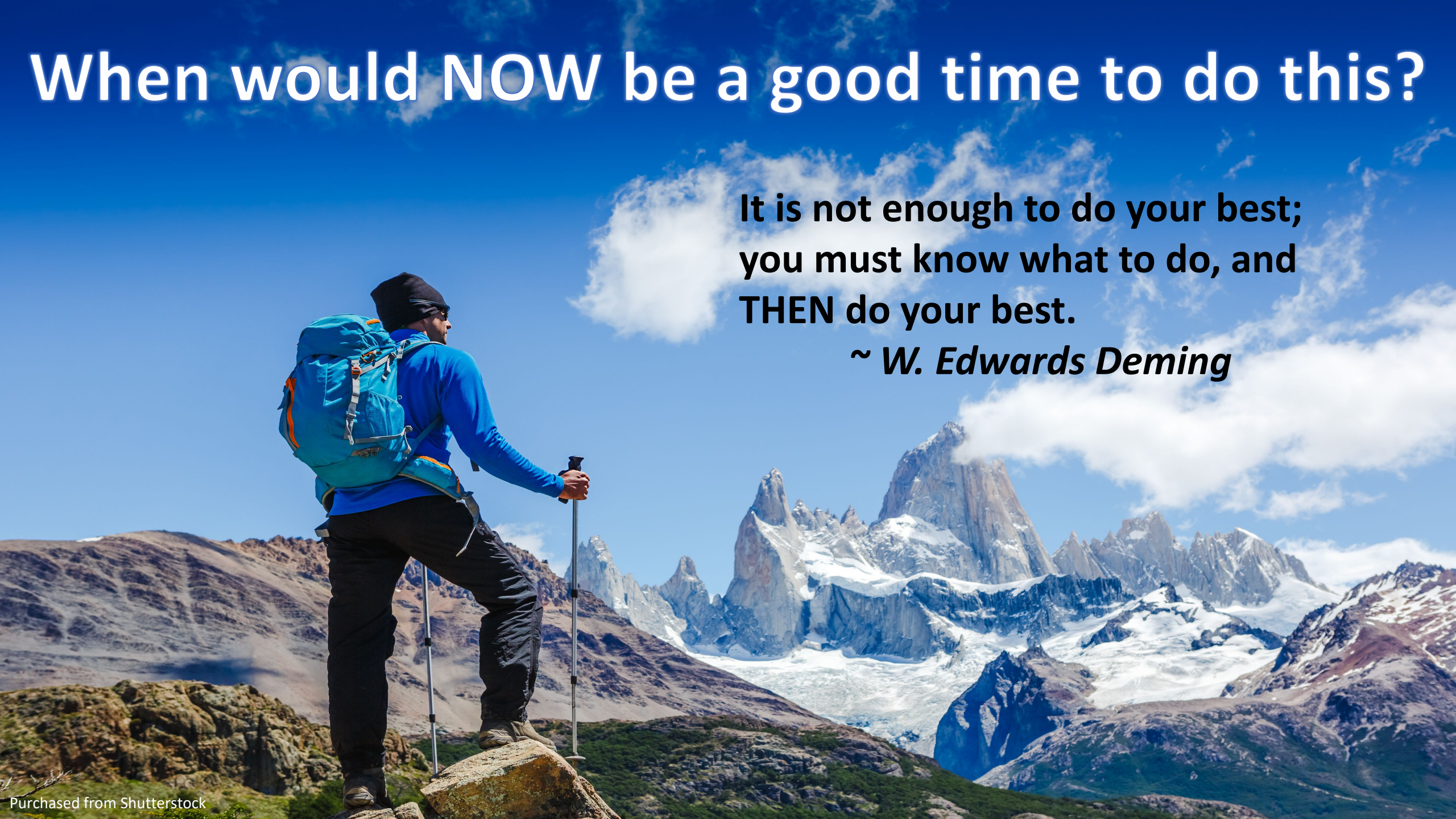
- Retrospective, observational study in the surgical ICU of a tertiary care medical center in Boston, MA, from 2005 to 2012
- N=6,697 patients in the surgical ICU



↓21% per year
Since 2008
Zero MRSA infections

Traa MX, et al. Crit Care Med 2014; 42:2151–2157

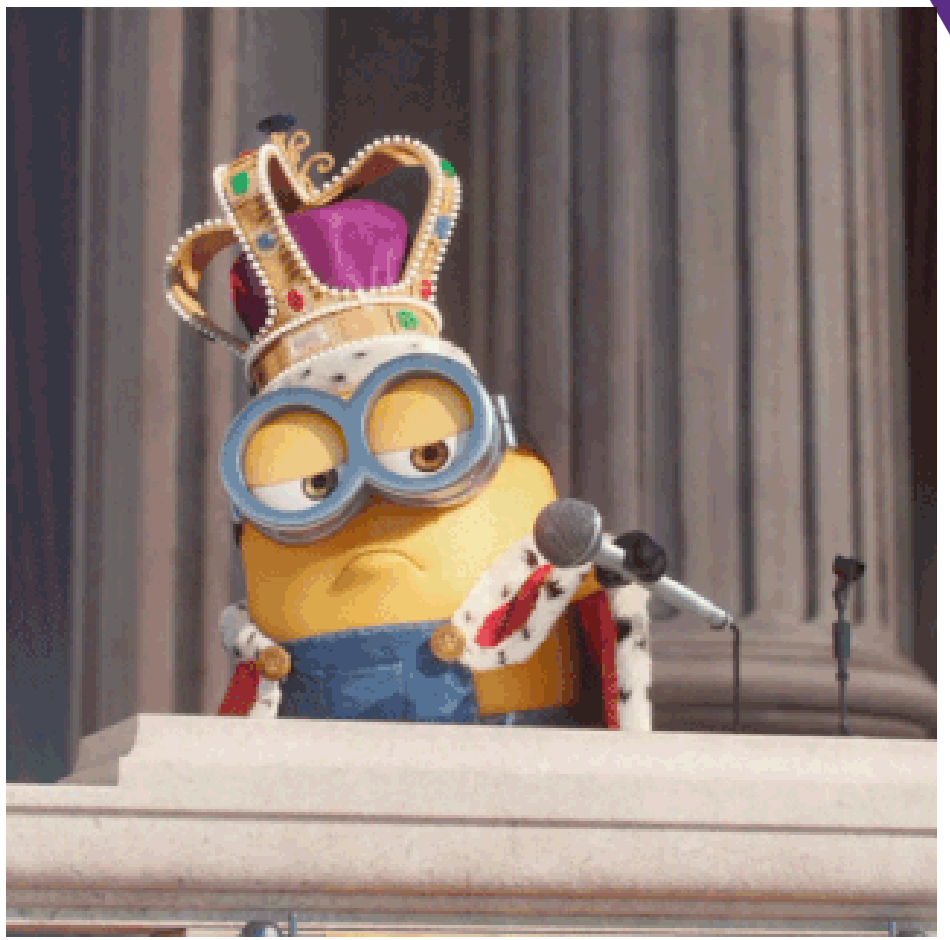
When would NOW be a good time to do this?



It is not enough to do your best;
you must know what to do, and
THEN do your best.

~ W. Edwards Deming

Bugging Out



https://giphy.com/gifs/asks-fieri-dedouche-DfbpTbQ9TvSX6

kvollman@comcast.net