

Preventing Cdiff and MDROs: You Have to Lift the Rocks to Find the Scorpions

James A. McKinnell

Consulting Specialist, M.D.

LA County Department of Public Health

The opinions expressed in this lecture are my own and do not reflect the position of the LA County Department of Public Health or Department of Health Services.

Disclosures

- I have received Government Research Funding from NIH, AHRQ, CDC, and CTSI
- I have served as a consultant for Achaogen, Allergan, Cempra, Science 37, Theravance, and ThermoFisher
- I lead antimicrobial stewardship initiatives in Skilled Nursing Facilities, Expert Stewardship, INC.
- I have no commercial/financial relationships related to decolonization, CHG, mupirocin, or iodophor products

CONTACT ISOLATION PRECAUTIONS

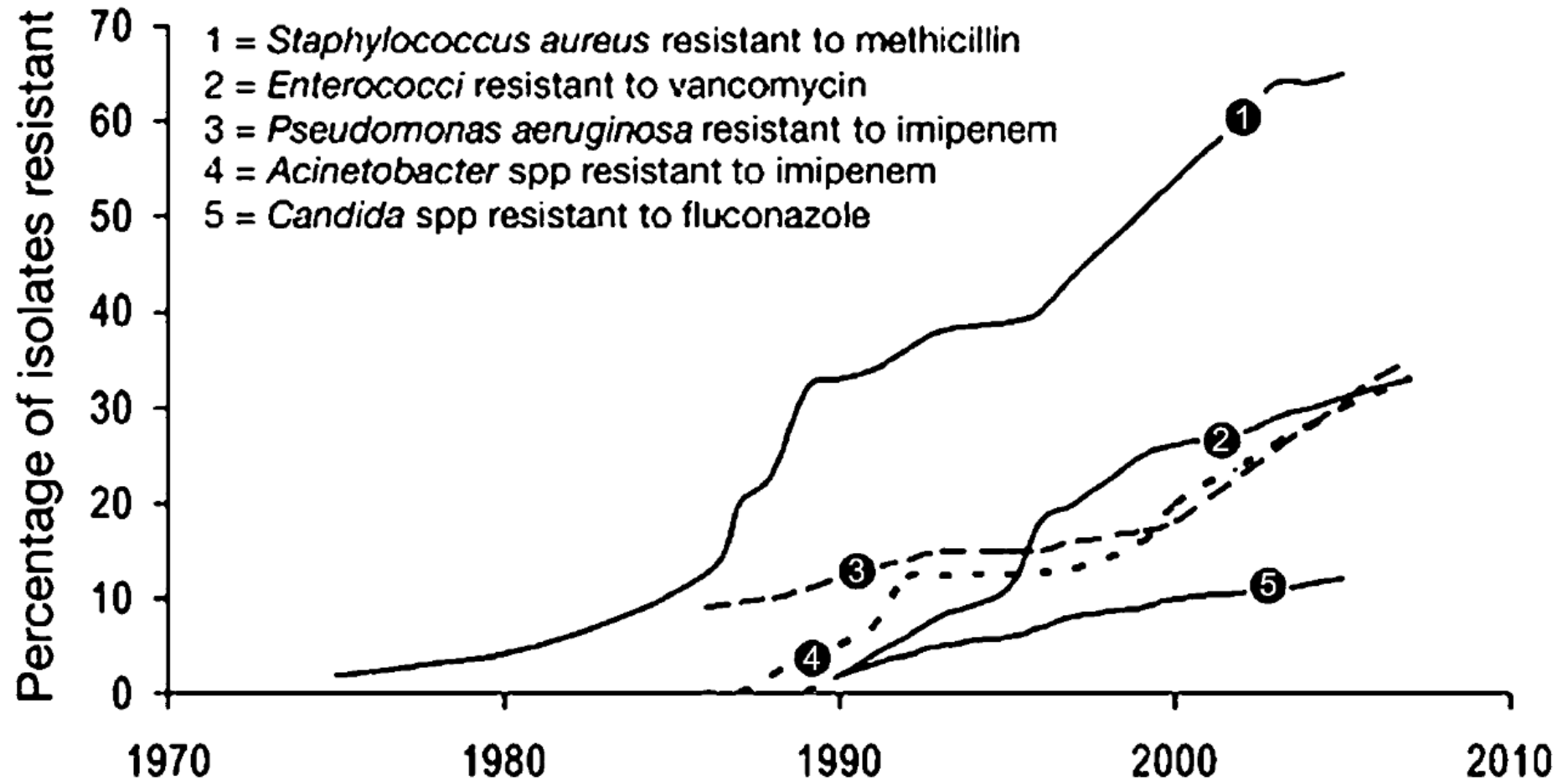
Visitors ~ See Nurse before entering



Clean Hands ~ Gown ~ Gloves

N-95 for High-Hazard Procedures (See other side)





US Causes of Death

	2013	Deaths
1	Heart Disease	611,000
2	Cancer	584,000
3	Accidents	130,000
4	Stroke	129,000
5	Healthcare Associated Infections	100,000
6	Alzheimer's Disease	83,000

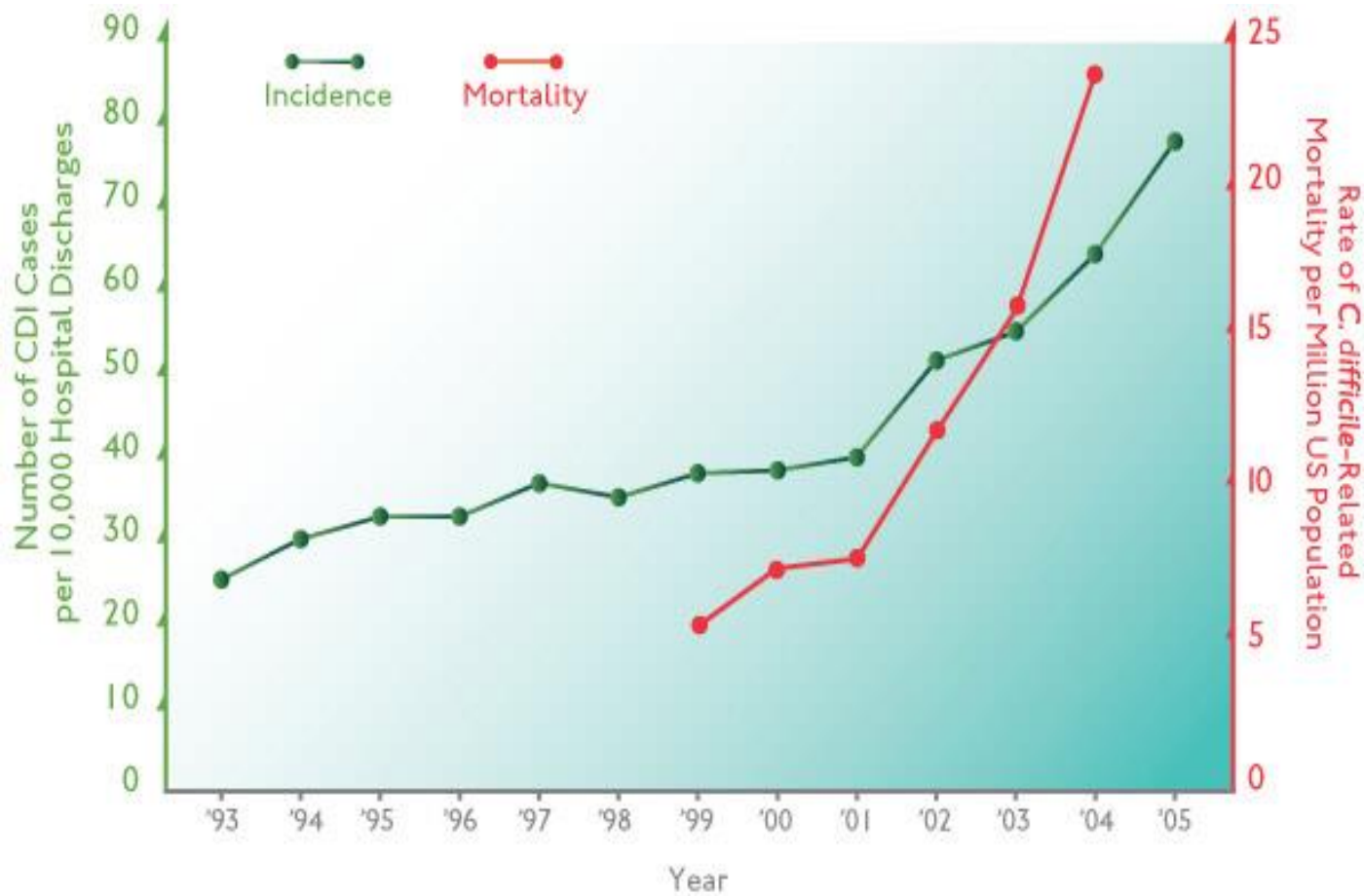
<http://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm> Accessed 4/22/2015, rounded to the nearest thousand deaths.

http://www.cdc.gov/HAI/pdfs/hai/infections_deaths.pdf Accessed 4/22/2015.

CDI: Impact

	Number of annual cases	Cost	Number of annual deaths
Hospital-onset, hospital acquired (HO-HA)	165,000	\$ 1.3 B	9,000
Community-onset hospital acquired (CO-HA) [4 weeks of hospitalization]	50,000	\$ 0.3 B	3,000
Nursing home-onset	263,000	\$ 2.2 B	16,500

Increasing US Mortality due to C difficile



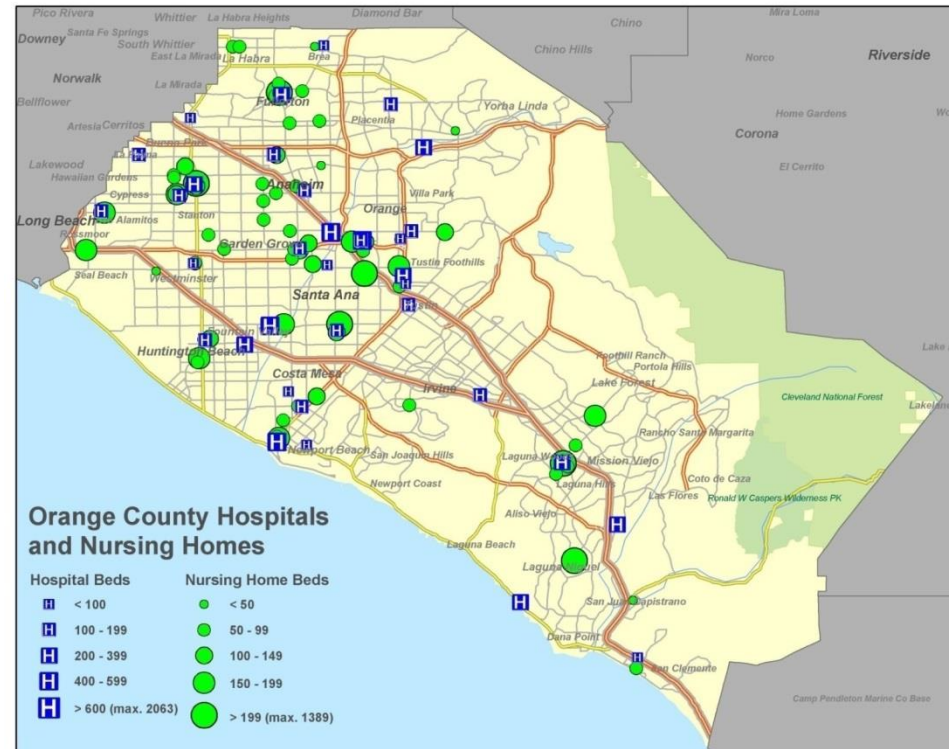
* Daneman et al. JAC 66:2856, Dec 2011

Insanity is
repeating the same mistakes
and
expecting different results.
-Narcotics Anonymous 1981

Orange County, California

Ideal Virtual Laboratory

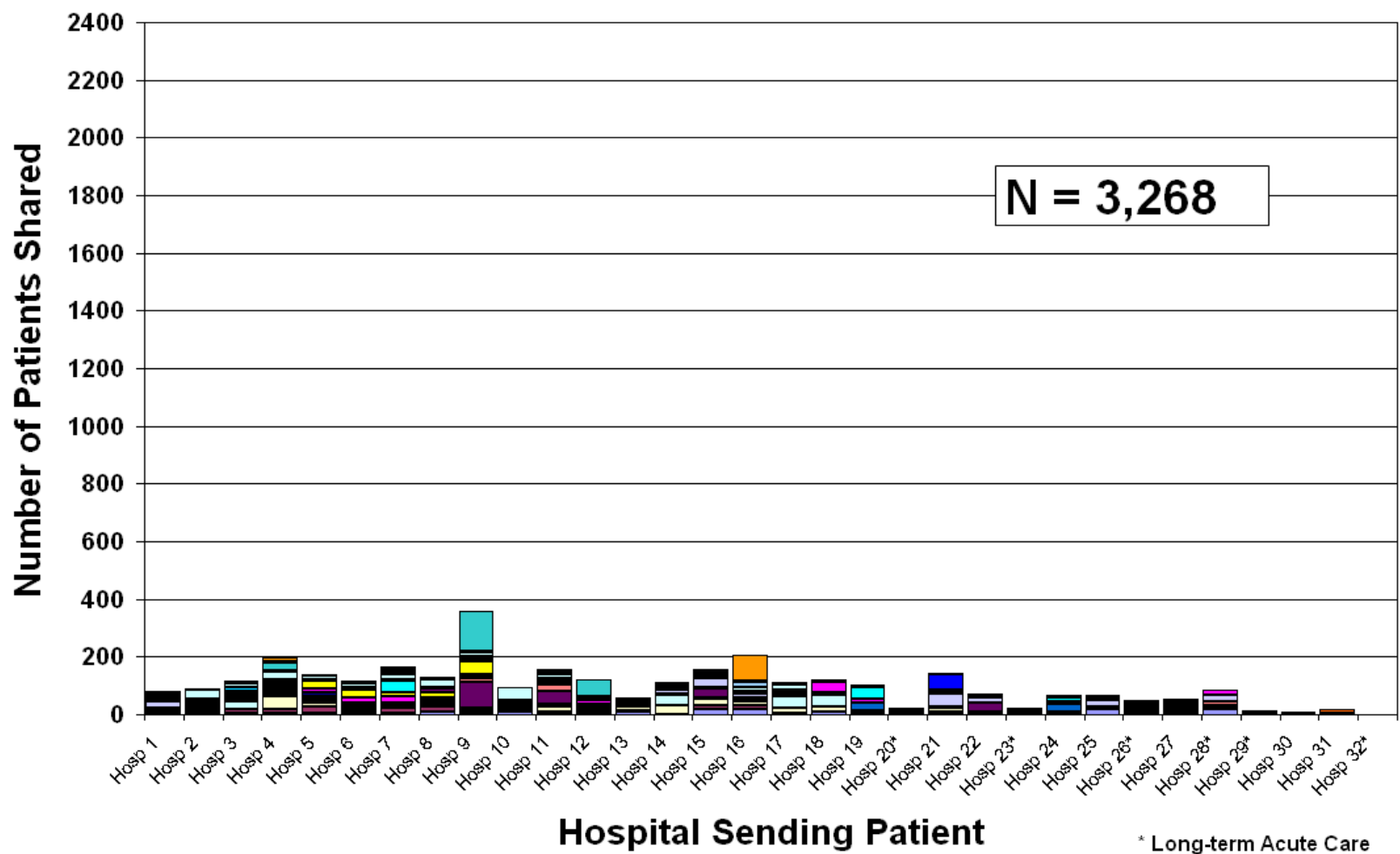
- Relatively enclosed
 - Ocean to West
 - Forest to East
 - Undeveloped land to South
 - Traffic to North



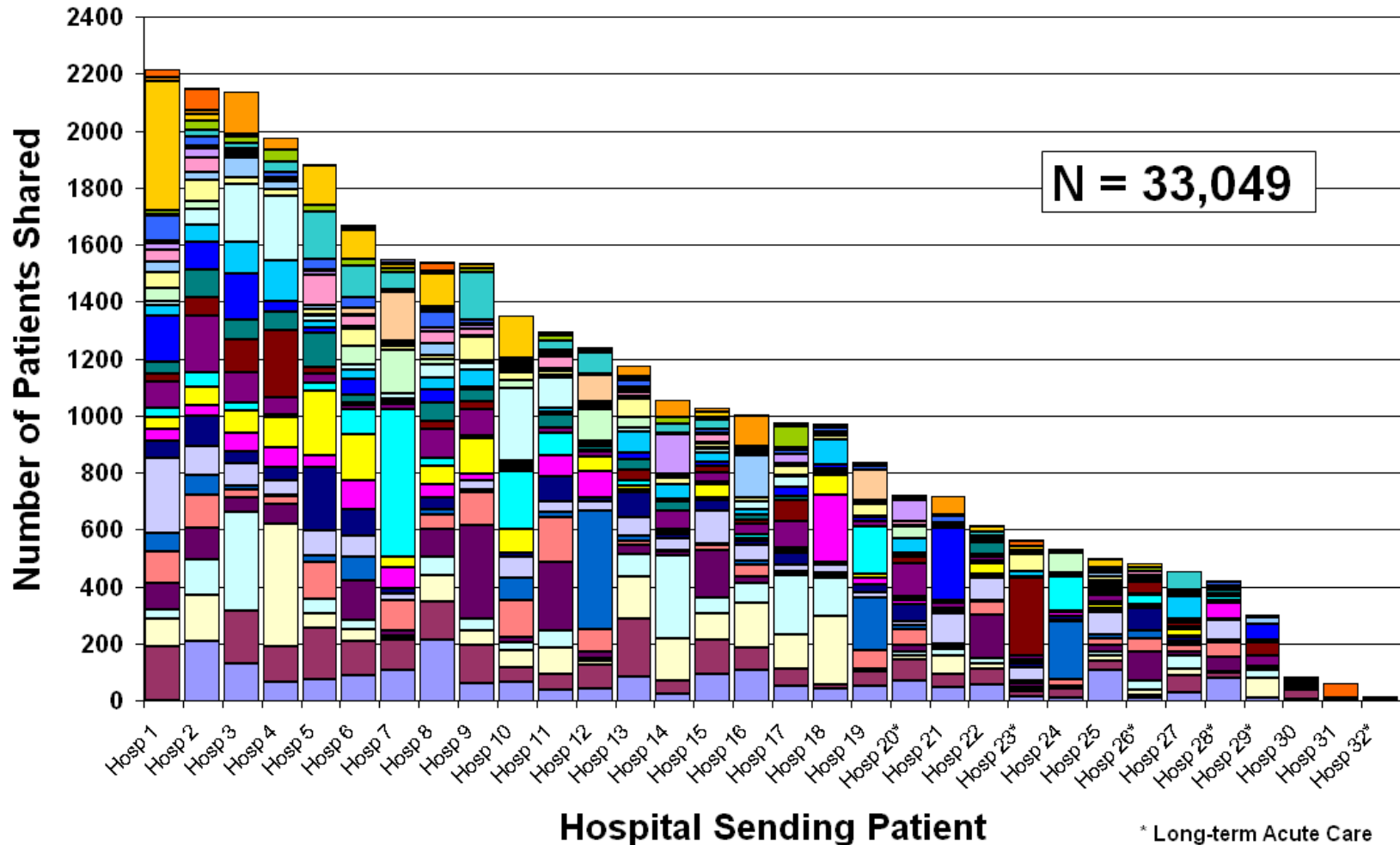
Orange County

- 32 Acute Care Hospitals
 - 6 Long-Term Acute Care Hospitals (LTACs)
 - 2 Dedicated Children's Hospitals
- 71 nursing homes
- Serves population of 3.1 million (6th largest US county)
- >320,000 admissions annually

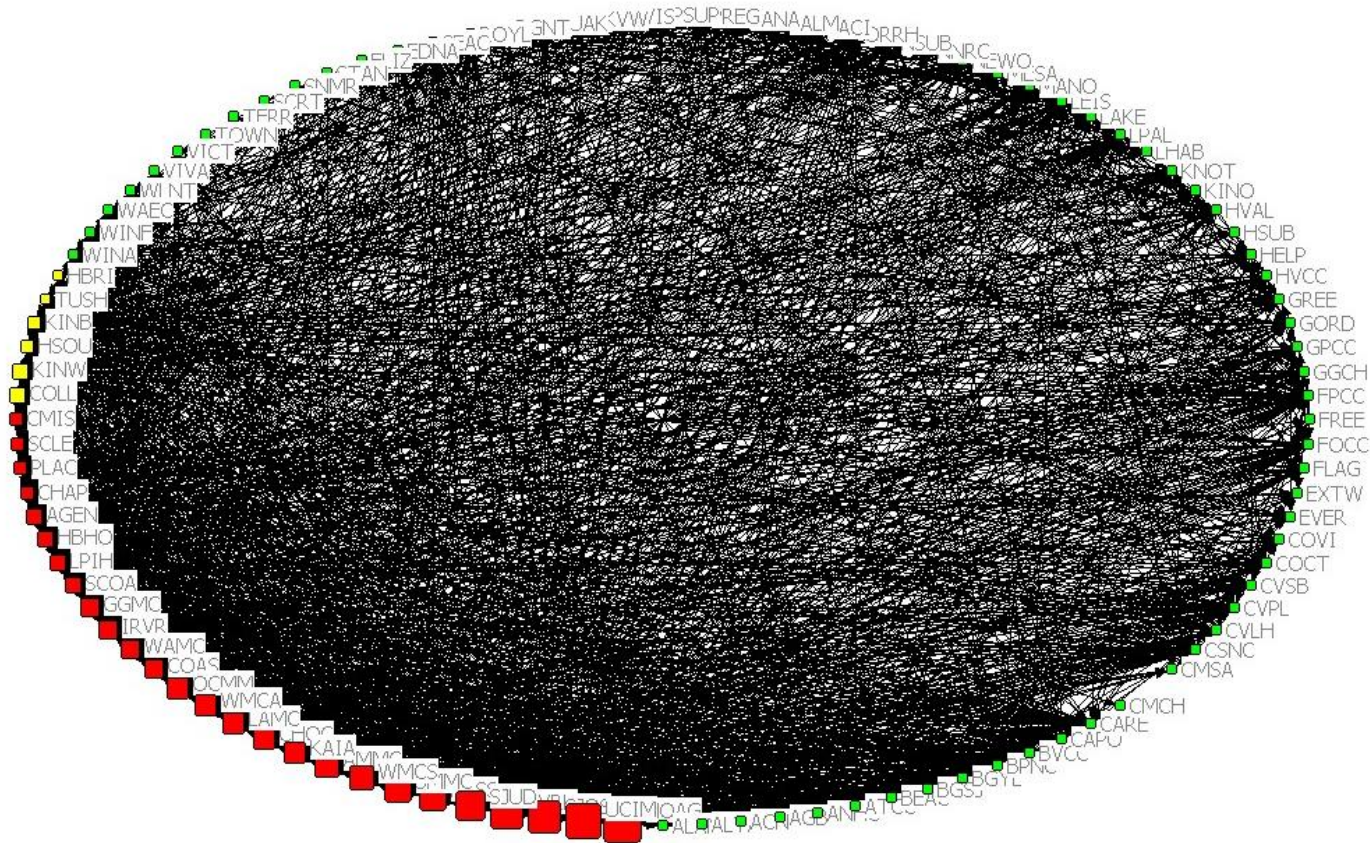
Hospitals Share Patients – Direct



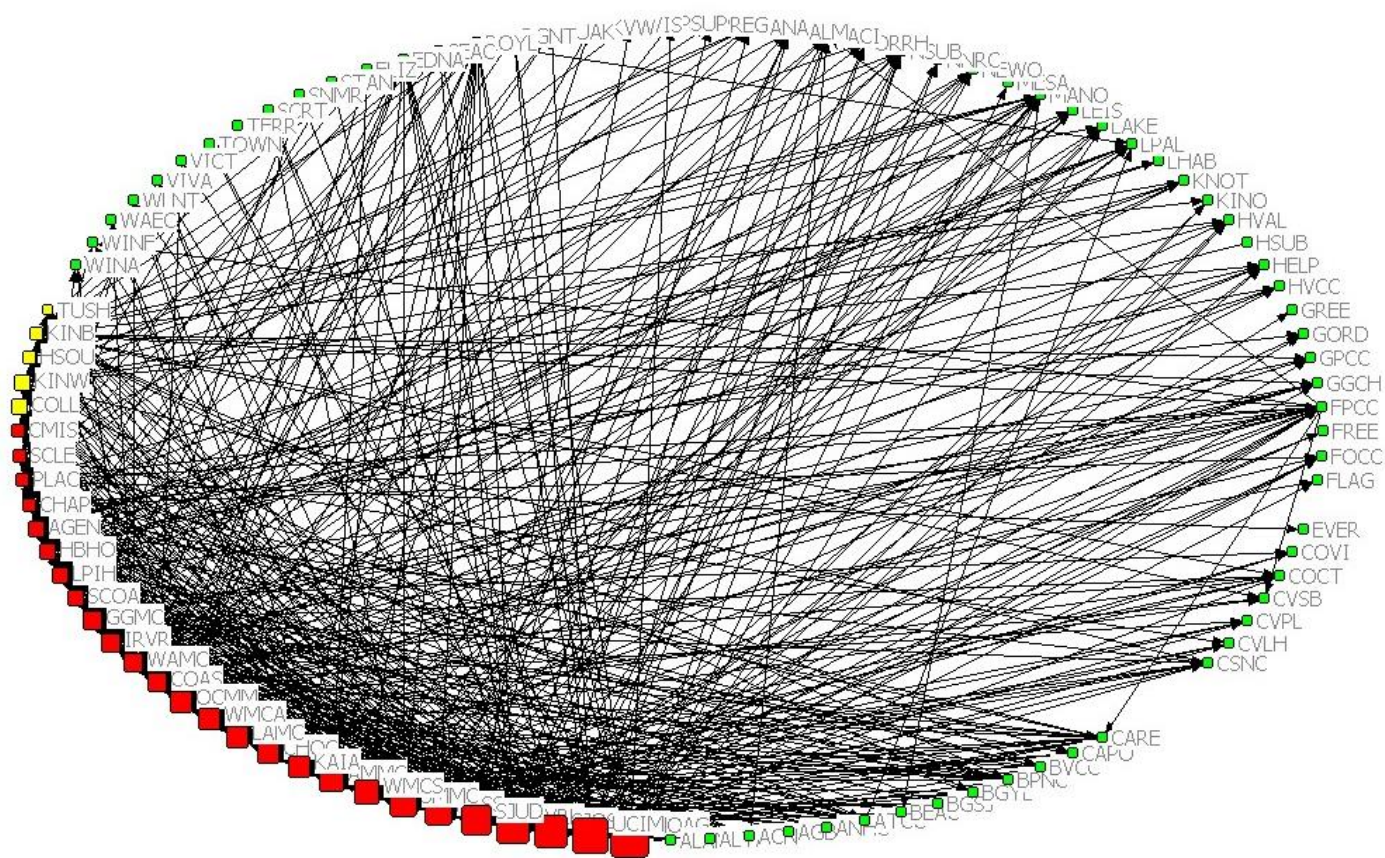
Hospitals Share Patients-Indirect



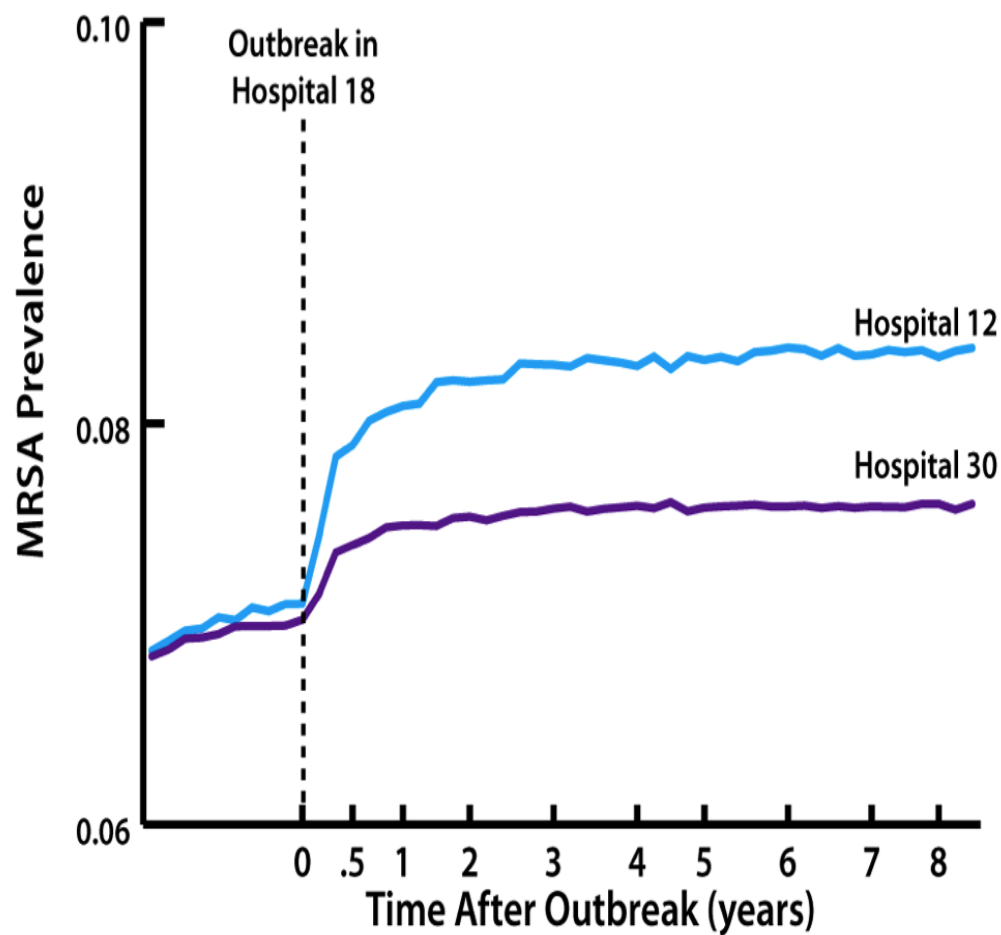
Hospitals Share Patients – 1 Patient



Sharing Patients – 10 Patients



Sustained Single Hospital Outbreak



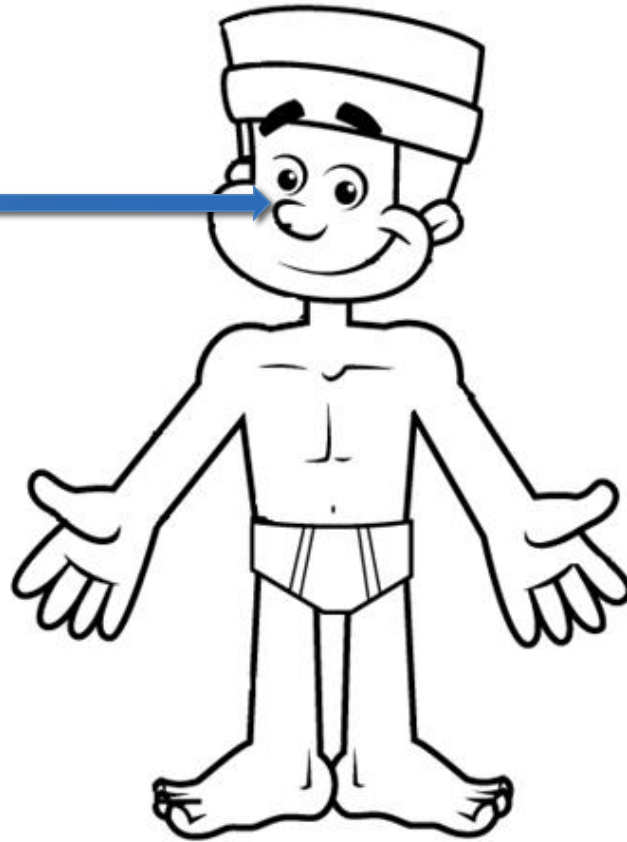
Objectives

- Understand the Dynamic Nature of Patient Colonization
Concept: Emergence or Unmasking
- Understand the Complexity of Environmental Contamination
Concept: Environmental Reservoirs
- Define Key Clinical Trials of Decolonization In ICUs, General Wards, Post Discharge and Long Term Acute Care
Concept: IP Continues Outside our Four Walls

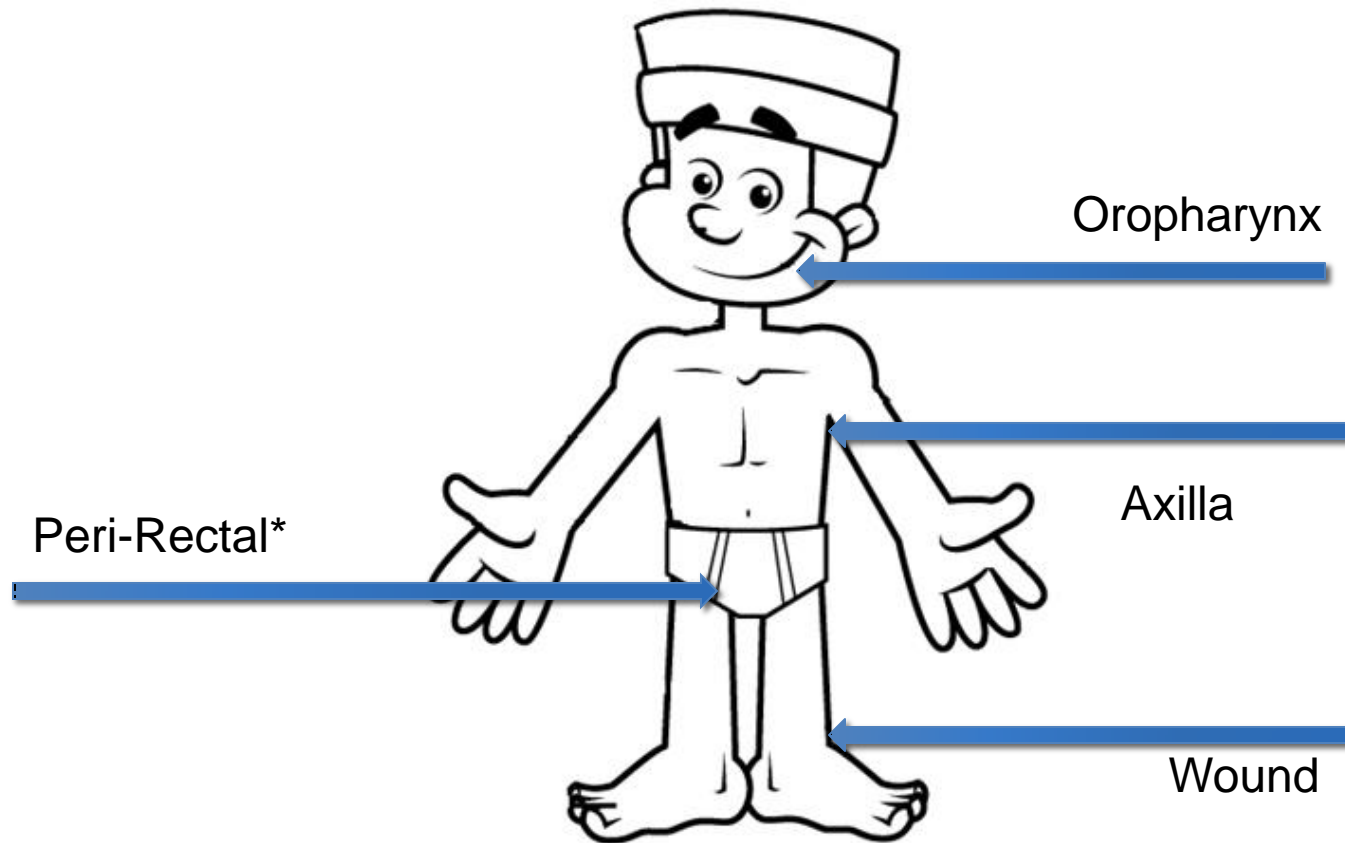
“Whatever you think you might know about a patient’s colonization status is likely wrong.”

Traditional Screening for MRSA

Nares Swab



Non-Nares Body Site Test Sites



Screening for MRSA at the Nares

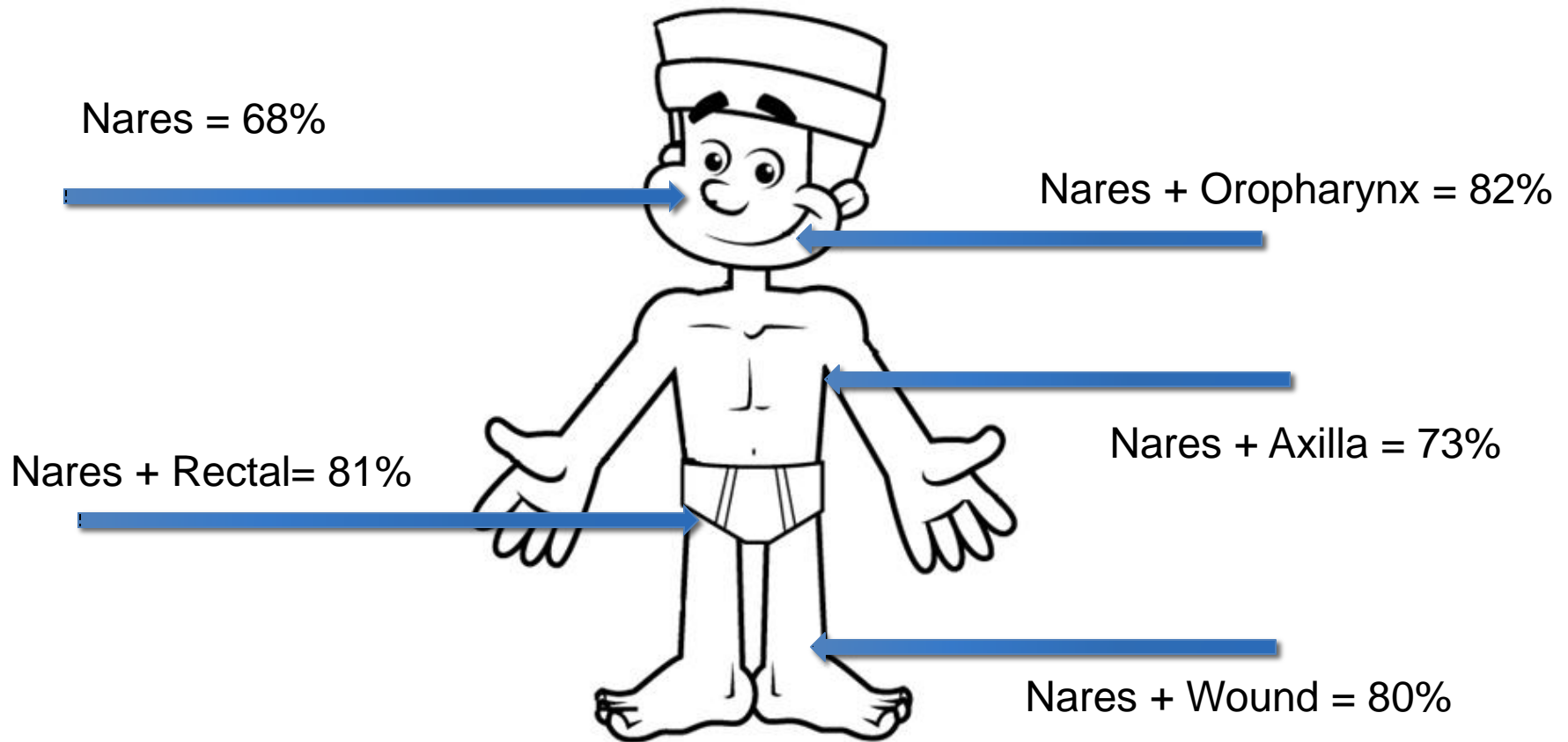
INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY FEBRUARY 2013, VOL. 34, NO. 2

ORIGINAL ARTICLE

Quantifying the Impact of Extranasal Testing of Body Sites for Methicillin-Resistant *Staphylococcus aureus* Colonization at the Time of Hospital or Intensive Care Unit Admission

James A. McKinnell, MD;^{1,2} Susan S. Huang, MD, MPH;³ Samantha J. Eells, MPH;¹
Eric Cui, BS;³ Loren G. Miller, MD, MPH¹

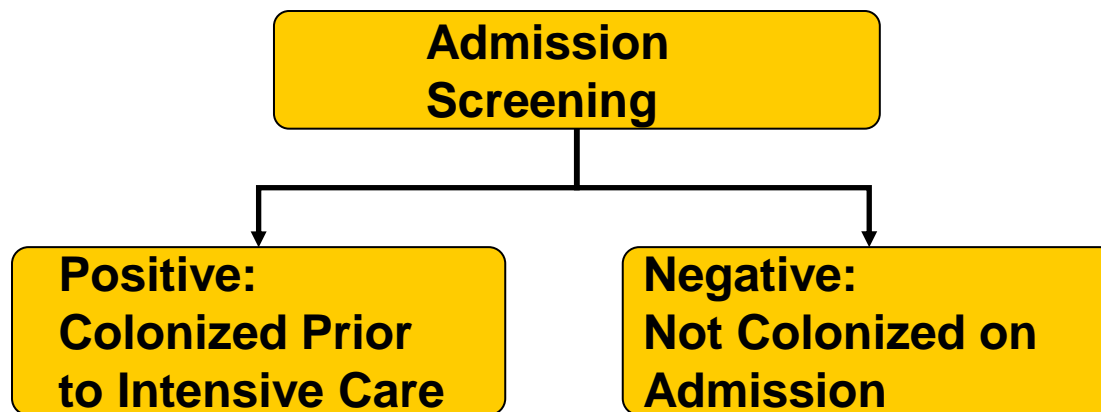
Non-Nares Body Site Test Sites



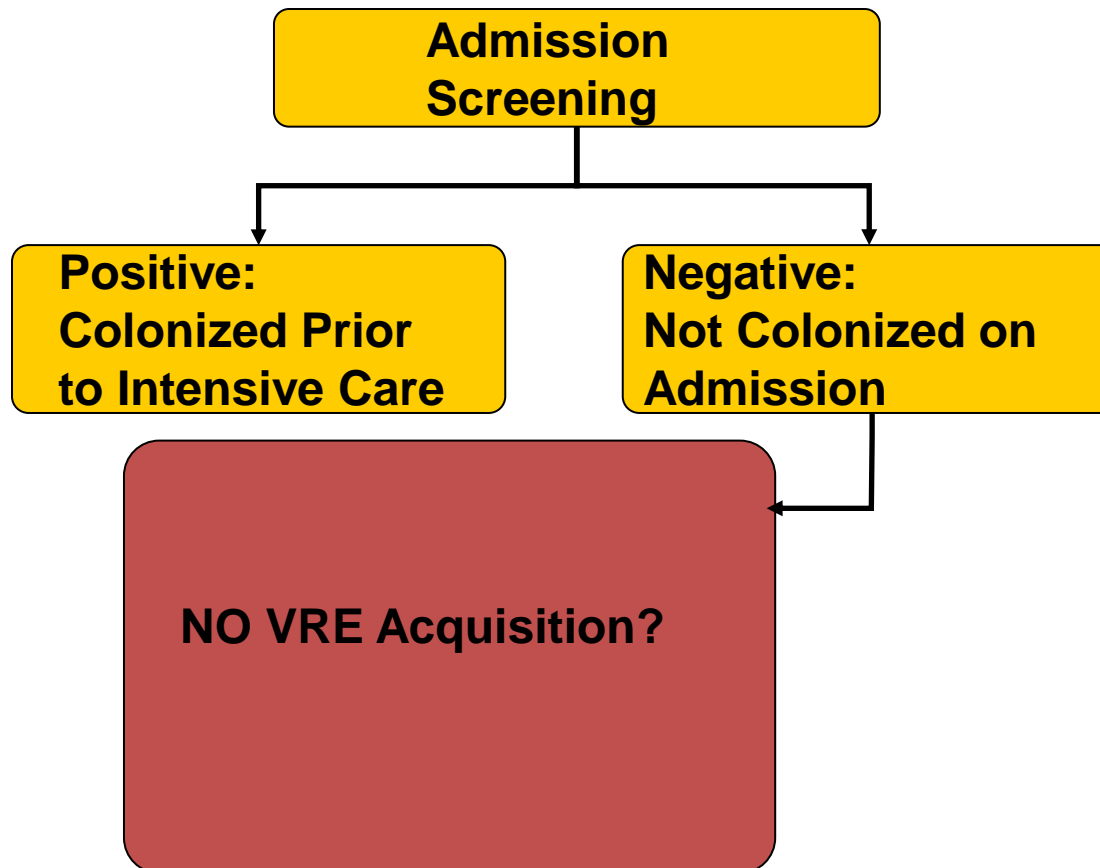
“Screening for MRSA at the Nares Alone will miss over 30% of all MRSA carriers.”

“Testing for colonization on admission is like driving forward using the rear-view mirror.”

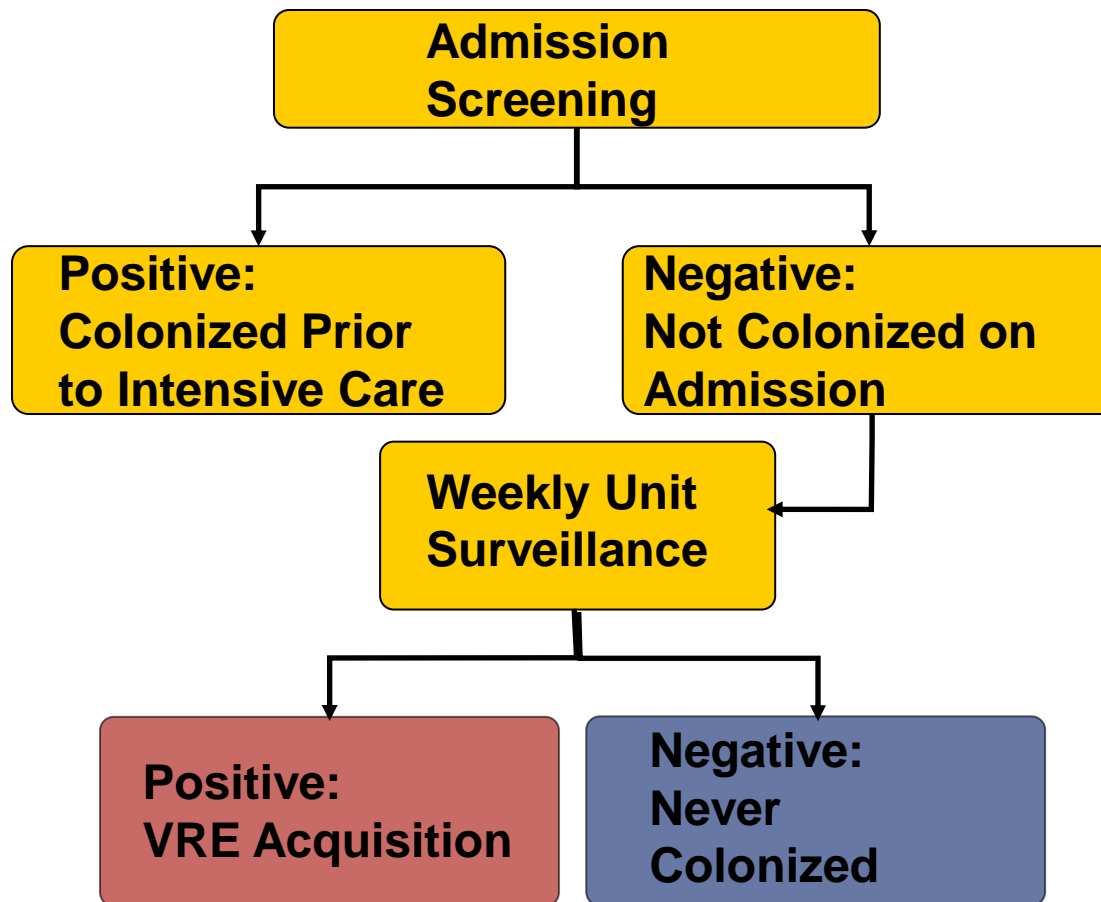
Traditional VRE Screening



Traditional VRE Screening



MICU Screening Protocol at UAB



Patient-level analysis of incident vancomycin-resistant enterococci colonization and antibiotic days of therapy

J. A. MCKINNELL^{1,2,3*}, D. F. KUNZ⁴, S. A. MOSER⁵, S. VANGALA⁶,
C.-H. TSENG⁶, M. SHAPIRO⁷ AND L. G. MILLER^{1,2}

“The Addition of Weekly Surveillance
Test Increased VRE Detection by
50%!!”

VRE Unmasking

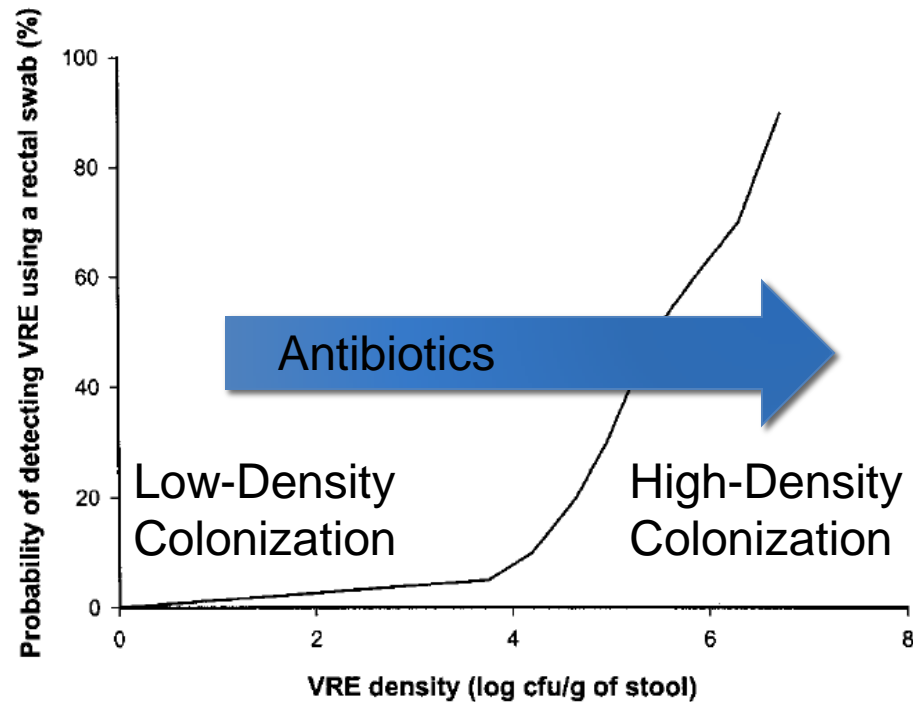
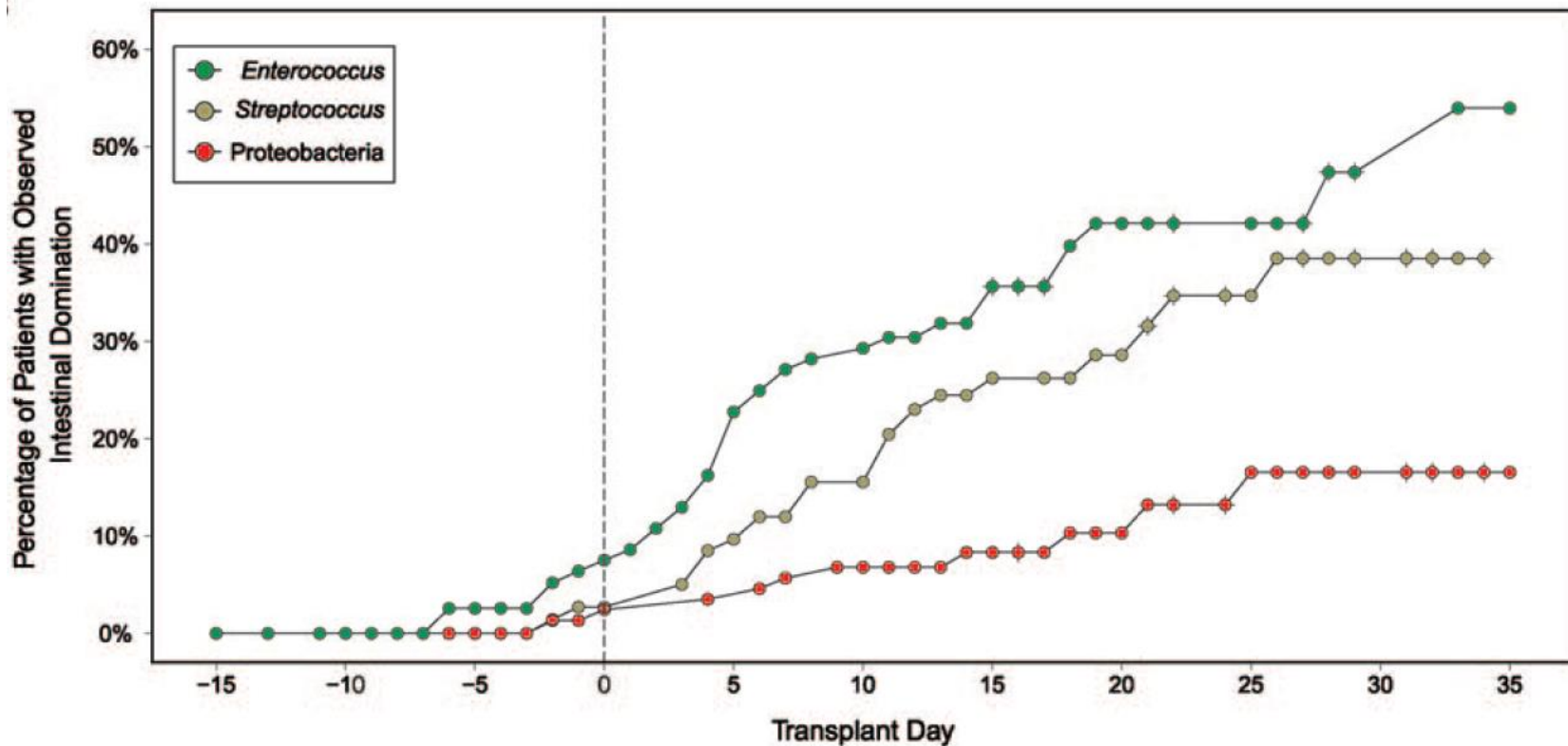


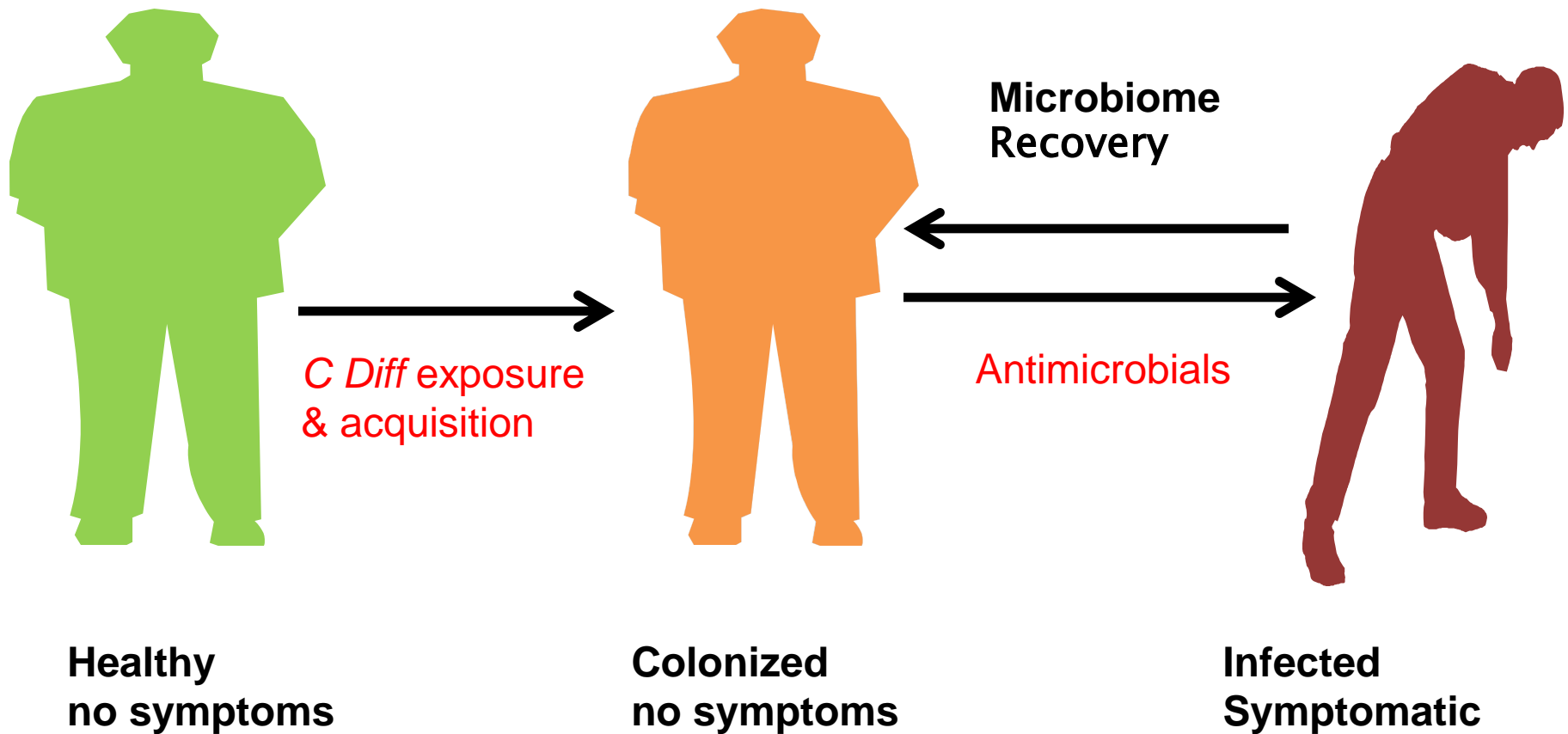
Figure 2. Relationship between the probability of detecting vancomycin-resistant *Enterococcus faecium* (VRE) by means of the rectal swab culture method and VRE stool density (Hosmer and Lemeshow goodness-of-fit test, $P = .73$).

Intestinal Domination and the Risk of Bacteremia in Patients Undergoing Allogeneic Hematopoietic Stem Cell Transplantation



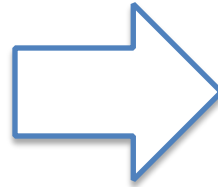
“We have very few options to take the fight to the intestinal microbiome reservoir.”

CDI Pathogenesis



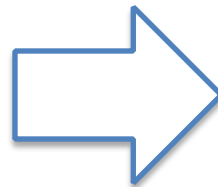
Antibiotics and CDI

Risk of CDI compared to resident on 1 antibiotic



	Number of ATBs		
	2 ATBs	3-4 ATBs	5+ ATBs
	2.5 times higher	3.3 times higher	9.6 times higher

Risk of CDI compared to resident on ATBs for <4 days



	Days of Antibiotic		
	4-7 days	8-18 days	>18 days
	1.4 times higher	3 times higher	7.8 times higher

Antimicrobials Predisposing to CDI

Very commonly related	Less commonly related	Uncommonly related
Clindamycin Ampicillin Amoxicillin Cephalosporins Fluoroquinolones	Sulfa Macrolides Carbapenems Other penicillins	Aminoglycosides Rifampin Tetracycline Chloramphenicol

Short Course Therapy!!!!

Diagnosis	Short (d)	Long (d)	Result
CAP	3 or 5	7, 8, or 10	Equal
HAP	7	10-15	Equal
VAP	8	15	Equal
Pyelo	7 or 5	14 or 10	Equal
Intra-abd	4	10	Equal
AECB	≤ 5	≥ 7	Equal
Cellulitis	5-6	10	Equal
Osteo	42	84	Equal

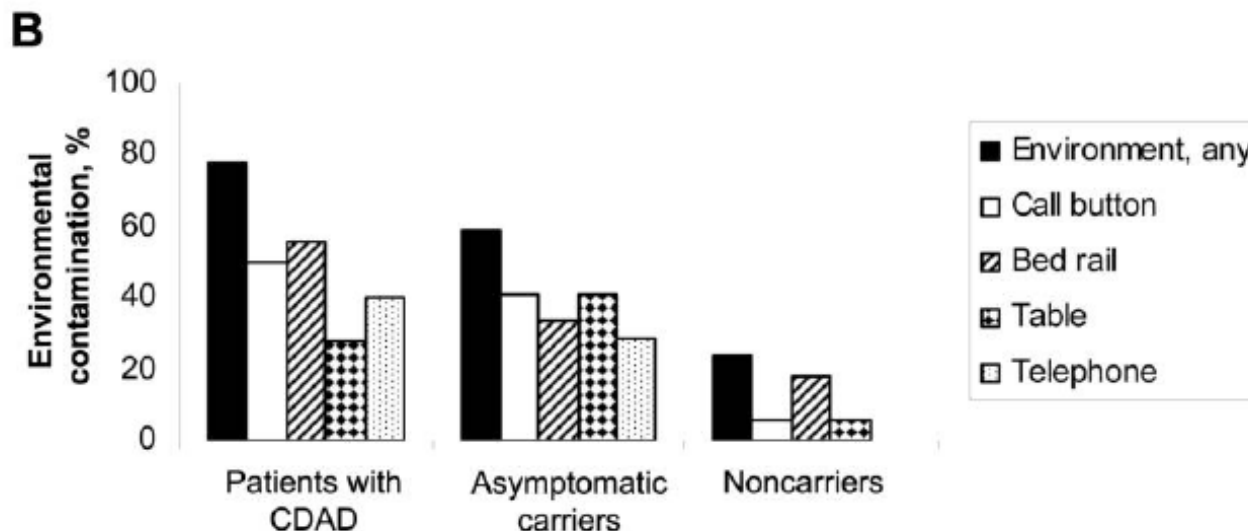
Asymptomatic carriers are the KEY source for transmission of *Clostridium difficile*

3-month study in LTCF with 73 residents

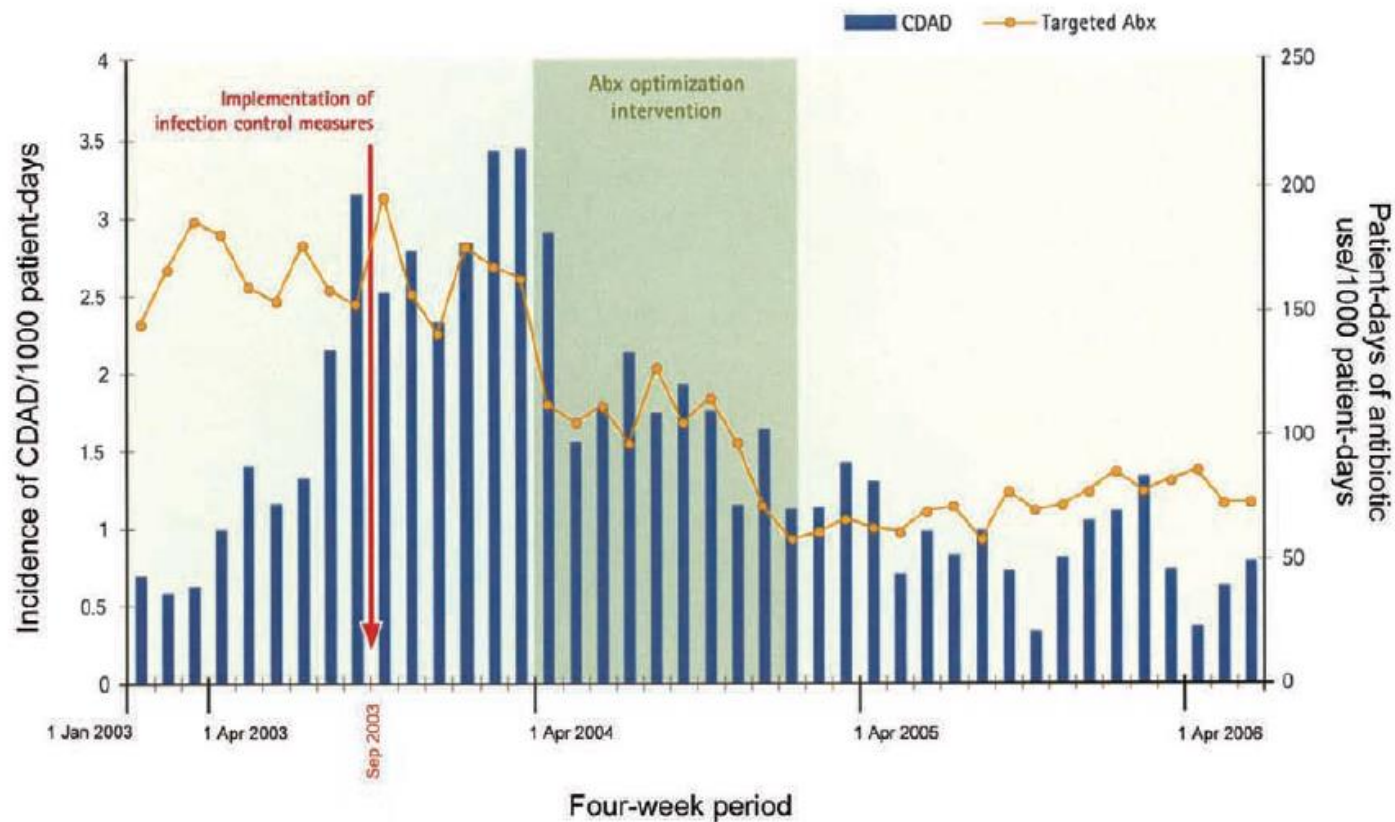
Five (7%) patients had CDI

35 (51%) were asymptomatic carriers (nine had a prior history of CDI)

Asymptomatic carriers associated with significantly higher rates of skin (61% vs. 19%) and environmental contamination (59% vs. 24%) than non-carriers



Formulary Restriction and/or Prospective Audit with Feedback Targeting High-Risk Antibiotics Can Reduce CDI Incidence



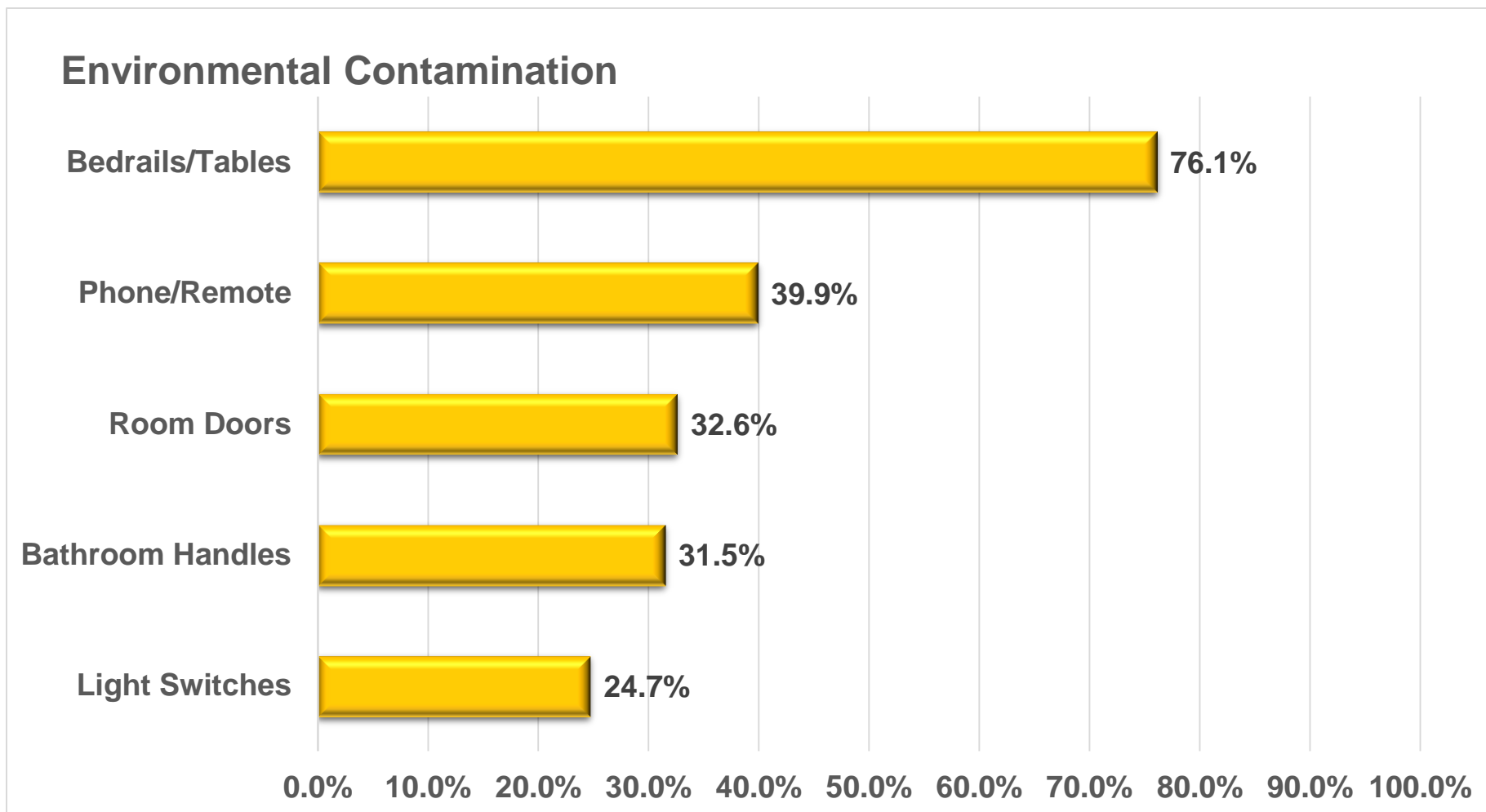
“We have very few options to take the fight to the intestinal microbiome reservoir.”

“Environmental Contamination may be Harder than you think.”

Elements of Environmental Cleaning

- Product
- Saturation
- Application

Resident with Known Colonization



Room Contamination

Post-Discharge Cleaning

Pathogen	% Contaminated After Discharge Cleaning
MRSA ¹	74% of surface cultures
MRSA ²	46% of rooms
MRSA ³	24% of rooms
VRE ³	22% of rooms
VRE ⁴	16% of rooms

¹ French GL et al. J Hosp Infect 2004;57:31-7

² Blythe D et al. J Hosp Infect 1998;38:67-70

³ Goodman ER et al. Infect Control Hosp Epidemiol 2008; 29:593-9

⁴ Byers KE. ICHE 1998;19:261-4.

Elements of Environmental Cleaning

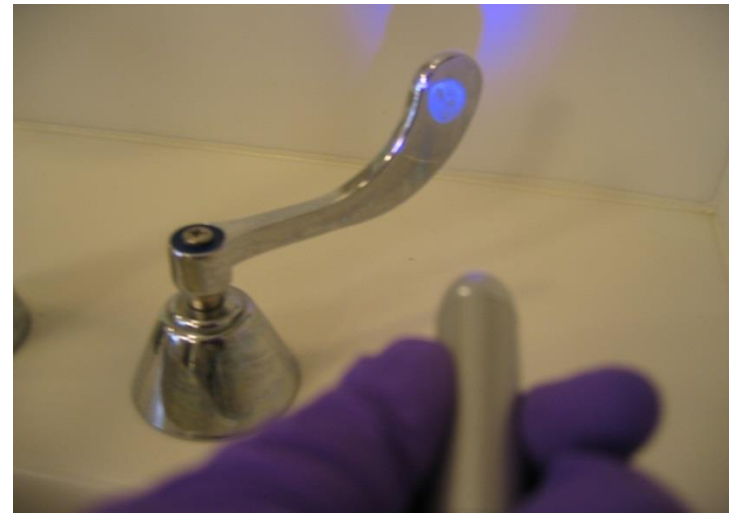
- Product
- Saturation
- Application
- Feedback

Black Light Target

- Fluorescent marker
 - An invisible gel that glows under black light
 - An inert, non-toxic substance



Without black light



With black light

Site A

sinks with connection
between overflow
cavity and drain



The Pig Pen Principle



MAJOR ARTICLE



Hygiene

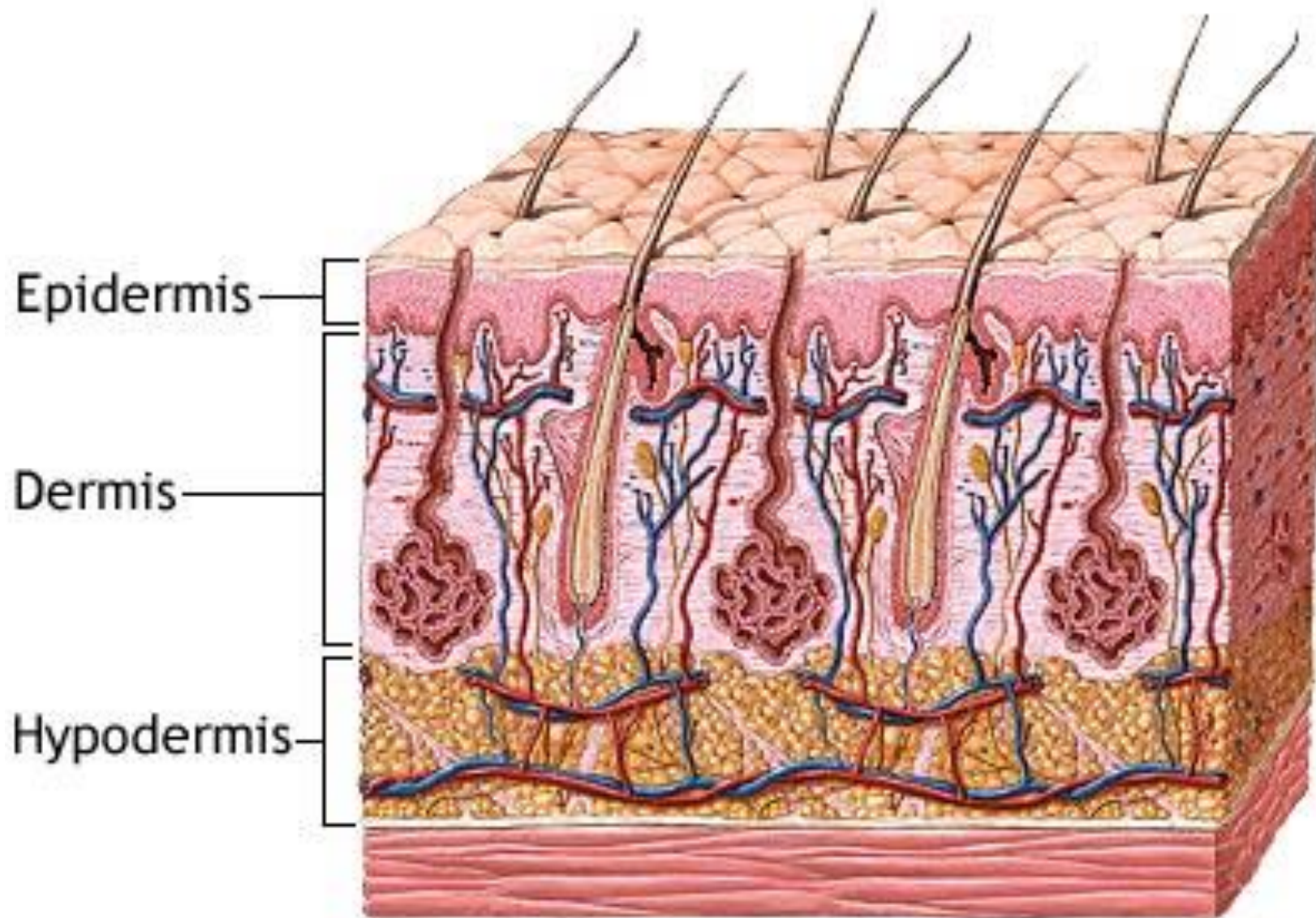
- Many Residents are Dependent on HCW for Personal Hygiene
- Bathing Frequency and Efficacy is Highly Variable
- Resident Hand Hygiene Programs are Uncommon

Mody JAMA Intern Med. 2013; 173(10):853-4.
SHEA/APIC Guideline. ICHE 2008; 29(9):785-814.

Skin Cleansing

- Use of topical antiseptics to clean patients
 - Chlorhexidine (CHG) for skin and wound bathing
 - Mupirocin or iodophor for nasal use
- CHG and iodophor used in healthcare for 60+ years with strong safety record

Standard of Care when we want to prepare patients for Surgery.

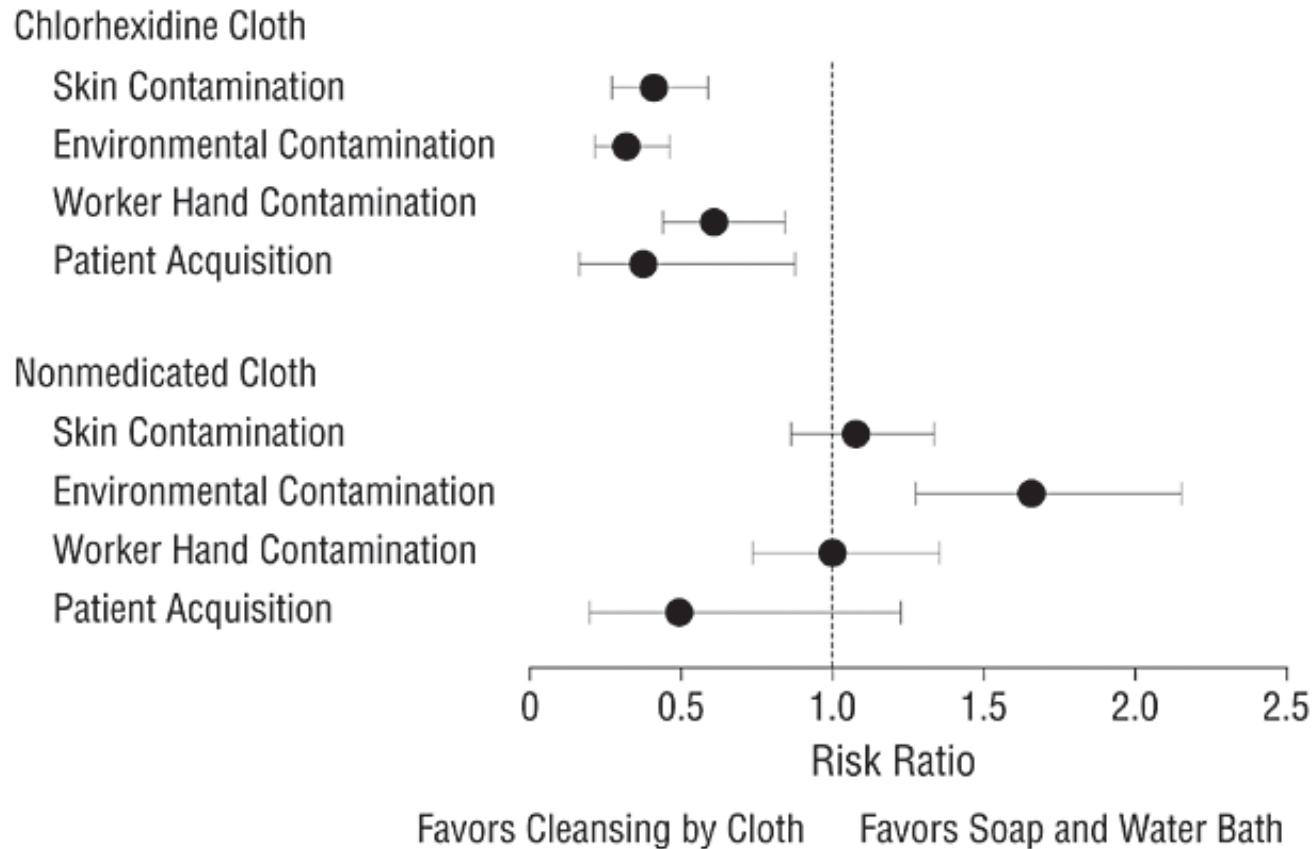


Nasal Decolonization

- **Iodophor** vs Mupirocin
 - Used in healthcare 60+ years
 - Nasal formulation
 - Safety data for twice daily x 5 day regimen
 - ****Less Resistance??****
 - Better tolerated than mupirocin ¹

¹ Maslow J, et al. Orthopedics. 2014 Jun;37(6):e576-

CHG Impact on Skin, Environment, Staff Contamination and VRE Acquisition



Decolonization Trials

- ICU
 - REDUCE MRSA Trial and others**
 - Mupirocin-Iodophor Swapout
- Non-ICU
 - ABATE Infection Trial
- Post-Discharge
 - Project CLEAR
- Nursing Homes
 - PROTECT Trial
 - SHIELD-OC Project

ICU Decolonization Evidence Summary

Author	Study Year	Study Type	Hospital	ICU	N	Findings	Publication
Vernon	10/02-12/03	Observational	1	1	1,787	65% less VRE acquisition 40-70% less VRE on skin, HCW hands, environment	Arch Intern Med 2006; 166:306-312
Climo	12/04-1/06	Observational	4	6	5,293	66% less VRE BSI 32% less MRSA acquisition 50% less VRE acquisition	Crit Care Med 2009; 37:1858-1865
Bleasdale	12/05-6/06	Observational	1	2	836	61% less primary BSI	Arch Intern Med 2007; 167(19):2073-2079
Popovich	9/04-10/06	Observational	1	1	3,816	87% less CLABSI 41% less blood contaminants	ICHE 2009; 30(10):959-63
Climo	8/07-2/09	Cluster RCT	6	9	7,727	23% less MRSA/VRE acquisition	N Engl J Med 2013; 368:533-42
Milestone	2/08-9/10	Cluster RCT	5	10	4,947	36% less total BSI (as treated)	Lancet. 2013; 381(9872):1099-106
Huang	1/09-9/11	Cluster RCT	43	74	122,646	37% less MRSA clinical cultures 44% less all-cause BSI	N Engl J Med 2013 368:2255-2265

Decolonization Trials

- ICU
 - REDUCE MRSA Trial and others**
 - Mupirocin-Iodophor Swapout
- Non-ICU
 - ABATE Infection Trial**
- Post-Discharge
 - Project CLEAR
- Nursing Homes
 - PROTECT Trial
 - SHIELD-OC Project

Abate Trial

- Large Scale Cluster Randomized Trial of Decolonization in routine ward Settings
- Negative Study for the Primary Outcome
- Post Hoc Analysis showed potential benefit for patients with central lines and devices

Decolonization Trials

- ICU
 - REDUCE MRSA Trial and others
 - Mupirocin-Iodophor Swapout
- Non-ICU
 - ABATE Infection Trial
- **Post-Discharge**
 - Project CLEAR**
- Nursing Homes
 - PROTECT Trial
 - SHIELD-OC Project

Post-Discharge MRSA Infection Risks

Figure 1. Distribution of Weeks Between Previous Hospitalization and Current Admission Date, Stratified by Long-term Care Facility Residence

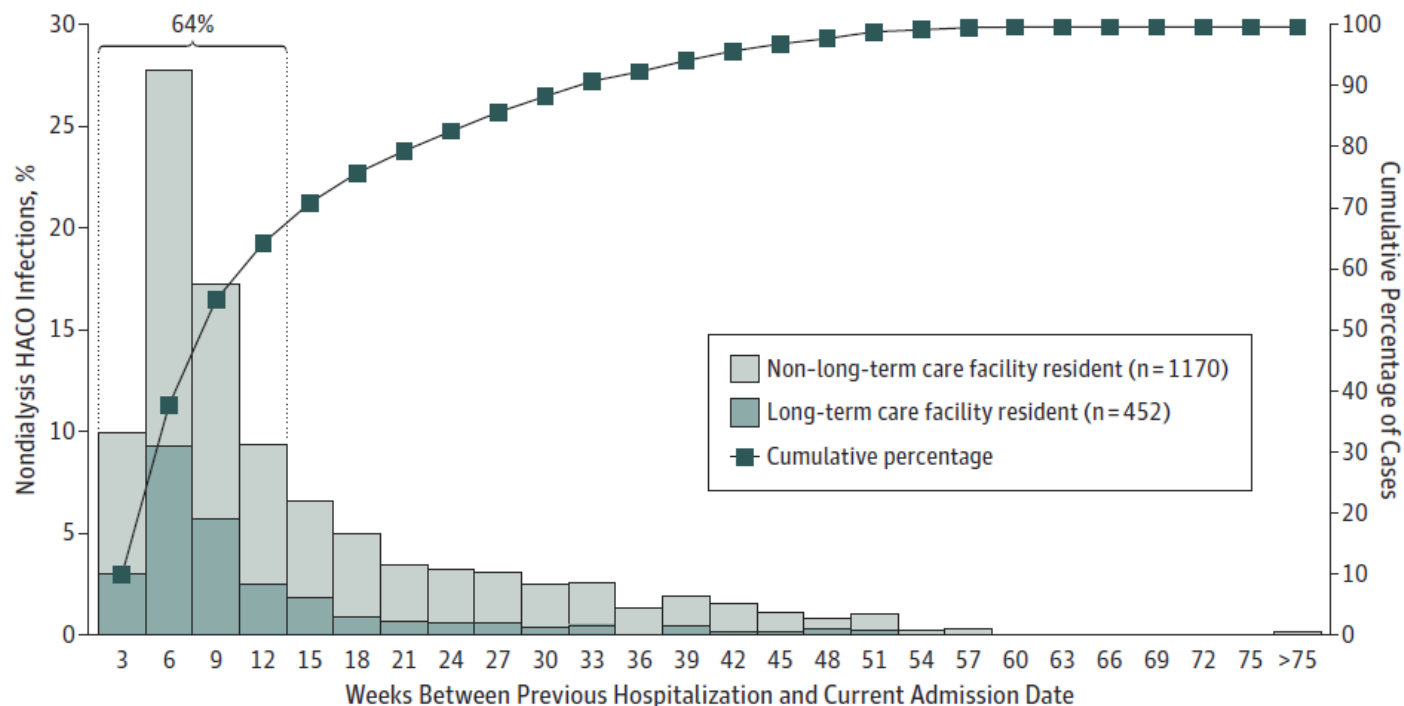


Table 3. National Estimated Incidence and Mortality of Invasive MRSA Infections,^a United States, 2005 and 2011

Dantes et al. JAMA Int Med 2013;173(21):1970-8

Number Needed to Treat

	Overall	Full Adherence
MRSA Infection	36	25
MRSA Hospitalization	41	28
Any Infection	25	11
Hospitalization due to Infection	27	11

Prevention of Colonization and Infection by *Klebsiella pneumoniae* Carbapenemase–Producing Enterobacteriaceae in Long-term Acute-Care Hospitals

Mary K. Hayden,^{1,2} Michael Y. Lin,¹ Karen Lolans,² Shayna Weiner,¹ Donald Blom,¹ Nicholas M. Moore,³ Louis Fogg,⁴ David Henry,⁵ Rosie Lyles,⁶ Caroline Thurlow,¹ Monica Sikka,¹ David Hines,⁷ and Robert A. Weinstein^{1,6}; for the Centers for Disease Control and Prevention Epicenters Program

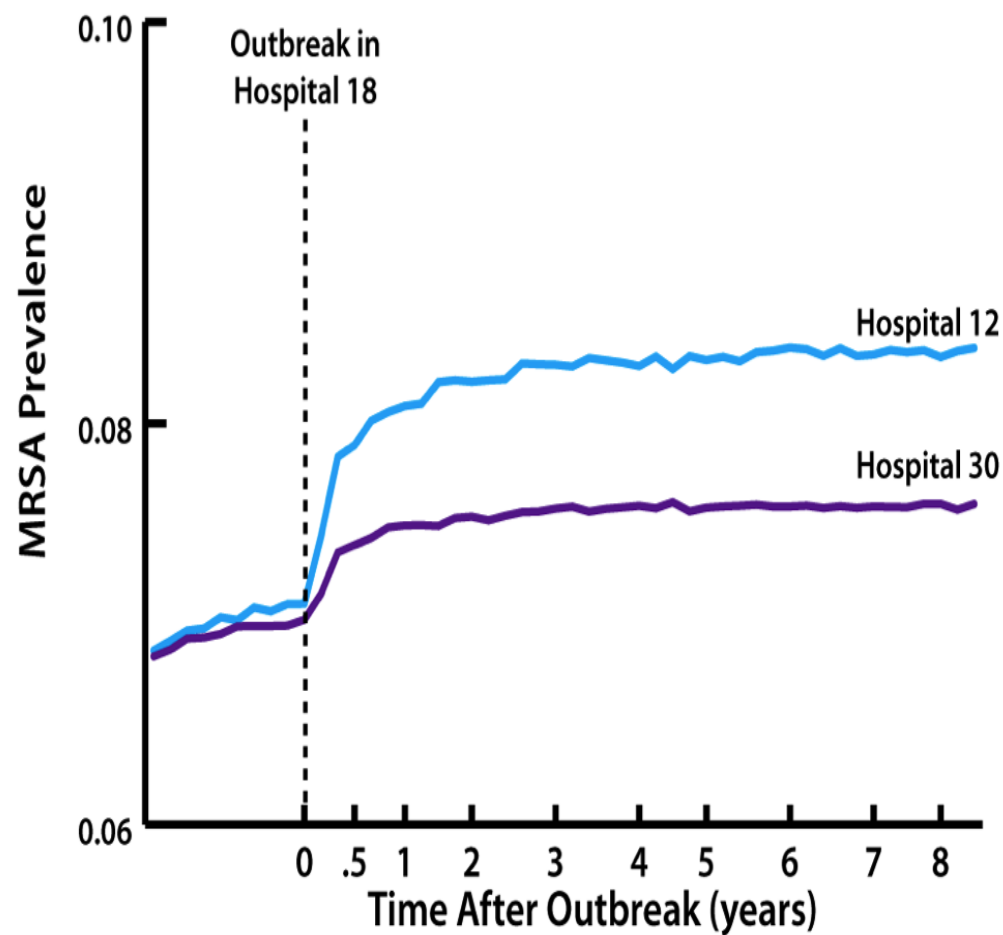
Hayden MK. Clin Infect Dis 2015 Apr 15;60(8):1153-61.

Evidence for CHG in Long Term Care

- 4 LTACHs, N=2,981 patients
- Baseline CRE → total prevalence: 46%
 - admission importation: 21%
- Intervention → rectal screening & contact precautions
 - daily CHG bathing
- Impact
 - reduced CRE transmission by 50%
 - reduced CRE bacteremia by 56%
 - reduced all bacteremia by 32%

SUMMARY

Sustained Single Hospital Outbreak



- **Emergence or Unmasking of Antibiotic Resistance:**

The Patient Had This Nasty Germ the Whole Time – We Just Uncovered the Problem Here

- **Emergence or Unmasking of Antibiotic Resistance:**

The Patient Had This Nasty Germ the Whole Time – We Just Uncovered the Problem Here

Universal Precautions and Antibiotic Stewardship

- **Emergence or Unmasking of Antibiotic Resistance:**

The Patient Had This Nasty Germ the Whole Time – We Just Uncovered the Problem Here

Universal Precautions and Antibiotic Stewardship

- **Environmental Reservoirs:**

Complex and ongoing issue

- **Emergence or Unmasking of Antibiotic Resistance:**

The Patient Had This Nasty Germ the Whole Time – We Just Uncovered the Problem Here

Universal Precautions and Antibiotic Stewardship

- **Environmental Reservoirs:**

Complex and Ongoing Issue

Collaboration and Training of EVS and Nursing

- **Bathe Your Patients:**

We are responsible for Hygiene

Bathing is Important – Even after Hospital Discharge

- **Emergence or Unmasking of Antibiotic Resistance:**

The Patient Had This Nasty Germ the Whole Time – We Just Uncovered the Problem Here

Universal Precautions and Antibiotic Stewardship

- **Environmental Reservoirs:**

Complex and Ongoing Issue

Collaboration and Training of EVS and Nursing

- **Bathe Your Patients:**

We are responsible for Hygiene

- **Emergence or Unmasking of Antibiotic Resistance:**

The Patient Had This Nasty Germ the Whole Time – We Just Uncovered the Problem Here

Universal Precautions and Antibiotic Stewardship

- **Environmental Reservoirs:**

Complex and Ongoing Issue

Collaboration and Training of EVS and Nursing

- **Bathe Your Patients:**

We are responsible for Hygiene

Bathing is Important – Even after Hospital Discharge

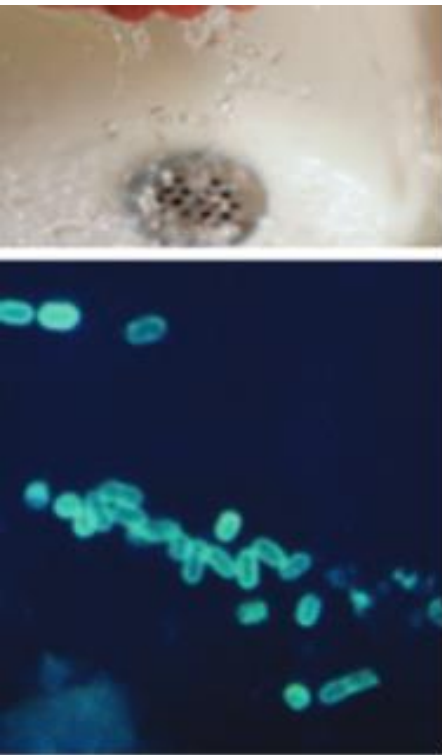
Thank you for your attention...



James A. McKinnell, M.D.

LA Biomed at Harbor-UCLA

LA Department of Public Health, HAI-ARC



Facility Guidance for Control of Carbapenem-resistant *Enterobacteriaceae* (CRE)

November 2015 Update - CRE Toolkit

National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion

