The Role of Environmental Surfaces in Hospital Infections
Dr. Phillip Carling, Boston University School of Medicine
Teleclass Sponsored by Ecolab www.ecolab.com

The Role of Environmental Surfaces in Healthcare Infections

Philip C. Carling, M.D.
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Hosted by Paul Webber
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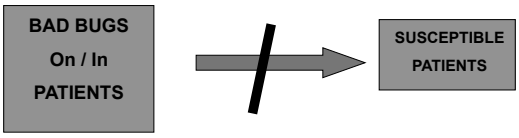
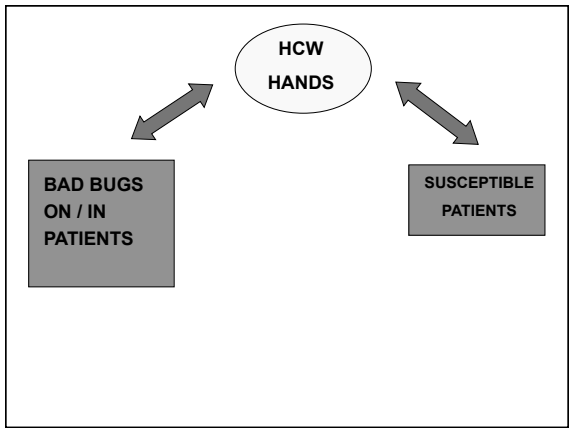
Disclosure
Consultant - Ecolab, Steris, ASHES

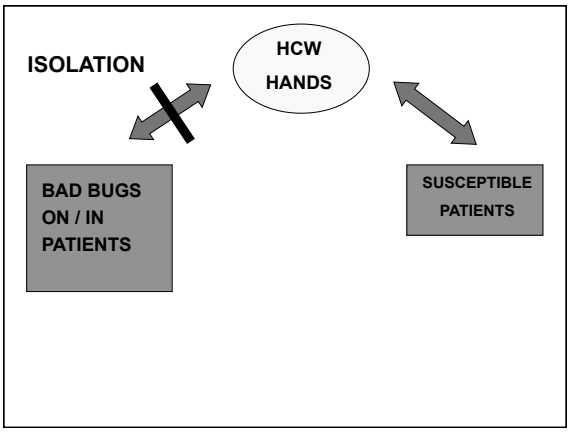
Today's Presentation

- Current issues in isolation and hand hygiene
- Why environmental hygiene is important
- What to do about the problem of environmental contamination
- Can improving Environmental hygiene impact transmission of HAPs?

The Infection Prevention Goal







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Current Issues with Isolation

Extremely Difficult to Implement and Maintain

When to Begin…..When to Stop

Extreme Isolation – The European Experience

Active Surveillance Cultures

- Opinion v. Science
- The VA Experience – Reported at IDSA/ICAAC
  - Success v. No impact.
- Current approaches to defining transmission are flawed
  - Detecting colonization
  - Not all MRSA are the same (need to do PGFE)

AJIC major articles

Adverse outcomes associated with contact precautions: A review of the literature

Daniel J. Morgan, MD,[a] Daniel J. Diekema, MD, MS,[b] Kent Sepkowitz, MD,[c] and Eli N. Perencevich, MD, MSc[a]
New York, New York; Iowa city, Iowa; and Baltimore, Maryland

Our review of the literature demonstrates that contact precautions have unintended consequences that are potentially deleterious to the patient. Measures to ameliorate these deleterious consequences of contact precautions are urgently needed.

Am J Infect Control. 2009 (May); 37: 85-91

HEALTHCARE EPIDEMIOLOGY INVITED ARTICLE

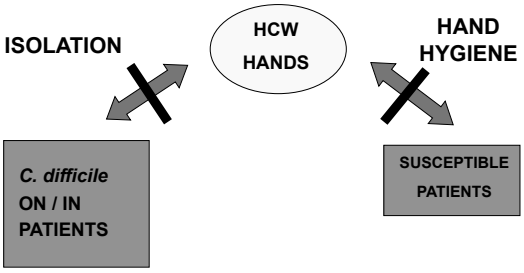
Robert A. Weinstein, Section Editor

Taking Off the Gloves: Toward a Less Dogmatic Approach to the Use of Contact Isolation

Kathryn B. Kirkland
Section of Infectious Disease and International Health, Dartmouth-Hitchcock Medical Center, Lebanon, and Center for Leadership and Improvement, The Dartmouth Institute for Health Policy and Clinical Practice, Dartmouth Medical School, Hanover, New Hampshire

"Despite the existence of dozens of published reports and series of guidelines that cite these reports, evidence that contact isolation is necessary for the prevention of HAIs is inconclusive"

Clinical Infectious Diseases 2009 (April); 48: 766-71.



Hand Hygiene Issues

Success stories were based on mixed interventions….Not enhanced HH alone

Logistical limitations are becoming clarified

There may be a "compliance ceiling"

Microbial efficacy – Product Differences

Microbial resurgence is rapid following HH

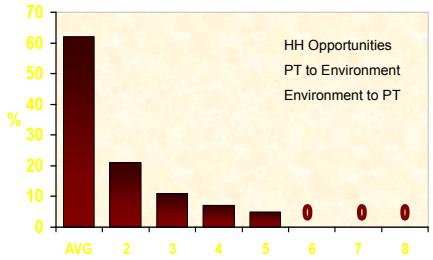
HH in Complex Intense Environments is Very Difficult

30 to 40 HH "Moments" per hour during direct patient care

HH in Complex Intense Environments is Very Difficult

30 to 40 HH "Moments" per hour during direct patient care

How Rapidly does HH compliance deteriorate during a single patient encounter?



Number of Successive Contacts

Evillard etal J Hosp Infect – July 2009

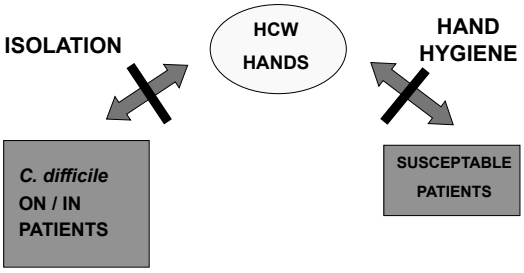
Hand Hygiene Issues

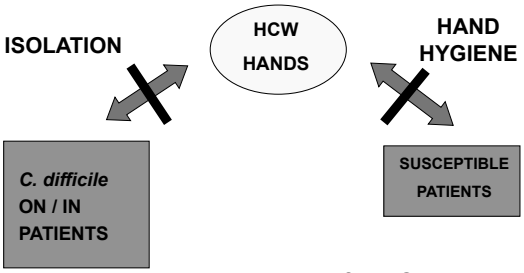
Success stories were based on mixed interventions….Not enhanced HH alone

Logistical limitations are becoming clarified

There may be a "compliance ceiling"

Improving HH does not decrease CDAD –

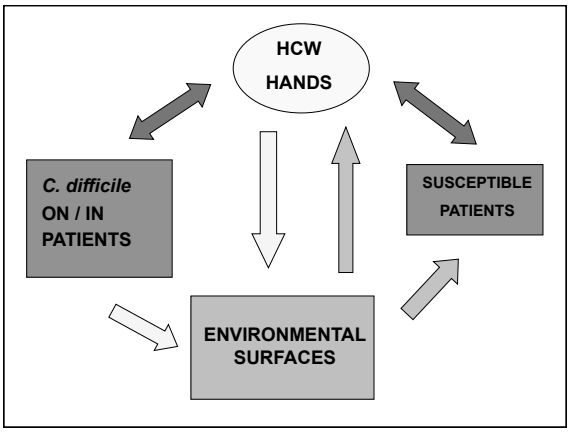




The Rest of the Story…
also known as…..

The Rest of the Story

The Missing Link

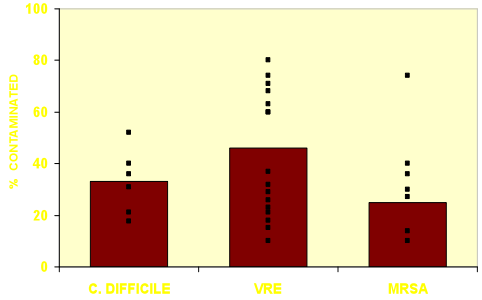


How much of a problem is the environment?

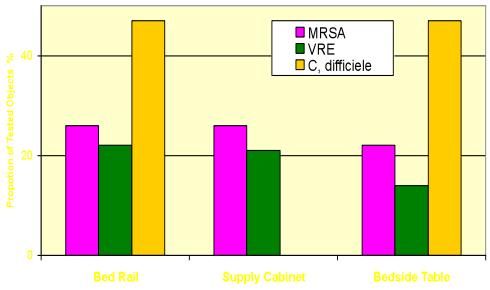
Recent Clarification

Surface Contamination of Near-patient Environment

23 Studies

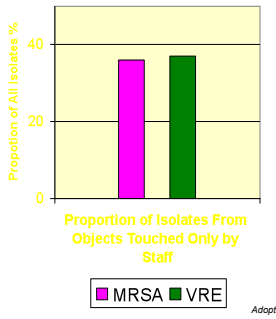


Environmental Contamination with Antimicrobial Resistant Organisms (MDROs)



Adopted from – Speck SHEA Abstract 167, Baltimore, April 2007

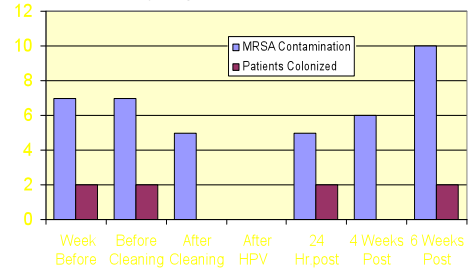
Environmental Contamination with Antimicrobial Resistant Organisms (MDROs)



39 % of positive cultures from staff only touched objects were different from those for which the patient was being isolated

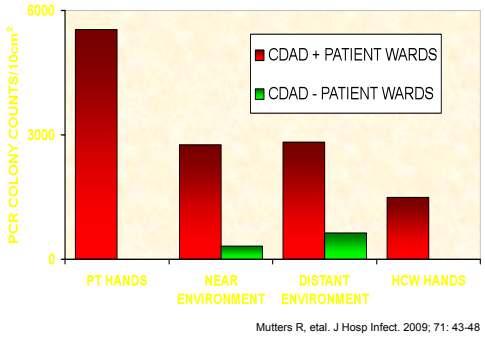
Adopted from – Speck SHEA Abstract 167, Baltimore, April 2007

Rapid recontamination with MRSA of the environment of an intensive care unit after decontamination with hydrogen peroxide vapour



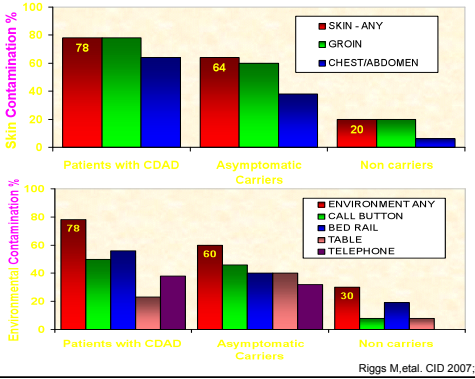
Adapted from - Hardy KJ et.al J Hosp. Infections 66,360 August 2007

C. difficile Environmental Contamination



Mutters R, etal. J Hosp Infect. 2009; 71: 43-48

How does it get there?



Riggs M,etal. CID 2007;45:592

Patient Acquisition of HAPs from Environmental Surfaces

- Most Important – C. difficile
- Important – MRSA, VRE, Acinetobacter, Norovirus, Coagulase Neg. Staph, Adenovirus, Influenza A
- Possibly Important – Hepatitis C, SARS,

Patient Acquisition of HAPs from Environmental Surfaces

- Most Important – C. difficile
- Important – MRSA, VRE, Acinetobacter, Norovirus, Coagulase Neg. Staph, Adenovirus, Influenza A
- Possibly Important – Hepatitis C, SARS,

Why?

Survival of Pathogens on Environmental Surfaces

C. difficile	> 5 months
Staphylococci	7 months
VRE	4 months
Acinetobacter	5 months
Norovirus	3 weeks
Adenovirus	3 months
Rotavirus	3 months
SARS, HIV etc.	days to week

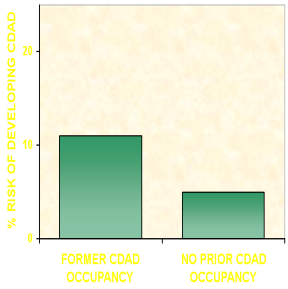
Increased risk from prior room occupants

Well established for:

MRSA, VRE, *A. baumannii*
Rotavirus and Norovirus

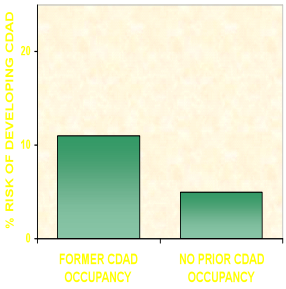
Recent Clarification re. *C. difficile*

C. difficile Transmission to Prior Room Occupants



Shaugnessey etal. Abstract K-4194 IDSA / ICAAC. October 2008

C. difficile Transmission to Prior Room Occupants



110% Increased risk

Shaugnessey etal. Abstract K-4194 IDSA / ICAAC. October 2008

Will wearing gloves help protect susceptible patients?

Setting – ICU with A. baumanni outbreak over 4 years

Epidemiology – 50% PT infect/colonized (2008)

- All with the same strain by PFGE

18/48 (40%) Environmental samples positive

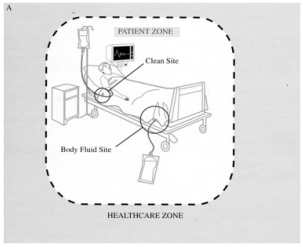
Gloves 60 % contaminated*

Problem ongoing – may shut unit

* Monitor cables, Desks, Bed Rails, Ventilators

Saafeld etal. J Hosp Infect – August 2009

Since surfaces in the "patient zone" are contaminated with environmentally resilient transmissible pathogens such as *C. difficile*, etc., and both HH and Isolation have limitations…..what more can be done?



Sax H, Pittet D et al. JHI September 2007

What can we do??

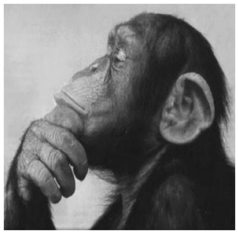
The equation is simple

Develop a better disinfectant?

Develop a more effective way to clean ?

Improve the thoroughness of patient zone cleaning

What can we do??

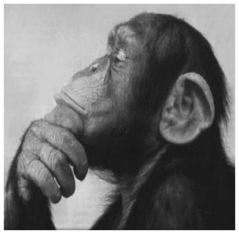


The equation is simple

Develop a better disinfectant?

- A better bleach?
- A greener bleach?
- A green yet rapidly effective disinfectant?

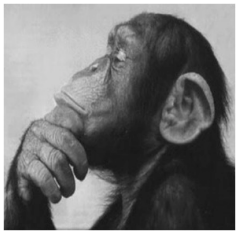
What can we do??



The equation is simple

Develop a more effective way to clean ?
- Microfiber is nice but how good is it?
- Ultra-microfiber ?
- Disposable wipes?
- Differences between disposable wipes?

What can we do??



The equation is simple

Develop a better disinfectant?

Develop a more effective way to clean ?

Improve the thoroughness of patient zone cleaning

GOAL OF THE PROJECT

To develop a surrogate marking system to evaluate the effectiveness of environmental cleaning/disinfection of the near-patient environment

The Targeting Solution

A mixture of several glues, soaps and a targeting dye which:
- Dries rapidly
- Environmentally stable
- Readily wetted by spray disinfectants
- Easily removed with light abrasion
- Inconspicuous

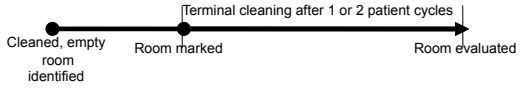
DAZO Solution

Target After Marking

Target Enhanced

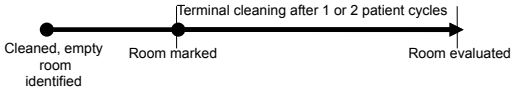
Areas marked

Phase I: Covert Baseline Environmental Cleaning Evaluation

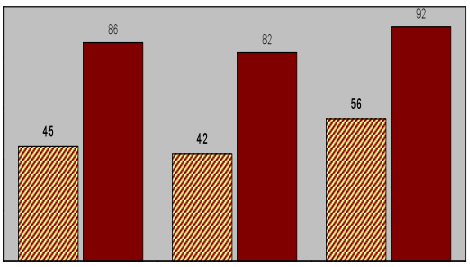


Phase II: **A. Programmatic Analysis**
B. Educational Interventions – ES staff

Phase III: Re-evaluation of Cleaning and feedback to ES



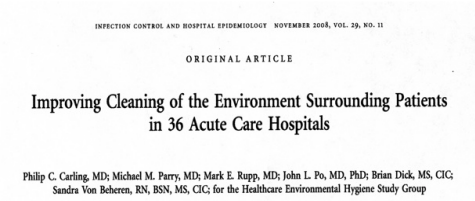
Preliminary Results – Three Hospitals



Clinical Infectious Diseases – February 2006

The Healthcare Environmental Hygiene Study Group

On the basis of our preliminary results and presentations at SHEA, APIC and ICAAC conferences we have gathered together a group of hospitals to further evaluate the tool and process improvement programs



INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY NOVEMBER 2008, VOL. 29, NO. 11

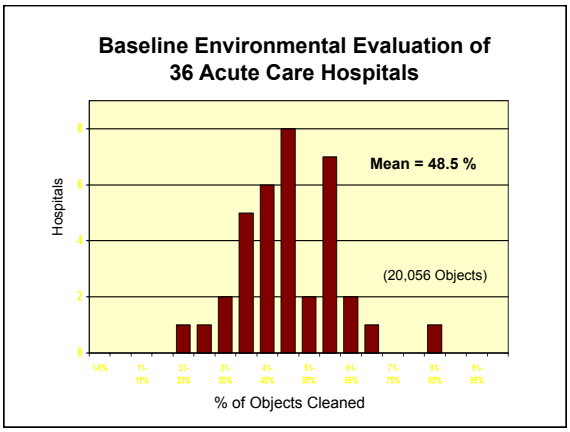
ORIGINAL ARTICLE

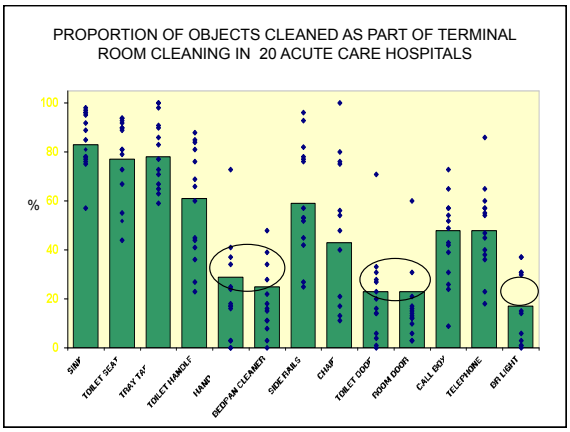
Improving Cleaning of the Environment Surrounding Patients in 36 Acute Care Hospitals

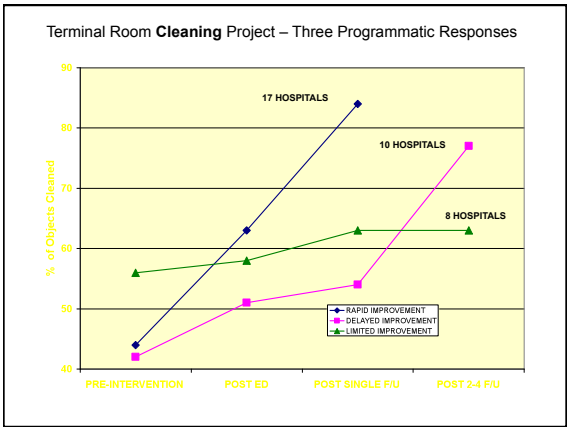
Philip C. Carling, MD; Michael M. Parry, MD; Mark E. Rupp, MD; John L. Po, MD, PhD; Brian Dick, MS, CIC; Sandra Von Beheren, RN, BSN, MS, CIC; for the Healthcare Environmental Hygiene Study Group

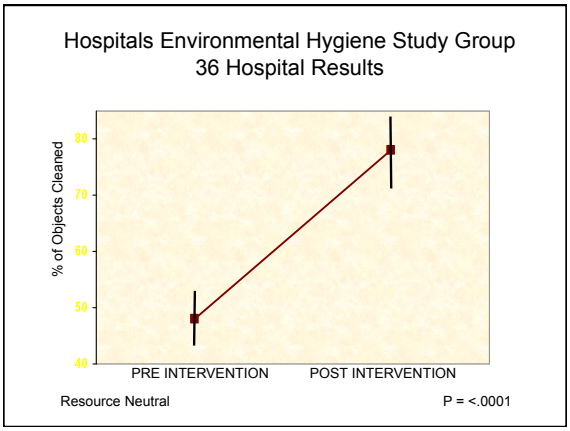
RESULTS

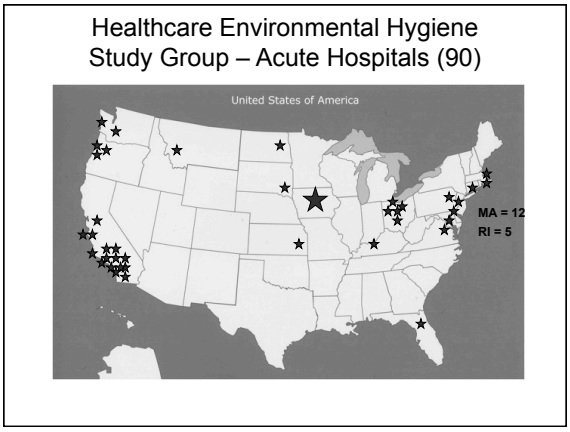
The Role of Environmental Surfaces in Hospital Infections
Dr. Phillip Carling, Boston University School of Medicine
Teleclass Sponsored by Ecolab www.ecolab.com

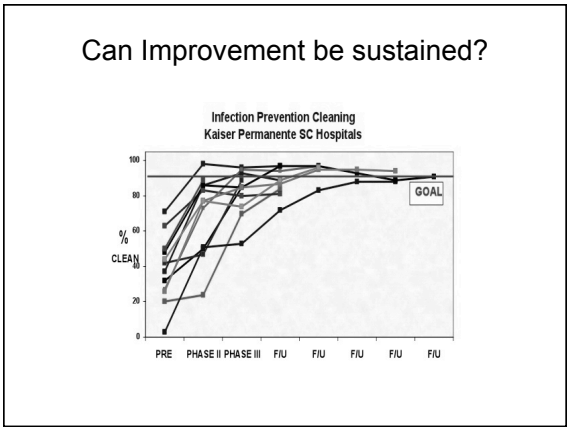












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Healthcare Environmental Hygiene Study Group

Current Projects

- OR Terminal Cleaning Project – 8 sites
- NICU Discharge Cleaning Project – 6 sites
- ICU daily Cleaning Project – 8 sites
- Skilled Nursing Facility Daily Cleaning Project – 3 Sites
- Chemotherapy Suite Daily Cleaning Project – 4 sites
- Canadian Consortium – 6 Major Medical Centers

Does improving environmental hygiene have a measurable Impact on environmental contamination?

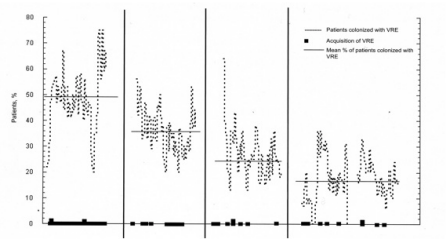
Hayden – VRE - 2006
Eckstein – VRE - 2007
Goodman – MRSA and VRE - 2008

Reduction in Acquisition of Vancomycin-Resistant Enterococcus after Enforcement of Routine Environmental Cleaning Measures

Mary K. Hayden,[1] Marc J. M. Bonten,[2] Donald W. Blom,[1] Elizabeth A. Lyle,[1] David A. M. C. van de Vijver,[3] and Robert A. Weinstein*[1]
[1]Rush University Medical Center and [2]Stroger (Cook County) Hospital, Chicago, Illinois; and [3]University Medical Center Utrecht, Utrecht, The Netherlands

- Baseline – Observation of daily disinfection cleaning by a single observer over 2 months
  – Standardized high touch sites monitored
- Intervention – Educational and programmatic interventions to improve disinfection cleaning implemented over 2 months
- Washout – No intervention – 2 months
- Additional Hand Hygiene Intervention – Multimodality educational and performance feedback over 3 months

Reduction in Acquisition of Vancomycin-Resistant Enterococcus after Enforcement of Routine Environmental Cleaning Measures



(HH not improved)

BMC Infectious Diseases
BioMed Central

Research article
Open Access

Reduction of *Clostridium Difficile* and vancomycin-resistant *Enterococcus* contamination of environmental surfaces after an intervention to improve cleaning methods

Brittany C Eckstein[1], Daniel A Adams[1], Elizabeth C Eckstein[2], Agam Rao[3], Ajay K Sethi[4], Gopala K Yadavalli[1] and Curtis J Donskey*[1]

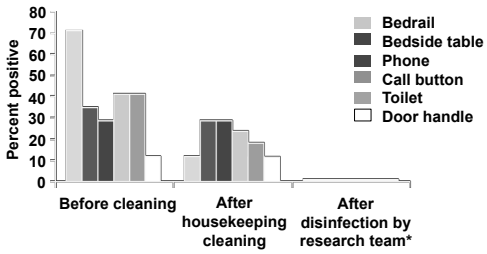
June 2007

Methods:

Culture based evaluation - Pre-intervention;

- after routine terminal cleaning;
- after terminal cleaning by the research staff;
- following education of the ES staff and administrative interventions

Percentage of VRE-positive cultures
n=17 rooms

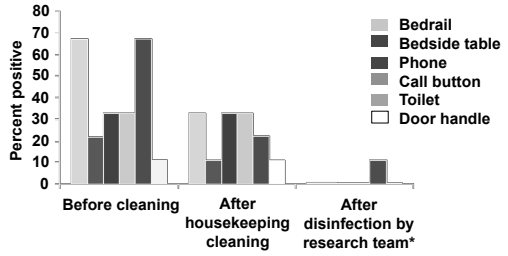


*Similar results found after ES cleaning following interventions

Eckstein et al, BMC Infect Dis. 2007 Jun 21;7:61.

Percentage of *C. difficile*-positive cultures

n=9 rooms



*Similar results found after ES cleaning following interventions

Eckstein et al, BMC Infect Dis. 2007 Jun 21;7:61.

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY JULY 2008, VOL. 29, NO. 7

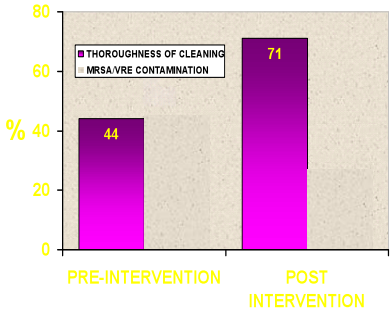
ORIGINAL ARTICLE

Impact of an Environmental Cleaning Intervention on the Presence of Methicillin-Resistant *Staphylococcus aureus* and Vancomycin-Resistant Enterococci on Surfaces in Intensive Care Unit Rooms

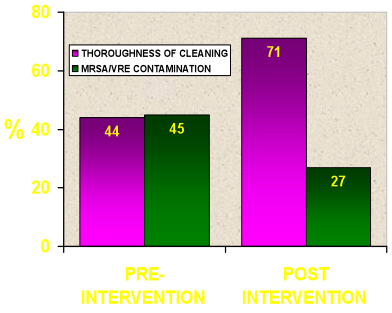
Eric R. Goodman, BS; Richard Platt, MD, MS; Richard Bass, BS, CHESP; Andrew B. Onderdonk, PhD; Deborah S. Yokoe, MD, MPH; Susan S. Huang, MD MPH

- Site – Brigham and Women's Hospital, Boston - 10 ICUs with 100 beds
- Design – Identical to the Healthcare Environmental Hygiene Study Group protocols
- Six week covert analysis followed by a 6mo. Intervention analysis

Brigham & Woman's ICU Study



Brigham & Woman's ICU Study



Brigham & Woman's ICU Study

Impact of an Environmental Cleaning Intervention on the Risk of Acquiring MRSA and VRE from Prior Room Occupants (SHEA Abstract 273)

Datta R, Platt R, Kleinman K, Huang SS

Brigham & Woman's ICU Study

Impact of an Environmental Cleaning Intervention on the Risk of Acquiring MRSA and VRE from Prior Room Occupants (SHEA Abstract 273)

Datta R, Platt R, Kleinman K, Huang SS

"For both MRSA and VRE, absolute risk appeared diminished during the intervention regardless of prior occupant status"

Conclusions

- It is very likely that surfaces in the Patient Zone are of relevance in the transmission of Healthcare Associated Pathogens.
- While optimizing hand hygiene and isolation practice is clearly important there is no reason why the effectiveness and thoroughness of environmental hygienic cleaning should not also be optimized, particularly since such an intervention can be essentially resource neutral.

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