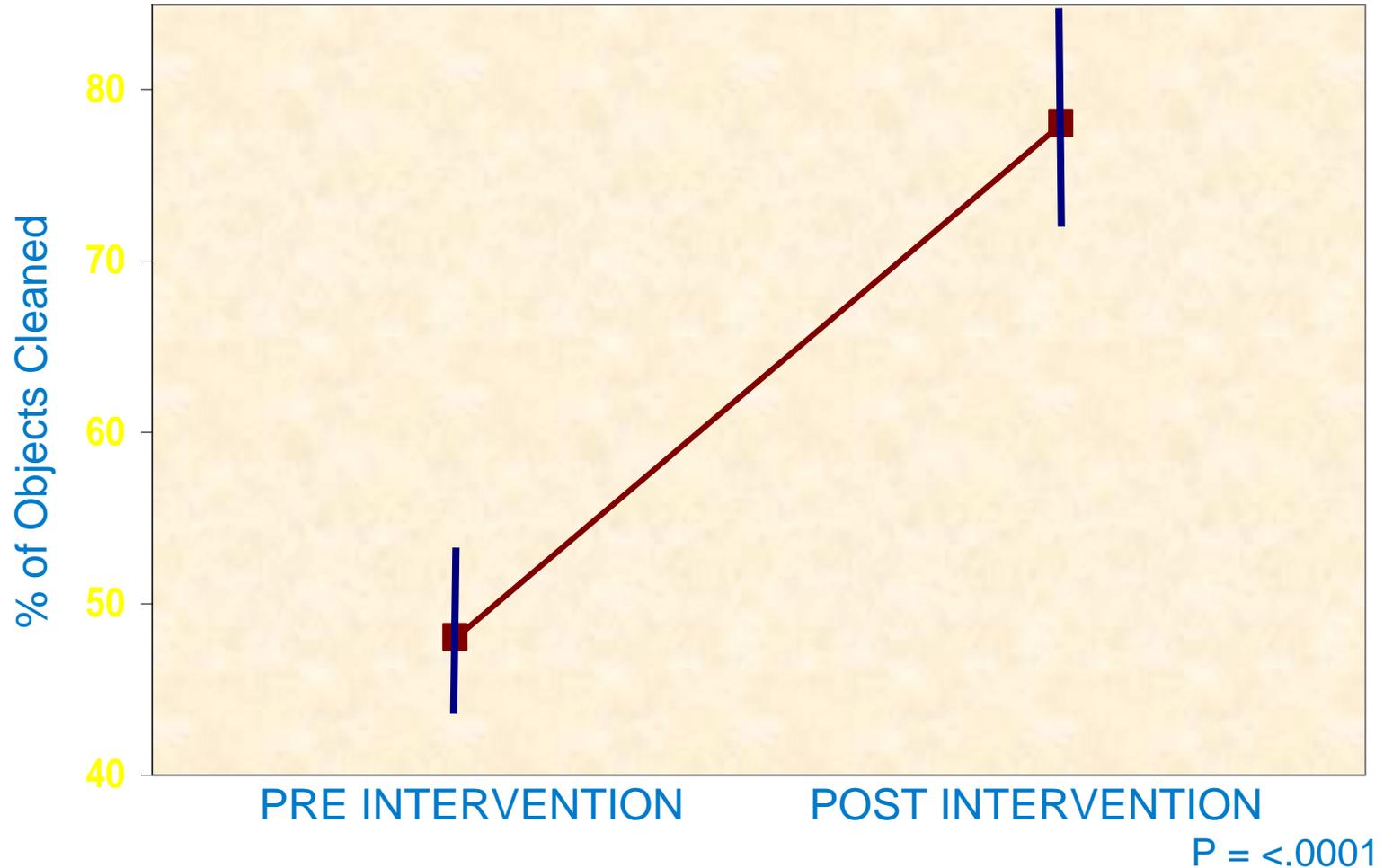


# Cleaning Can Be Programmatically Improved

Improving cleaning of the environment surrounding patients  
in 36 acute care hospitals.



Carling PC, Parry MM, Rupp ME, Po JL, Dick B, Von Beheren S; Healthcare Environmental Hygiene Study Group.  
Infect Control Hosp Epidemiol. 2008 Nov;29(11):1035-41.  
Slide courtesy of Dr. Philip Carling, Boston University School of Medicine

# A Novel Technique for Identifying Opportunities to Improve Environmental Hygiene in the Operating Room

JULIE JEFFERSON, MPH, RN, CIC; RITA WHELAN, RN; BRIAN DICK, MPH, MT (ASCP), CIC;  
PHILIP CARLING, MD

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## ABSTRACT

Environmental cleaning and disinfection is essential for optimizing safe patient care in the OR; however, perioperative staff members have not had an easy-to-use, objective method for determining whether high-touch, potentially contaminated surfaces have been cleaned during terminal room cleaning. To address this issue, members of the Healthcare Environmental Hygiene Study Group used a transparent, removable, environmentally stable disclosing agent and handheld ultraviolet light to determine whether potentially contaminated surfaces had been contacted by a wet disinfection cleaning cloth during terminal cleaning of ORs. Results from the project showed that 237 of 946 targeted surfaces (25%) had the disclosing agent removed (ie, were cleaned). The use of the disclosing agent for staff education and process monitoring has led to significant improvements in the disinfection cleaning process. *AORN J* 93 (March 2011) 358-364. © AORN, Inc, 2011. doi: 10.1016/j.aorn.2010.08.022

**Pre-intervention: 25% of 946 HTOs were cleaned in the OR**

**The use of the fluorescent marker led to significant improvements in cleaning**

# Peer Reviewed Studies Supporting Programmatic Approach to Improved Environmental Hygiene in Healthcare



Hayden MK (2006)  
Huang (2006)  
Hardy KJ (2006)  
Drees M (2008)  
Shaughnessy M (2008)  
Wilks M (2006)  
Datta R (2009)  
Martinex JA (2003)

Hayden MK (2006)  
Carling PC (2006)  
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Carling PC (2010)  
Boyce JM (2009)  
Eckstein BC (2007)  
Goodman ER (2008)  
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Guerrero D 2010)

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Bruno-Murtha (2009)  
Jean W (2010)  
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Dancer SJ (2009)

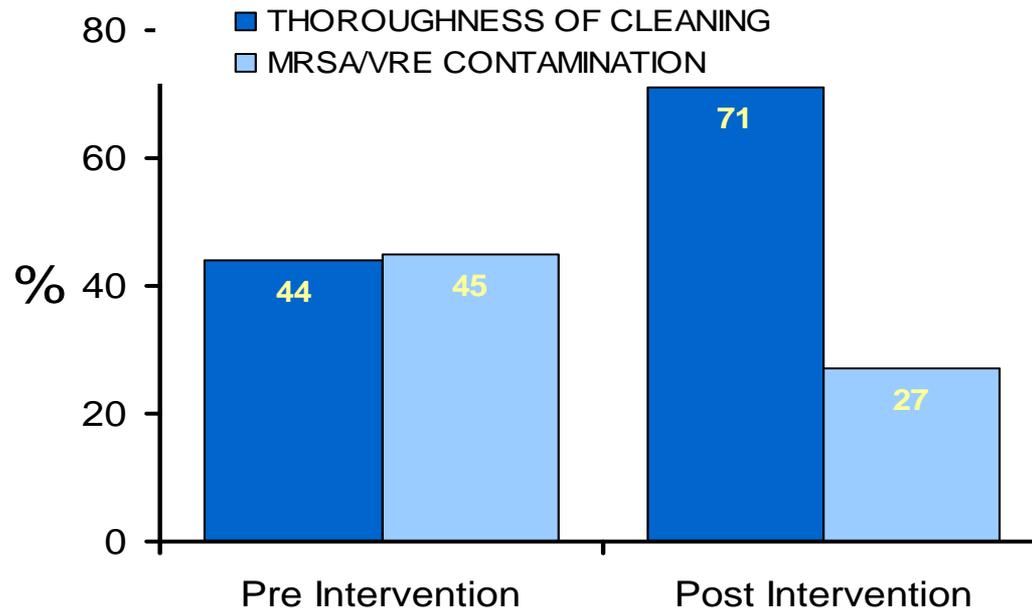
Hayden MK (2006)  
Wilks M (2006)  
Datta R (2009)  
Hota B (2008)  
Jean W (2010)  
Dancer SJ (2009)

Many studies published within the last five years

# Acquisition of Pathogens is Decreased With Improved Cleaning

Impact of an Environmental Cleaning Intervention on the Presence of MRSA and VRE on Surfaces in Intensive Care Unit Rooms

- ▲ 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 6 month intervention analysis



# Peer Reviewed Studies Supporting Programmatic Approach to Improved Environmental Hygiene in Healthcare



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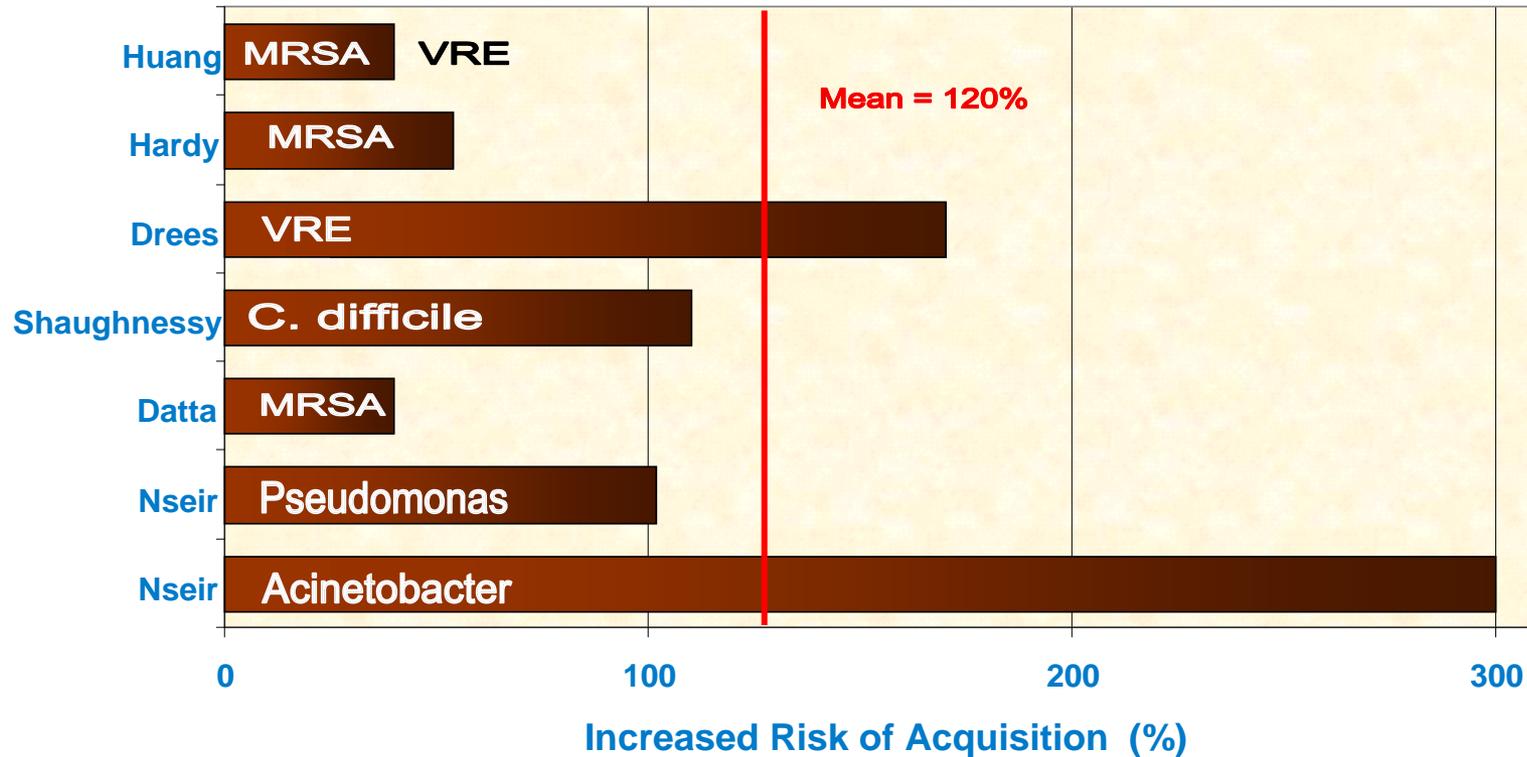
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Dancer SJ (2009)

Many studies published within the last five years

# Previously Contaminated Rooms Increase Transmission Risk

8 studies as of February 2011



Two additional studies demonstrated very significant risk without quantification  
– Martinez (VRE) and Wilks (Acinetobacter)

# Acquisition of Pathogens is Decreased with Improved Cleaning

## Environmental Cleaning Intervention and Risk of Acquiring Multidrug-Resistant Organisms From Prior Room Occupants

- ▲ Retrospective cohort study on 10 ICUs
- ▲ Targeted feedback using a black-light marker, cleaning cloths saturated with disinfectant via bucket immersion, and increased education regarding the importance of repeated bucket immersion during cleaning
- ▲ Acquisition of MRSA and VRE was lowered from 3.0% to 1.5% for MRSA and from 3.0% to 2.2% for VRE
- ▲ Patients in rooms previously occupied by MRSA carriers had an increased risk of acquisition during the baseline (3.9% vs 2.9%) but not the intervention (1.5% vs 1.5%) period
- ▲ In contrast, patients in rooms previously occupied by VRE carriers had an increased risk of acquisition during the baseline (4.5% vs 2.8%) and intervention (3.5% vs 2.0%) periods

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

# Acquisition of Pathogens is Decreased with Improved Cleaning

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

- ▲ Four periods in the study
  1. Baseline period
  2. Period of educational intervention to improve environmental cleaning
  3. "Washout" period without any specific intervention
  4. Period of multimodal hand hygiene intervention
- ▲ 47% decrease in environmental contamination when the number of high touch objects cleaned increased from 48% to 85%
- ▲ Decreased environmental VRE contamination in period 2 lead to a decrease in transmission to patients that was sustained through all subsequent periods
- ▲ Following several months of improved cleaning (83-85% of HTOs being cleaned) acquisition of VRE decreased by 70% without additional interventions.



Requirements are  
Evolving

# Requirements are Evolving

## A call for monitoring, evaluating and improving environmental hygiene

### CDC



“Clean and Disinfect high touch surfaces.”

Guidelines for Environmental Infection Control in Health Care  
Facilities Environmental Services I, E, 3. 2003

“Monitor (i.e., supervise and inspect) cleaning performance to ensure consistent cleaning and disinfection of surfaces in close proximity to the patient and likely to be touched by the patient and health care Professionals (e.g. bedrails, carts, bedside commodes, doorknobs, faucet handles). *Category 1B*.

Management of MDROs in Healthcare Settings – October 2006 V.B.8.b.

### CMS



“The infection prevention and control program must include appropriate monitoring of housekeeping... activities to ensure that the hospital maintains a sanitary environment.”

§482.42 Condition of Participation: Infection Control Interpretive Guidelines §482.42,  
November 21, 2007

### IHI



“Hospitals should use immediate feedback mechanisms to assess cleaning and reinforce proper technique.”

5 Million Lives Campaign – Guide to Significantly Reducing MRSA Infections , December 2006

### State of California



The Legislature finds and declares all the following: 1. (b) (6) Constant evaluation and monitoring of a sanitary environment to avoid transmission of pathogens that cause HAI.

California Senate Bill No. 158, Chapter 294, Section 1, (a) (3) and (b) (6)

### DHHS



“Standardized methods (i.e., performance methods) that are feasible, valid, and reliable for measuring and reporting compliance with..., environmental cleaning practices in order to prevent infection”

Action plan to Prevent healthcare-associated Infections,  
Section D.1.(1)(b), January 2009 (p. 29-30)

### The Joint Commission



Use data analysis to identify and resolve environmental safety issues.

Set one or more priorities for improving the environment of care.

Evaluate changes to determine if they resolved the environmental safety issues.

2010 Hospital Accreditation Standards EC.04.01.01

# CDC Toolkit: Options for Evaluating Environmental Cleaning

- ▲ CDC published toolkit for Evaluating Environmental Cleaning
- ▲ Infection Prevention led program in collaboration with Environmental Services (EVS)
- ▲ Published October 2010

The screenshot shows the CDC website interface. At the top, it says 'CDC Home' and 'Centers for Disease Control and Prevention'. Below that is a navigation bar with 'A-Z Index' and letters A through Z. The main heading is 'Healthcare-Associated Infections: Recovery Act'. On the left, there is a sidebar menu with items like 'State Funding Map', 'Performance Measures: FY10 Q2', 'Success Stories', 'State Resources', 'Newsletters', 'Toolkits', and 'Options for Evaluating Environmental Cleaning'. The main content area has the title 'Options for Evaluating Environmental Cleaning' and lists authors: Alice Guh, MD, MPH<sup>1</sup> and Philip Carling, MD<sup>2</sup>. It also includes a 'On this Page' section with links to 'Introduction', 'Level I Program', and 'Level II Program'. The 'Introduction' section begins with 'In view of the evidence that transmission of many healthcare acquired pathogens (HAPs) is related to contamination of near-patient surfaces and equipment, all hospitals are encouraged to...'

# New CDC Recommendations

Acute Care Hospitals should implement  
Level I Program:

Basic interventions to optimize disinfection cleaning policies, procedures and ES staff education and process. When completed move to Level II Program.

Level II Program:

All elements of Level I + Objective Monitoring

National Center for Emerging and Zoonotic Infectious Diseases

Division of Healthcare Quality Promotion



# CDC Tool Kit Recommendations

- ▲ Recommendations to optimize high touch surface cleaning:
  - Focus on **cleaning high-touch** objects (HTOs)
  - **Objective monitoring** of the thoroughness of disinfection cleaning of HTOs
  - **Continuous feedback** that drives focused education for ES staff
  - **Development of reports** documenting progress to share with leadership and Joint Commission surveyors



# Monitoring the Environment

# AJIC Contents

## American Journal of Infection Control

- Current views of health care design and construction: Practical implications for safer, cleaner environments** **S1**  
JM Bartley, RN Olmsted, and J Haas
- Applications of ultraviolet germicidal irradiation disinfection in health care facilities: Effective adjunct, but not stand-alone technology** **S13**  
F Memarzadeh, RN Olmsted, and JM Bartley
- Role of hospital surfaces in the transmission of emerging health care-associated pathogens: *Norovirus*, *Clostridium difficile*, and *Acinetobacter* species** **S25**  
DJ Weber, WA Rutala, MB Miller, K Huslage, and E Sickbert-Bennett
- Promises and pitfalls of recent advances in chemical means of preventing the spread of nosocomial infections by environmental surfaces** **S34**  
SA Sattar
- Evaluating hygienic cleaning in health care settings: What you do not know can harm your patients** **S41**  
PC Carling, and JM Bartley

# Approaches to Programmatic Environmental Cleaning Monitoring

## Conventional Program

- ▲ Subjective visual assessment
- ▲ Deficiency oriented
- ▲ Episodic evaluation
- ▲ Problem detection feedback
- ▲ Open definition of correctable interventions

## Enhanced Program

- ▲ Objective assessment
- ▲ Performance oriented
- ▲ Ongoing cyclic monitoring
- ▲ Objective performance feed back
- ▲ Goal oriented structured process improvement model

# Evaluating Patient Zone Environmental Hygiene

| Method                      | Ease of Use | Identifies Pathogens | Useful for Individual Teaching | Directly Evaluates Cleaning | Published Use in Programmatic Improvement |
|-----------------------------|-------------|----------------------|--------------------------------|-----------------------------|---|
| Direct Practice Observation | Low         | No                   | Yes                            | Yes                         | 1 Hospital                                |
| Swab cultures               | High        | Yes                  | Not Studied                    | Potentially                 | 1 Hospital                                |
| Agar slide cultures         | Good        | Limited              | Not Studied                    | Potentially                 | 1 Hospital                                |
| Fluorescent gel             | High        | No                   | Yes                            | Yes                         | 49 Hospitals                              |
| ATP system                  | High        | No                   | Yes                            | Potentially                 | 2 Hospitals                               |

# Environmental Monitoring Methods

## Qualitative

### Visual Assessment

- Observations – overt or covert
- Limited to visible soil
- Can be subjective



### Fluorescent Marker

- Accepted , objective methodology
- Clear marker applied to HTOs after patient discharged, before cleaning
- Marker reviewed by auditor with black light after cleaning
  - Removal of the mark or pattern is a “pass”. Intact or disturbed mark is a “fail”



# Fluorescent Marker

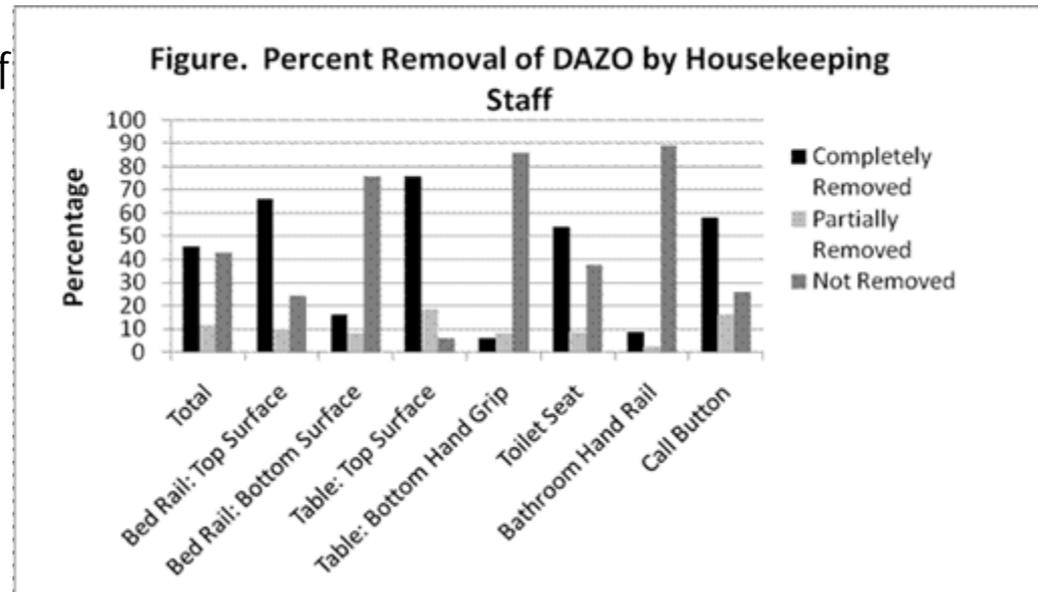
## Improving environmental hygiene in 27 intensive care units to decrease multidrug-resistant bacterial transmission

- ▲ Significant improvements in intensive care unit room cleaning can be achieved using a structured approach that incorporates a simple, highly objective surface targeting method and repeated performance feedback to environmental services personnel.
- ▲ Given the documented environmental transmission of a wide range of multidrug-resistant pathogens, findings identify a substantial opportunity to enhance patient safety by improving the thoroughness of intensive care unit environmental hygiene.

# Fluorescent Marker

## Evaluation of the DAZO<sup>®</sup> Fluorescent Marker Method for Monitoring Environmental Cleaning

- 46% of HTOs had complete removal of DAZO
- Removal of DAZO correlated well with removal of bacteria or *C. difficile* spores from the site of marker placement



# Environmental Monitoring Methods

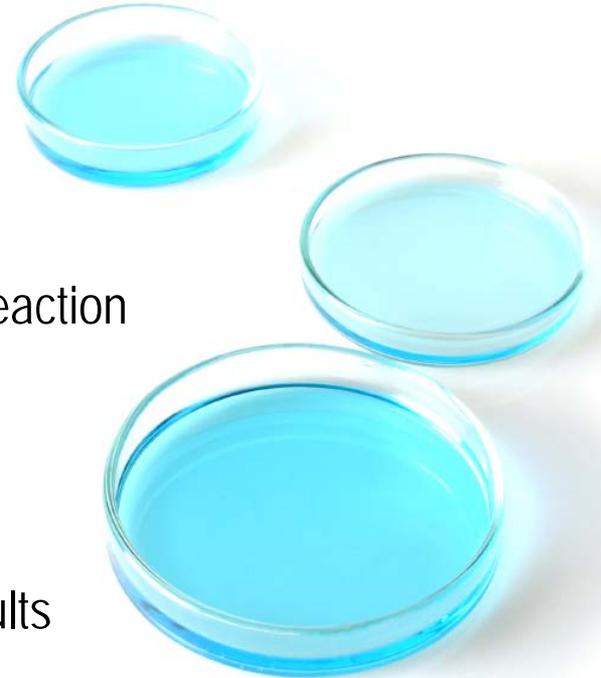
## Quantitative

### ▲ Total Aerobic Bacteria Count

- Pre-cleaning culture taken of HTOs
- Post-cleaning cultures taken to ensure appropriate cleaning and reduction of organisms
- Reliable, specific results
- At least 2 days of incubation before results available

### ▲ ATP (adenosine triphosphate) Measurement

- Measurement of cellular material (ATP) via an enzyme reaction
  - Can be living or dead microorganisms
  - Can be other soil – food, blood, etc.
- Very quick results
- Readings for “clean” vs “dirty” not well-defined
- Interferences (both positive and negative) can affect results



# Culture

## ▲ Outbreak investigation

- Surfaces – CDAD, MRSA, VRE, Acinetobacter
- Water – Pseudomonas, Aeromonas, Legionella

## ▲ Intervention Efficacy Analysis

- Various disinfectants, cloths, wipes, devices
- ES personnel based interventions
- Dozens of studies but only three reports have evaluated cultures as a measure of thoroughness of cleaning



Hayden MK, Bonten MJ, Blom DW, Lyle EA, van de Vijver DA, Weinstein RA. *Reduction in acquisition of vancomycin-resistant enterococcus after enforcement of routine environmental cleaning measures.* Clin Infect Dis. 2006 Jun 1;42(11):1552-60.

Goodman ER, Platt R, Bass R, Onderdonk AB, Yokoe DS, Huang SS. *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.* Infect Control Hosp Epidemiol. 2008 Jul;29(7):593-9.

Guerrero D, Carling PC, Jury L, Ponnada S, Nerandzic M, Eckstein EC, Donskey C. Beyond the "Hawthorne effect": Reduction of *Colistidium difficile* environmental contamination through active intervention to improve cleaning practices. Abstract 60. SHEA Fifth Decennial Meeting; Atlanta, GA; March 18-22, 2010.

# ATP

Swab surface → luciferase tagging of ATP → Hand held luminometer

## Industrial Use

- ▲ Developed in the 1970s for commercial food preparation
- ▲ Very clean surfaces – important
- ▲ High-grade disinfectants + Rinsing
- ▲ Testing immediately after cleaning and just before use is the standard

# ATP

## Healthcare Use

- ▲ Results vary more than 10 fold between commercially available systems
- ▲ An ATP RLU (Relative Light Unit) standard has not been set to define clean versus contaminated surfaces
- ▲ Surface contaminants may artificially increase or decrease RLU Readings
  - Bleach quenches the ATP reaction
  - ATP measures all organic debris-microbial and non-microbial
  - Microbial organic debris includes both live and dead bacteria
  - Microbial organic debris (including dead bacteria) accounts for 66% of ATP on surfaces (6)
- ▲ Other Considerations
  - Refrigeration
  - Storage
  - Cost
  - Time

# Environmental Monitoring Methods

Who is really caring for your environment of care? Developing standardized cleaning procedures and effective monitoring techniques

- ▲ In 2007, a multidisciplinary task force revised policies outlining staff responsibilities for cleaning in-patient nursing care units and chose a monitoring system using adenosine triphosphate bioluminescence test
- ▲ Selected ATP based on desire for a quantitative measure of cleanliness

# ATP

## Evaluation of ATP Bioluminescence Assays for Potential Use in a Hospital Setting

- ▲ Compared commercial luminometers for detecting the number *Staphylococcus aureus* associated with surfaces.
- ▲ The data showed that the ATP bioluminescence methods tested were not robust enough to generate quantitative data on bacterial numbers, especially at low concentrations.

# Monitoring Method Comparison: Improvement Trends after Intervention

| Surface            | ATP "A" | ATP "B" | Culture | DAZO |
|--------------------|---------|---------|---------|------|
| Toilet Handle      | No      | Yes     | No      | No   |
| Sink               | Yes     | No      | Yes     | Yes  |
| Toilet Seat        | Yes     | No      | Yes     | Yes  |
| Toilet Hand Hold   | Yes     | Yes     | Yes     | Yes  |
| Bathroom Door Knob | Yes     | No      | Yes     | Yes  |
| Bed Pan Cleaner    | No      | Yes     | Yes     | Yes  |
| Call Button        | Yes     | Yes     | Yes     | Yes  |
| Room Door Knob     | Yes     | No      | Yes     | Yes  |
| Bed Rail           | Yes     | Yes     | Yes     | Yes  |
| Tray Table         | Yes     | Yes     | Yes     | Yes  |
| Telephone          | Yes     | No      | Yes     | Yes  |
| Bed Side Table     | Yes     | No      | Yes     | Yes  |


**Culture and Gel trends match**

# Environmental Monitoring Methods

## Shedding light on new methods to improve hospital cleanliness: The use of ultraviolet monitors as surrogate markers for bacterial contamination

- ▲ The presence or absence of fluorescent markers on high risk, high-touch, and frequently contaminated objects after terminal cleaning can logically be used as a surrogate for surface cleanliness
- ▲ “We believe that the time has come to change the status quo about hospital cleaning protocols. Hospitals should logically focus their initial efforts on ensuring that the basic components of environmental cleaning are followed by using surrogate markers of bacterial contamination for environmental services supervisors and staff.”