The Role of Environmental Cleaning and Disinfection in Preventing HAIs
Learning Objectives:

– Discuss the role of environmental cleaning and disinfection in the prevention of HAIs.
– Identify evidence-based methods and best practices for environmental cleaning in healthcare facilities.
– Discuss controversies and challenges for infection control managers and resources for effective management.
Outline of Today’s Presentation

Issues with terminology
Why terminal room cleaning is important
Addressing suboptimal cleaning practice
Does enhanced cleaning make a difference?
Conventional vs. enhanced environmental cleaning monitoring
Where are we going with surface disinfectants and new technologies?
Terminology

• **Disinfection cleaning** – Implies the use of a low level disinfectant to decrease bio-burden

• **Environmental cleaning** – (in Healthcare) – surface cleaning to reduce bio-burden

• **Hygienic cleaning** – New, more specific term – surface cleaning to reduce bio-burden (confusion with hand hygiene?)
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**How clean vs. How well cleaned**...Just because it is clean does not necessarily mean it was well cleaned
Terminology

Sax H, Pittet D et al. JHI September 2007
How Clean is the Clean Appearing Hospital Environment?
Surface evaluation using ATP bioluminescence

Swab surface → luciferase tagging of ATP → Hand held luminometer

Used in the commercial food preparation industry to evaluate surface cleaning before reuse and as an educational tool for more than 30 years.
How Clean is the Clean Appearing Hospital Environment?

Visually clean surfaces may be contaminated.

82% of sites visually clean
24% clean by ATP bioluminescence
30% clean using microbiological techniques
Some “clean” surfaces had organism counts > 40 cfu/cm²

Griffith et al. J Hosp Infect 2000;45:19-28
Correlation between ATP bioluminescence (RLU/Swab) and aerobic colony count (cfu/swab)
Bioluminescence
PPV = 63%  NPV = 71%

Satisfactory by RLUs but Unsatisfactory by # CFU
Does contamination of surfaces in the patient zone contribute to HAP Transmission?
Increased acquisition risk from prior room occupant
6 studies as of January 2011

How well is the Patient Zone being cleaned?
Fluorescent Gel System

The Targeting Solution

A mixture of several glues, soaps and a targeting dye which:

- Dries rapidly
- Is environmentally stable
- Is readily wetted by spray disinfectants
- Is easily removed with light abrasion
- Is inconspicuous
Proportion of Objects Cleaned as Part of Terminal Room Cleaning in 20 Acute Care Hospitals
Increased risk of prior room occupant transmission

Baseline Thoroughness of Cleaning

MRSA, VRE, CD, AB, Ps (120%)

40%

10 Studies
Thoroughness of Environmental Cleaning

[Bar chart showing the percentage of thorough cleaning in different settings.]

- DAILY CLEANING
- TERMINAL CLEANING

Settings include:
- HEHSG HOSP
- IOWA HOSP
- OTHER HOSP
- OPERATING ROOMS
- NICU
- EMS VEHICLES
- ICU DAILY
- AMB CHEMO
- MD CLINIC
- LONG TERM
- DIALYSIS

Legend:
- Green bars for DAILY CLEANING
- Red bars for TERMINAL CLEANING

95% CI indicated.
Thoroughness of Environmental Cleaning

- Mean = 34%
- >65,000 Objects

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<tr>
<th>Environment</th>
<th>Sites</th>
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<td>HEHSG HOSP</td>
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<td>55%</td>
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<tr>
<td>IOWA HOSP</td>
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<td>50%</td>
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<td>OTHER HOSP</td>
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<td>75%</td>
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Can the thoroughness of disinfection cleaning be improved?
RESULTS
Hospitals Environmental Hygiene Study Group
36 Hospital Results

PRE INTERVENTION

POST INTERVENTION

% of Objects Cleaned

Resource Neutral

P = <.0001
Is it a surprise that this degree of improvement was resource neutral??

Terminal Cleaning

Rupp ME, Adler A, Schellen M, Abstract 203 Fifth Decennial

SHEA
The Society for Healthcare Epidemiology of America

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Disinfection cleaning can be programmatically improved - 13 studies as of January 2011

Thoroughness of Cleaning Score (%)

- Hayden
- Eckstein
- Goodman*
- Carling*
- Po*
- Po*
- Carling*
- Hota
- Bruno-Murtha*
- Clark*
- Guerro
- Sulis*
- Rupp*

Mean = 80%
Increased risk of prior room occupant transmission

Baseline Thoroughness of Cleaning

Thoroughness of cleaning following structured interventions
Are such results sustainable?
Kaiser Health Systems Southern California Hospital Group

PRE PHASE II

CLEAN

90% GOAL

Ref
Group Benchmarking

- PRE
- PHASE II
- PHASE III
- 6/09
- 8/09
- 10/09
- 12/09
- 2/10

Goal: 90%
Improved thoroughness of hygienic cleaning is a worthy goal given the billions of dollars involved...but will it impact transmission of HAPs?
Increased risk of prior room occupant transmission

Baseline thoroughness of Cleaning

Thoroughness of cleaning following structured interventions

Programmatic decrease in environmental contamination

Programmatic decrease in acquisition

Carling PC, Bartley JM. Am J Infect Control 2010;38 S41-50
Moving beyond Conventional Monitoring of health care environmental cleaning
### 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 quantitative assessment
- Performance oriented
- Ongoing cyclic monitoring
- Objective performance feedback
- Goal oriented structured Process Improvement model
Approaches to Programmatic Environmental Cleaning Monitoring

**Conventional Program Advantages**

An established model

**Enhanced Program Advantages**

Direct evaluation of practice
Uses a standardized, consistent, objective and uniform system of monitoring
Provides regular and ongoing performance results to ES staff
Facilitates the monitoring of many data points to optimize performance analysis
Provides positive practice based feedback to ES staff
Allows for objective remedial interventions
Easily adaptable to existing PI modalities
Facilitates compliance with JCAHO standards
Facilitates compliance with CMS CoP
Intrinsic internal benchmarking
External benchmarking, reporting and recognition feasible
Approaches to Programmatic Environmental Cleaning Monitoring

Conventional Program **Limitations**

- Inability to evaluate actual practice
- Based only on negative outcome analysis
- Limited generalizability of findings
- Poor specificity and low sensitivity
- Subjectivity with a high potential for observer bias
- Poor programmatic specificity
- Potential for observer bias
- Only evaluates daily HP
- Limited ability to support JCAHO standard EC.04.01.03.EP2
- Limited ability to demonstrate compliance with CMS CoP 482.42
- Benchmarking not feasible

Enhanced Program **Limitations**

- Requires a new program implementation
- Ongoing administrative support critical to success
- Potential resistance to objective monitoring and reporting
- While useful, the covert baseline evaluation may be difficult to implement effectively

**Monitoring tool considerations**
Systems for Evaluating Healthcare Environmental Hygiene
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ATP Bioluminescence Testing in Healthcare Settings

Potential usefulness:

Has been used as a surrogate for environmental culturing

Evaluates cleanliness

Can rapidly define how clean an object is.... but non-microbial ATP is also evaluated

Standards to optimize predictive values are still being evaluated

Can be used to do one-on-one education of ES staff
ATP Bioluminescence Testing in Healthcare Settings

Potential limitations:
Secondary cleaning of the site is required to remove disinfectant induced signal decay or enhancement.

Involvement of the ES staff is implicit since evaluation must be done within minutes of cleaning.

Pre-intervention evaluation of disinfection cleaning is difficult without inducing a Hawthorne effect.

Results are individual ES staff / time specific.

Many manufacturers of luminometers and ATP swabs makes interinstitutional standardization difficult.
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Surface Disinfection – CMS Citation

Exposure Time

- CMS surveyors (CA) have been paying closer attention to cleaning the environment, including a determination if hospitals are following manufacturers’ directions for disinfectant contact time
- Hospitals cited for using shorter contact time than manufacturers’ directions
- Appealed based on published peer-reviewed literature supporting shorter exposure times
- Appeal denied

Rutala W, 2010
Surface Disinfection – CMS Citation

Exposure Time

- Multiple scientific studies have demonstrated the efficacy of hospital disinfectants against pathogens causing HAIs with contact time of one minute
- Environmental Services staff can achieve contact times of ten minutes by reapplying the disinfectant 5-6 times to the surface as the typical dry time is 1.5-2 minutes
- Equally important as contact time is the application of the disinfectant to the surface or equipment to ensure all contaminated surfaces are wiped
- No data that has demonstrated improved infection prevention by ten minute contact time vs. one minute contact time

Rutala W, 2010
What about new technologies?

They all:

- Have similarities and differences that are difficult to compare;
- Claim to effectively kill many log \(^{10}\) bacteria (C. diff not as well or more slowly);
- Claim to be less damaging to surfaces than bleach as if bleach was the only thing that kills C. diff spores;
- Are expensive both directly and indirectly;
- As of today they have limited, if any, defined applicability in general healthcare settings;
When in darkness so deep I move with an especially slow foot.

Remember:

While surface cleaning in the patient zone is important, we really don’t know:

How important which disinfectant is;

How much better microfibre is than traditional cloth for surface cleaning;

When to use bleach and when not to;

When technological interventions should be considered
Decontamination with UVC

Disadvantages:

- Do not know if use decreases the incidence of HAIs
- Only done at terminal disinfection (i.e., not daily cleaning)
- All patients and staff must be removed from the room/area
- Capitol equipment costs are substantial
- Does not remove dust and stains which are important to patients/visitors
- Sensitive use parameters (e.g., UV dose delivered)

Rutala W, 2010
Now is the time to carefully evaluate the role of product and technology in the clinical setting

Old assumptions and new claims of effectiveness of all tools, chemicals and technological interventions **must:**

be _quantitatively_ evaluated _clinically_ while objectively analyzing the _thoroughness_ of cleaning practice
Conclusions

• It is very likely that surfaces in the Patient Zone are highly relevant 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.