The Healthcare Environment: Evaluating Cleaning Practices and Improving Compliance

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NorthShore University HealthSystem

Illinois Campaign to Eliminate *Clostridium difficile*

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Disclosure and Disclaimer

- Speaker has no financial disclosures or conflict of interest related to this presentation
- The opinions, viewpoints and content presented may not represent the position of the Illinois Department of Public Health or any of its programs or Telligen

Objectives

- Learn ***why*** the healthcare environment is important in *C. difficile* acquisition and transmission
- Understand the components of the CDC level I and II environmental cleaning monitoring program
- Learn strategies and tools to assess environmental cleaning practices
- Learn ***how*** to implement an environmental cleaning monitoring program using a non-punitive and team-based approach

How is Environmental Cleaning Being Evaluated in this Hospital ?

Are Shiny Floors Enough ??

Slide courtesy of Dr. Philip Carling

The Status Quo

- Most hospitals assess the adequacy of hospital cleaning by visual inspection

- VISUAL INSPECTION FOR CLEANLINESS IS INADEQUATE
  - Impossible to standardize
  - May lead to poorly cleaned hospital rooms
  - Role in MDRO transmission

The Status Quo

- The role of the environment was largely ignored by modern hospital epidemiologists until relatively recently
- Hand hygiene remains the single most important measure to prevent transmission of pathogens in health care settings, ***but . . .***
- Clean hands frequently become contaminated with pathogens *AFTER* hand hygiene and *BEFORE* or *DURING* direct patient contact

Clean hospitals: More than just clean hands!

- Surfaces contaminated with MRSA, VRE and *C. difficile* can result in indirect transmission bacteria by two mechanisms:

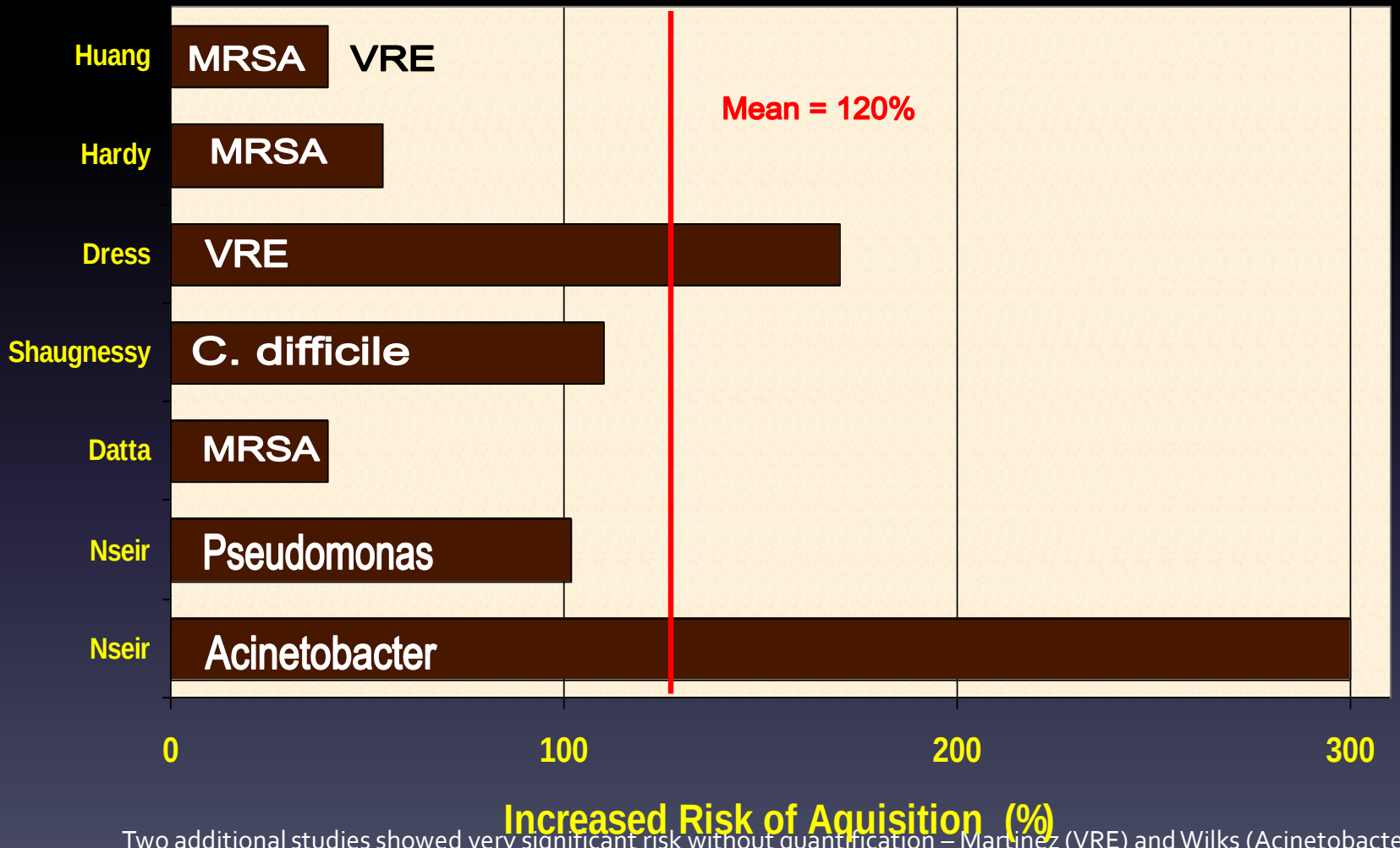
1) The hands or gloves of healthcare workers can become contaminated via inanimate **(environmental)** contact
2) Organisms can be acquired by patients directly from the **environment**

Boyce, J. *J Hosp Infect* 2007;65(S2):50-54

Role of the Environment in Transmission of Selected Pathogens

Pathogen	Survival	Environmental Data
C difficile	Months	3+
VRE	Days to Weeks	3+
MRSA	Days to Weeks	2-3+
Acinetobacter spp.	> 1 Month	2-3+
Pseudomonas spp.	< 1 day	1+

Increased Acquisition Risk from Prior Room Occupant



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

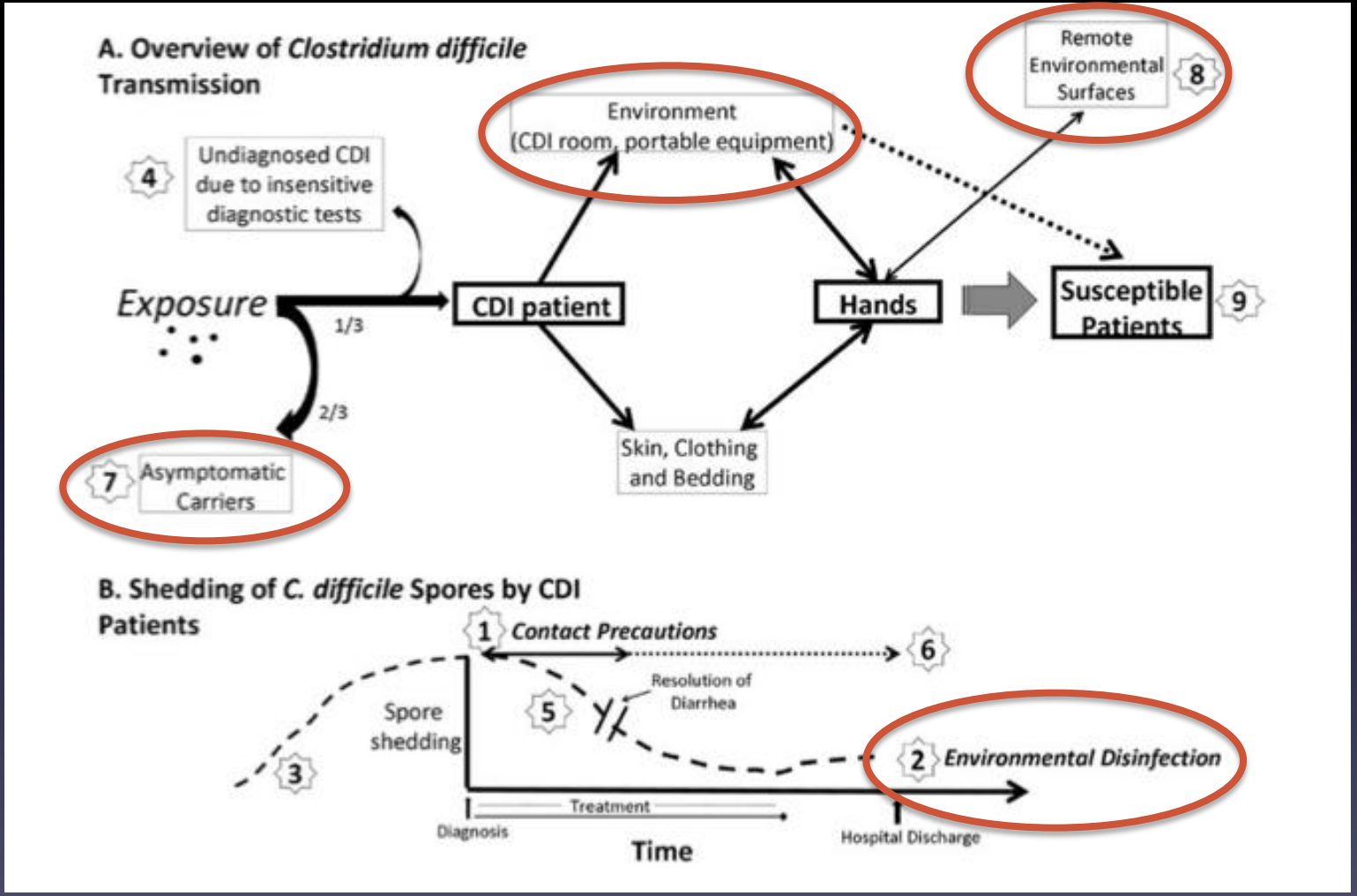
Slide courtesy of Dr. Philip Carling

C. difficile

- *Clostridium difficile* is a spore-forming organism, making it particularly stable in the environment
- Hospital floors have been shown to remain contaminated with *C. difficile* for up to five months following contamination
- Environmental contamination in hospitals is roughly proportional to the prevalence of hand contamination among healthcare workers
- The percentage of environmental samples collected from rooms of patients with CDAD that are positive for *C. difficile* has ranged from 9% to 74% in various studies

Fekety R. et al. Am J Med. 1981 Apr;70(4):906-8
Samore M. et al. Am J Med 1996; 100:32-40
McFarland M.V. et al. N Engl J Med 1989

C. difficile transmission



Donskey CJ. CID 2010; 50 (11): 1458-61

Preventing Transmission of *Clostridium difficile*: Is the Answer Blowing in the Wind?

Curtis J. Donskey

Geriatric Research, Education, and Clinical Center, Cleveland Veterans Affairs Medical Center, and Case Western Reserve University School of Medicine, Cleveland, Ohio

How many times must a doctor be told

Wash your hands and wear gloves, please?

Yes, and how many times will an- other stand by

Pretending he just doesn't see?

And how many times must we re- mind

Those things that we touch must be cleaned?

The answer, my friend, is blowin' in the wind

The answer is blowin' in the wind.

Donskey CJ. CID 2010; 50 (11): 1458-61

C. difficile transmission

- Basic measures to prevent transmission include:
    1. Contact precautions while diarrhea is present
    2. **Environmental disinfection** of CDI rooms after discharge of patients

Donskey CJ. CID 2010; 50 (11): 1458-61

C. difficile transmission

Potential Source of Transmission	Intervention
3. CDI not being diagnosed and patients not being isolated in a timely fashion	Preemptive isolation of patients with suspected CDI
4. CDI not being diagnosed because of insensitive testing methods, such as enzyme immunoassay for toxin	Use of testing methods with increased sensitivity
5. Environmental surfaces in CDI rooms and the skin of patients with CDI	**Daily disinfection of surfaces in isolation rooms** and daily bathing to reduce the burden of spores on skin
6. Persistent shedding of spores after resolution of diarrhea	Continuation of contact precautions to time of discharge
7. Asymptomatic carriers	**Improve environmental disinfection** in non-CDI rooms
8. Contaminated surfaces outside patient rooms	**Improve environmental disinfection**
9. Overuse of antibiotics contributing to high numbers of susceptible patients	Antimicrobial stewardship

Donskey CJ. CID 2010; 50 (11): 1458-61

Major Infection Control Interventions to Reduce *C. difficile* transmission

- Hand hygiene
- Contact isolation
- Environmental cleaning

Samore et al. Am J Med 1996; 100:32-40
Fekety et al. Am J Med. 1981;70(4):906-8

Hand Hygiene

- Strict hand hygiene coupled with the use of appropriate isolation precautions
  - Most effective methods to reduce spread of *C. difficile* in hospitals
- Alcohol is not effective at killing *C. difficile* spores
  - Healthcare workers should wash their hands with soap and water when caring for patients with known or suspected *C. difficile* infection
  - Antimicrobial soaps are not sporicidal, many of the spores are rinsed away during hand washing

Barbut F et al. *J Clin Microbiol*. 2000;38(6):2386-8.
Boyce JM, Pittet D. *Am J Infect Control*. 2002;30(8):S1-46.
Garner JS. *Infect Control Hosp Epidemiol*. 1996;17(1):53-80.
Zafar AB et al. *Am J Infect Control*. 1998;26(6):588-93.

Contact Isolation

- Nine month prospective, observational study in patients on Rx for CDI (n= 52)
- Multiple sites were cultured for *C. difficile* before, during, and after treatment
  - Stool samples
  - Skin (chest and abdomen)
  - Environmental

Sethi AK et al. Infect Control Hosp Epidemiol. 2010 Jan;31(1):21-7

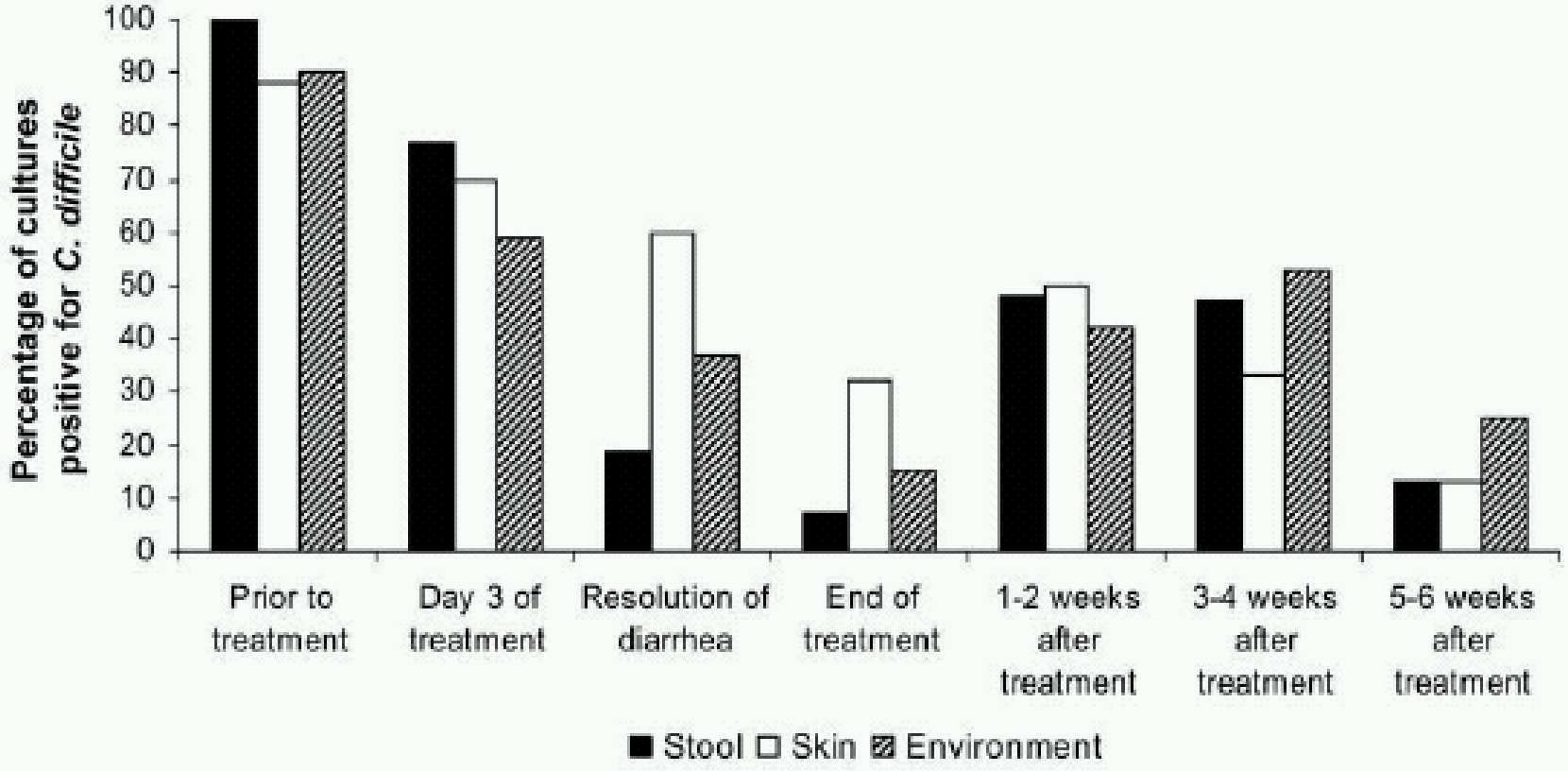
Importance of Contact Isolation

- Results:
  - During Rx no *C. difficile* was recovered from stool samples
  - 1-4 weeks post-Rx, 56% of pts asymptomatic carriers
  - 94% skin isolates and 82% environmental isolates genetically identical to concurrent stool isolates

	Skin Contamination	Environmental Shedding
Resolution of diarrhea	60%	37%
End of Rx	32%	14%
1-4 weeks post-Rx	58%	50%

Sethi AK et al. Infect Control Hosp Epidemiol. 2010 Jan;31(1):21-7

Persistent *C. Difficile* Shedding



Sethi AK et al. Infect Control Hosp Epidemiol. 2010 Jan;31(1):21-7

Environmental Cleaning

- Use of an appropriate sporicidal agent:
  - Sodium hypochlorite (bleach)
  - Glutaraldehyde
  - Peracetic acid
  - Hydrogen peroxide “dry mist” (vaporized)

Environmental Cleaning

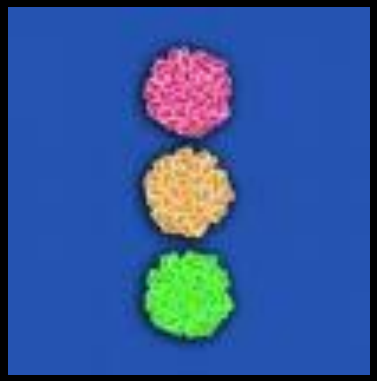
- Re-contamination occurs rapidly thus there is a compelling basis for the need for **ongoing and effective** environmental cleaning process
- Whatever product used:
  - AUDIT to ensure cleaning is done properly
  - Focus cleaning on "High-touch" areas for greatest impact in reducing spread of *C. difficile* and other important pathogens

Quality Improvement

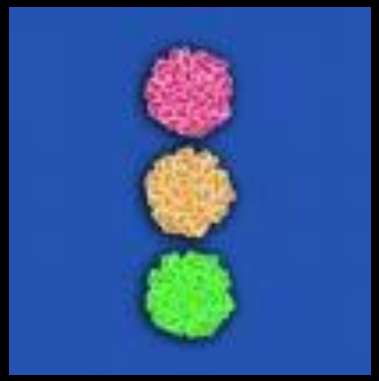
- Educational programs directed at staff responsible for cleaning have been shown to be effective in reducing environmental contamination with VRE and *C. difficile.*

- Interventions to improve hospital room cleaning include:
  - Educating cleaning staff
  - Use of fluorescent dyes or other monitoring systems
  - Feedback to cleaning staff

Eckstein B et al. BMC Infectious Diseases 2007; 7:61



Patient Safety



- Environmental Service personnel can help save lives and improve patient safety in their everyday cleaning practices

- Improvement in cleaning practices through education, quality assurance monitoring, and feedback can break the cycle of transmitting dangerous bacteria between the patients and their environment

THE WALL STREET JOURNAL.

THE INFORMED PATIENT | Updated June 4, 2012, 11:47 p.m. ET

Behind One Hospital's Fight Against Deadly Infection

CleanSpaces HealthyPatients

Does it work?

Ultraviolet Markers

- To help assess the adequacy of environmental cleaning transparent, an easily cleanable and environmentally stable solution was experimentally developed that fluoresces when exposed to UV light

- The material, which is the consistency of thick syrup, is dispensed on the object to be targeted using a nipple-tipped bottle. This unique material:
  - Dries invisibly
  - Resists dry abrasion
  - Easily removed with light abrasion after being wetted with water or a water-based disinfectant.

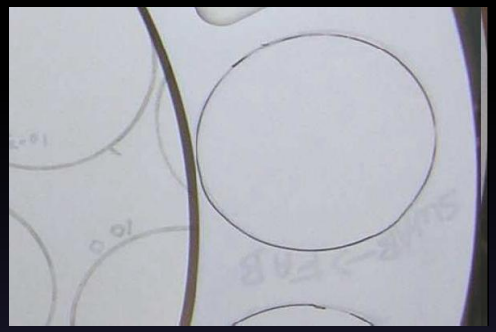
Carling P et al. *J Hosp Infect* 2008; 68:39–44
Carling P et al. *Infect Control Hosp Epidemiol*. 2008 Nov;29(11):1035-41

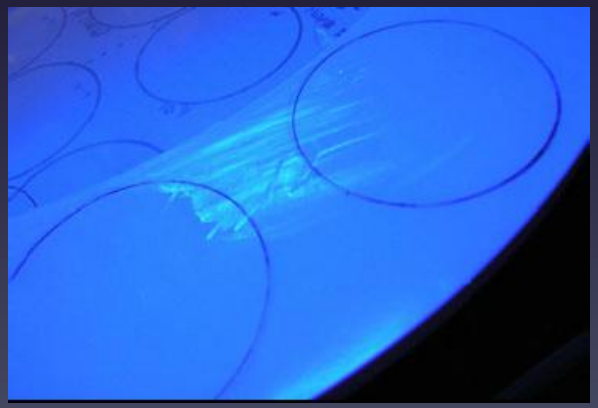
Ultraviolet Markers

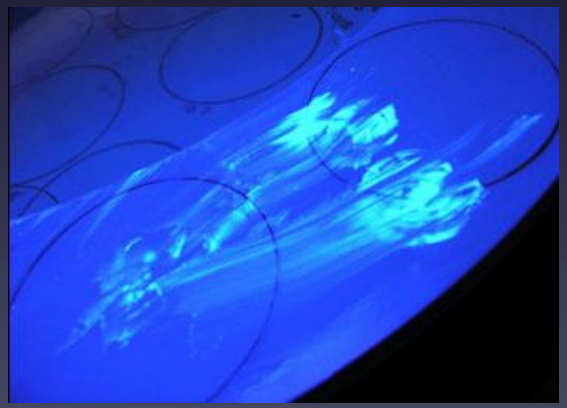
- Between 0.1 and 0.2 ml of the material is applied to the object to be marked so as to create an 1.0 cm 'target'
- The target is readily highlighted by a hand-held UV light as well as easily removed for one year after placement.
- The target objects chosen were defined on the basis of CDC definition of High-risk objects

http://www.cdc.gov/ncidod/dhqp/ pdf/guidelines/Enviro_guide_03.pdf

Use of UVMs to Monitor Efficacy of Cleaning







Ultraviolet Markers

- Thirty-six acute care hospitals in the United States ranging in size from 25 to 721 beds
- Prospective quasi-experimental, before-after, study
- Three Phases:
  - I: pre-intervention analysis (i.e baseline cleanliness)
  - II: programmatic analysis and educational interventions
  - III: performance feedback and programmatic analysis
- At baseline: 9,910 (48%) of 20,646 standardized environmental surfaces[13] were cleaned
- Post-intervention: 7,287 (77%) of 9,464 standardized environmental surfaces were cleaned

Carling P et al. *Infect Control Hosp Epidemiol*. 2008 Nov;29(11):1035-41

High-Risk Objects Tested

TABLE. Comparison of Rates of Cleaning for 14 Types of High-Risk Object (HRO) in 36 Acute Care Hospitals, Before and After Intervention

	Preintervention (phase I)		All hospitals postintervention (final results)	
Type of HRO	Mean % of HROs cleaned (range)	95% CI	Mean % of HROs cleaned (range)	95% CI
Sink	79 (38–97)	72.4–84	89 (47–100)	84.5–94
Tray table	74 (35–100)	68.7–79.8	87 (31–100)	81.8–92.2
Toilet seat	71 (3–100)	62.9–80.2	87 (38–100)	81.4–92.4
Flush handle	58 (6–88)	50.6–64.9	85 (40–100)	80.1–90.7
Side rail	57 (10–93)	49.1–64.3	81 (20–100)	73.9–88.6
Bedside table	55 (0–100)	45.7–63.5	76 (29–100)	68.5–83.7
Call box	52 (6–90)	44–60.8	81 (38–100)	73.9–87.5
Chair	53 (11–100)	42.4–62.8	78 (33–100)	70.5–85
Telephone	49 (12–86)	43.3–55	78 (20–100)	72.4–83.6
Bathroom door knobs	29 (0–82)	22.1–36.2	71 (19–95)	64.1–78.1
Bathroom handhold	28 (0–90)	20.9–35.8	74 (15–100)	66.1–81.6
Bathroom light switch	25 (0–84)	17.1–33.1	64 (8–100)	55.9–72.9
Room door knobs	22 (0–73)	15.9–28.4	66 (25–100)	59.7–73.2
Bedpan cleaner	22 (0–79)	15.9–28.3	62 (0–100)	51.7–71.4

NOTE. All *P* values are <.001; CI, confidence interval.

Carling P et al. *Infect Control Hosp Epidemiol*. 2008 Nov;29(11):1035-41

Improved Rates of Cleaning

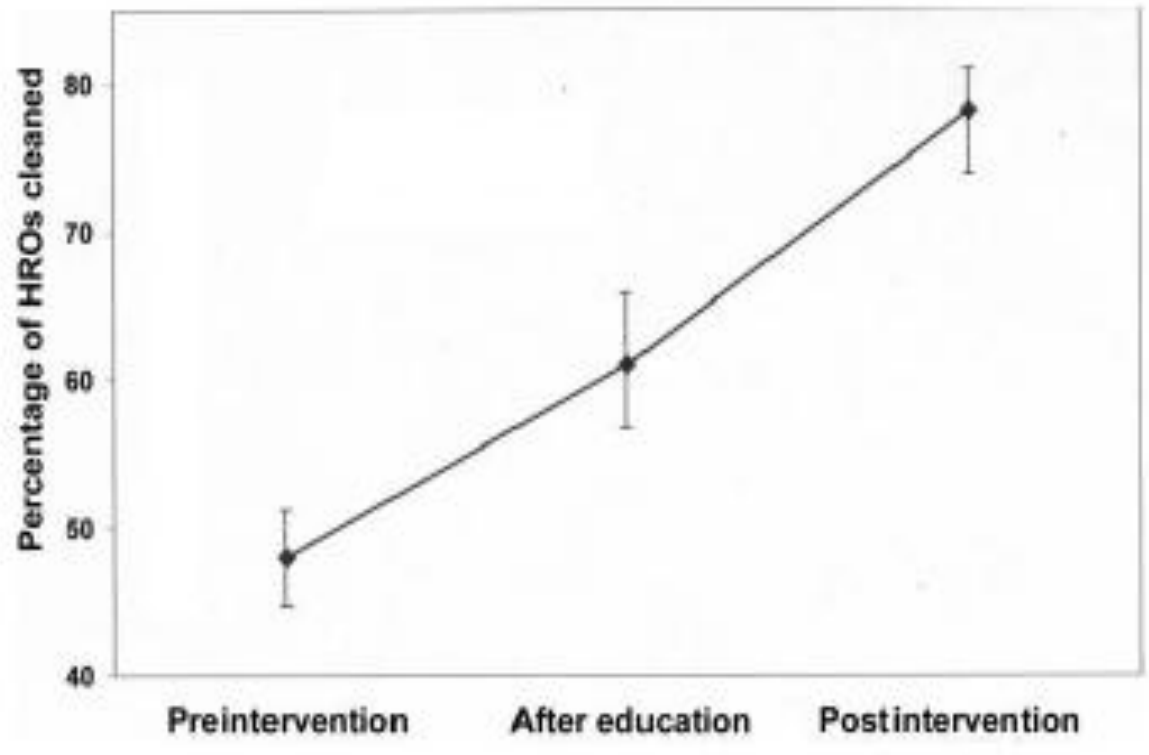
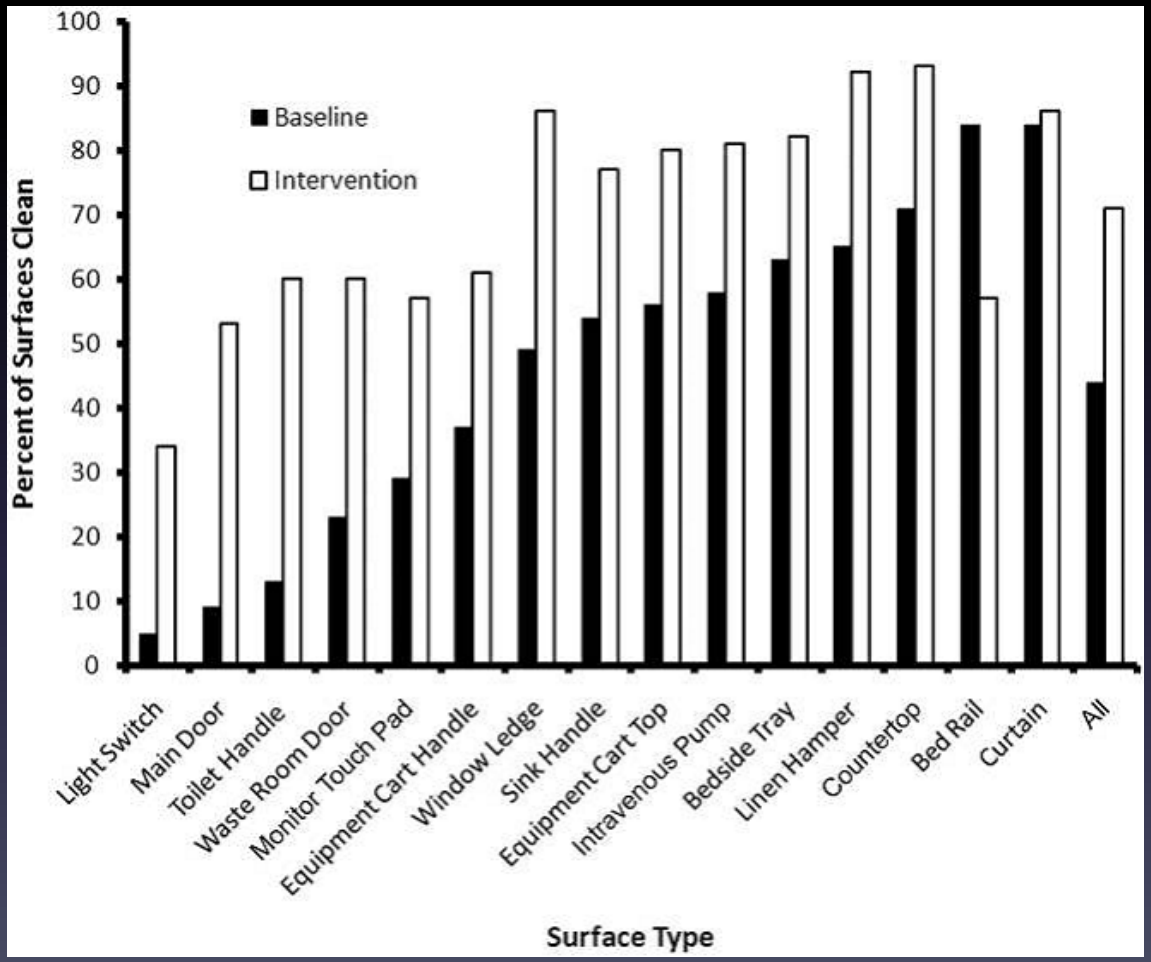


FIGURE 2. Change in the mean rate of environmental cleaning in the 36 study hospitals during the 3 phases of the study. HROs, high-risk objects; *whiskers*, 95% confidence intervals.

Carling P et al. *Infect Control Hosp Epidemiol*. 2008 Nov;29(11):1035-41

Improved Rates of Cleaning



Baseline 44%

Intervention 71%

Goodman ER et al. *Infect Control Hosp Epidemiol* 2008;29:593-99

Decreased Environmental Contamination

TABLE 3. Methicillin-Resistant *Staphylococcus aureus* (MRSA) and Vancomycin-Resistant Enterococci (VRE) Culture Data, by Study Period and Surface Type

	No. (%) of cultures with positive results			
	MRSA		VRE	
Surface	Baseline	Intervention	Baseline	Intervention
Doorknobs	4 (11)	2 (5)	2 (5)	1 (2)
Monitor touch pad	1 (3)	0 (0)	0 (0)	0 (0)
Equipment carts	0 (0)	3 (7)	0 (0)	0 (0)
Linen hamper and trash bin	6 (16)	2 (5)	4 (11)	6 (14)
Countertop	0 (0)	3 (7)	2 (5)	0 (0)
Bed rail	0 (0)	0 (0)	1 (7)	0 (0)
All surfaces	11 (6)	10 (4)	9 (5)	7 (3)

Baseline 45%

Intervention 27%

Goodman ER et al. *Infect Control Hosp Epidemiol* 2008;29:593-99

CDC Recommendations

Acute Care Hospitals should implement a:

Level I Program:

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

Level II Program:

All elements of Level I + Objective monitoring

Options for Evaluating Environmental Cleaning

October 2010

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

Slide courtesy of Dr. Philip Carling

CDC Recommendations

Web Link:

http://www.cdc.gov/hai/toolkits/evaluating-environmental-cleaning.html

Options for Evaluating Environmental Cleaning

October 2010

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

Slide courtesy of Dr. Philip Carling

Establish a Structure for the Auditing Program

Infection Prevention

AND

Environmental Services

- Early joint planning to define expectations, clarify policies and foster mutual respect
- One sided programs fail on many levels

Slide courtesy of Dr. Philip Carling

Develop a Program

1. Establish which type of objective method the hospital will use to evaluate environmental hygiene involving appropriate stakeholders.
2. Determine the number of rooms to audit.
3. Determine which objects to test for adequate cleaning.
4. Determine the baseline percentage of objects cleaned.
5. Develop an educational program for EVS staff including demonstration of method for evaluating environmental hygiene.
6. Monitor and provide timely education and feedback.
7. Audit the auditing process to ensure data reliable.

1. Objective Methods for Evaluating Environmental Hygiene

- Direct Practice Observation
- Swab Cultures
- Agar Slide Cultures
- Fluorescent Markers
- ATP Bioluminescence

Evaluating Patient Zone Environmental Cleaning

Method	Ease of Use	Identifies Pathogens	Accuracy	Useful for Teaching	Use in Programmatic Monitoring
Direct observation					
Culture swab					
Agar culture system					
Fluorescent system					
ATP Bioluminescence					

Slide courtesy of Dr. Philip Carling

Evaluating Patient Zone Environmental Cleaning

Method	Ease of Use	Identifies Pathogens	Accuracy	Useful for Teaching	Use in Programmatic Monitoring
Direct observation	Low	No	Variable	Yes	Difficult

Slide courtesy of Dr. Philip Carling

Evaluating Patient Zone Environmental Cleaning

Method	Ease of Use	Identifies Pathogens	Accuracy	Useful for Teaching	Use in Programmatic Monitoring
Direct observation	Low	No	Variable	Yes	Difficult
Culture swab	High	Yes	High	No	No

Slide courtesy of Dr. Philip Carling

Evaluating Patient Zone Environmental Cleaning

Method	Ease of Use	Identifies Pathogens	Accuracy	Useful for Teaching	Use in Programmatic Monitoring
Direct observation	Low	No	Variable	Yes	Difficult
Culture swab	High	Yes	High	No	No
Agar culture system	Moderate	Possible	Moderate	No	Possible*

* Measures cleanliness at that moment but NOT the process of cleaning

Slide courtesy of Dr. Philip Carling

Evaluating Patient Zone Environmental Cleaning

Method	Ease of Use	Identifies Pathogens	Accuracy	Useful for Teaching	Use in Programmatic Monitoring
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Agar culture system	Moderate	Possible	Moderate	No	Possible*
Fluorescent system	High	No	High	Yes	Yes

Slide courtesy of Dr. Philip Carling

Evaluating Patient Zone Environmental Cleaning

Method	Ease of Use	Identifies Pathogens	Accuracy	Useful for Teaching	Use in Programmatic Monitoring
Direct observation	Low	No	Variable	Yes	Difficult
Culture swab	High	Yes	High	No	No
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Fluorescent system	High	No	High	Yes	Yes
ATP Bioluminescence	High	No	Variable	Yes	Possible*

* Measures cleanliness at that moment but NOT the process of cleaning

Slide courtesy of Dr. Philip Carling

2. How Many Rooms to Test?

- Hospital size ≥150 beds:
  - Conduct baseline evaluation of all surfaces (listed in the checklist) in 10-15% sample of patient rooms
  - When the hospital achieves >80% cleaning rate then decrease the number to 5% of patient rooms unless there is a deterioration in practice noted.
- Hospital size < 150 beds:
  - Conduct a baseline evaluation of all available surfaces (listed in the checklist) in a minimum of 15 rooms for baseline ***and*** ongoing evaluation.

3. What to test?

CDC Environmental Checklist for Monitoring Terminal Cleaning[1]

Date:	
Unit:	
Room Number:	
Initials of ES staff (optional):[2]	

Evaluate the following priority sites for each patient room:

High-touch Room Surfaces[3]	**Cleaned**	**Not Cleaned**	**Not Present in Room**
Bed rails / controls			
Tray table			
IV pole (grab area)			
Call box / button			
Telephone			
Bedside table handle			
Chair			
Room sink			
Room light switch			
Room inner door knob			
Bathroom inner door knob / plate			

http://www.cdc.gov/HAI/toolkits/Environmental-Cleaning-Checklist-10-6-2010.pdf

For specific “how to” instructions…

- http://www.cdc.gov/HAI/toolkits/Appendices-Evaluating-Environ-Cleaning.html#a

- Patient Area
- Toilet Area
- Where Applicable

5. Educational Intervention

- Explain the importance of HAIs in a manner commensurate with the appropriate language and educational level using as many pictorial illustrations as is feasible.
- Explain their role in improving patient safety through optimized hygienic practice→ Empowerment
- Review specific terminal room cleaning practice expectations.
- Discuss the manner in which their practice will be evaluated. For Level II programs, a participatory demonstration of the monitoring method is very useful.
- Provide them with information from the baseline evaluation emphasizing or possibly exclusively showing them results for those objects which have been most thoroughly cleaned (Level II).

http://www.cdc.gov/hai/toolkits/evaluating-environmental-cleaning.html

5. Educational Intervention

- Stress the non-punitive nature of the program.
- Inform them that their good performance will be broadly recognized (i.e., beyond their department) and highlighted within their department for others to emulate. (Level II)
- Repeatedly reinforce the importance of their work, and how it directly relates to the hospital's goals and mission and how it is appreciated by patients and plays a major role in a patient's satisfaction with the hospital.
- Provide timely feedback

http://www.cdc.gov/hai/toolkits/evaluating-environmental-cleaning.html

6. Calculate the Thoroughness of Disinfection Cleaning (TDC) Score

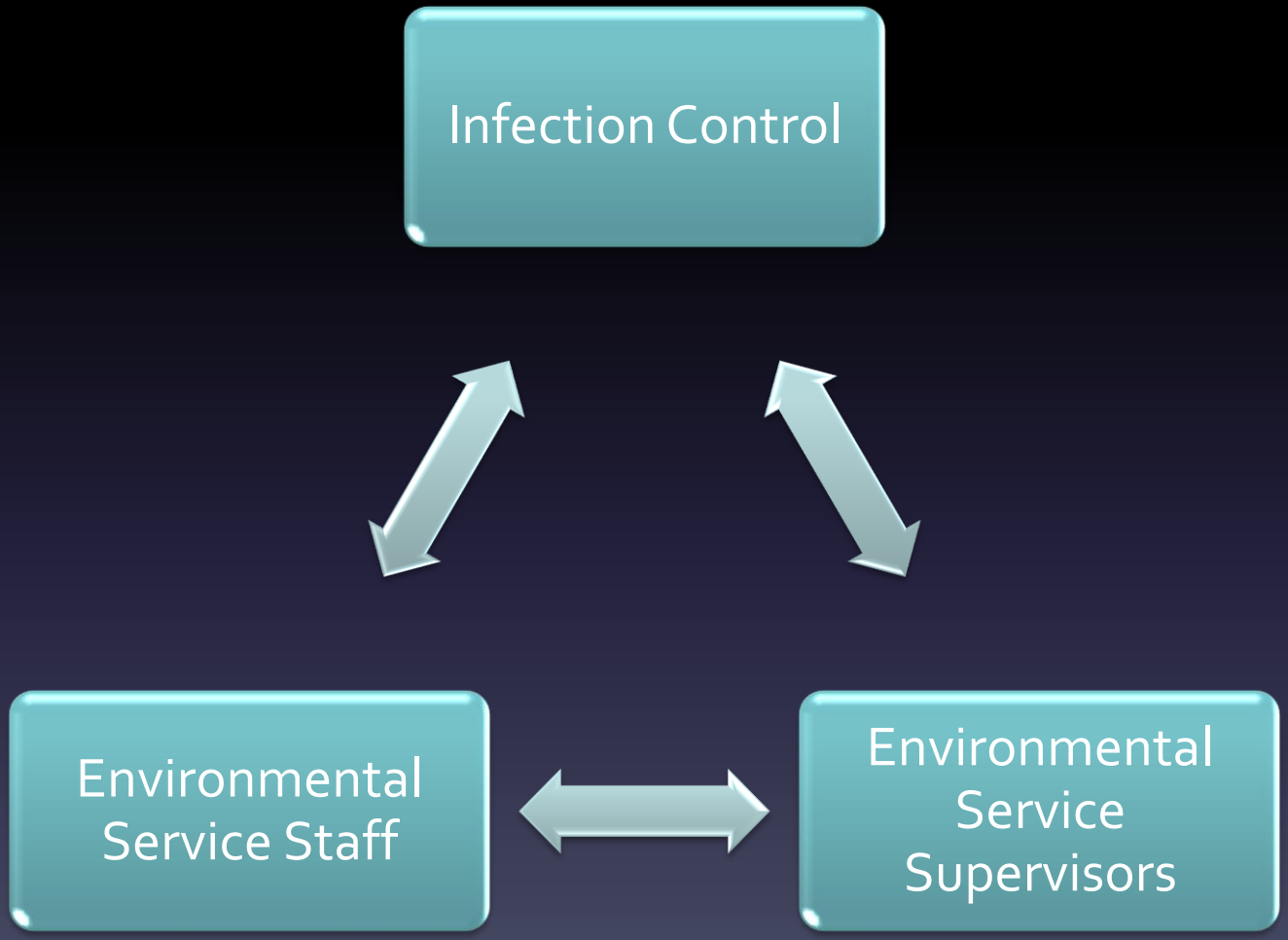
TERMINAL CLEANING

Record results of evaluation for each surface on the check list for every room monitored. Use the following symbols for marking:
O = NOT CLEAN, X = CLEAN, LEAVE BLANK = NOT EVALUABLE NOTE - USE CAP LETTERS "X" AND "O"
The percentage of individual surfaces cleaned will be automatically calculated in Sheet 2 (Aggregate Score Sheet).
Please report aggregate scores calculated for each category highlighted in Sheet 2 (Aggregate Score Sheet).

					High Touch I			High Touch II			High Touch III				Bathroom Surfaces					
Unit	Rm No.	Date of Marking (if applicable)	Date of Evaluation	Bed rails	Tray table	IV pole	Call box / button	Telephone	Bedside table handle	Chair	Rm sink	Rm light switch	Rm inner doorknob	BR inner doorknob	BR light switch	BR handrails	BR sink	Toilet seat	Toil h

http://www.cdc.gov/HAI/toolkits/Appendices-Evaluating-Environ-Cleaning.html#d

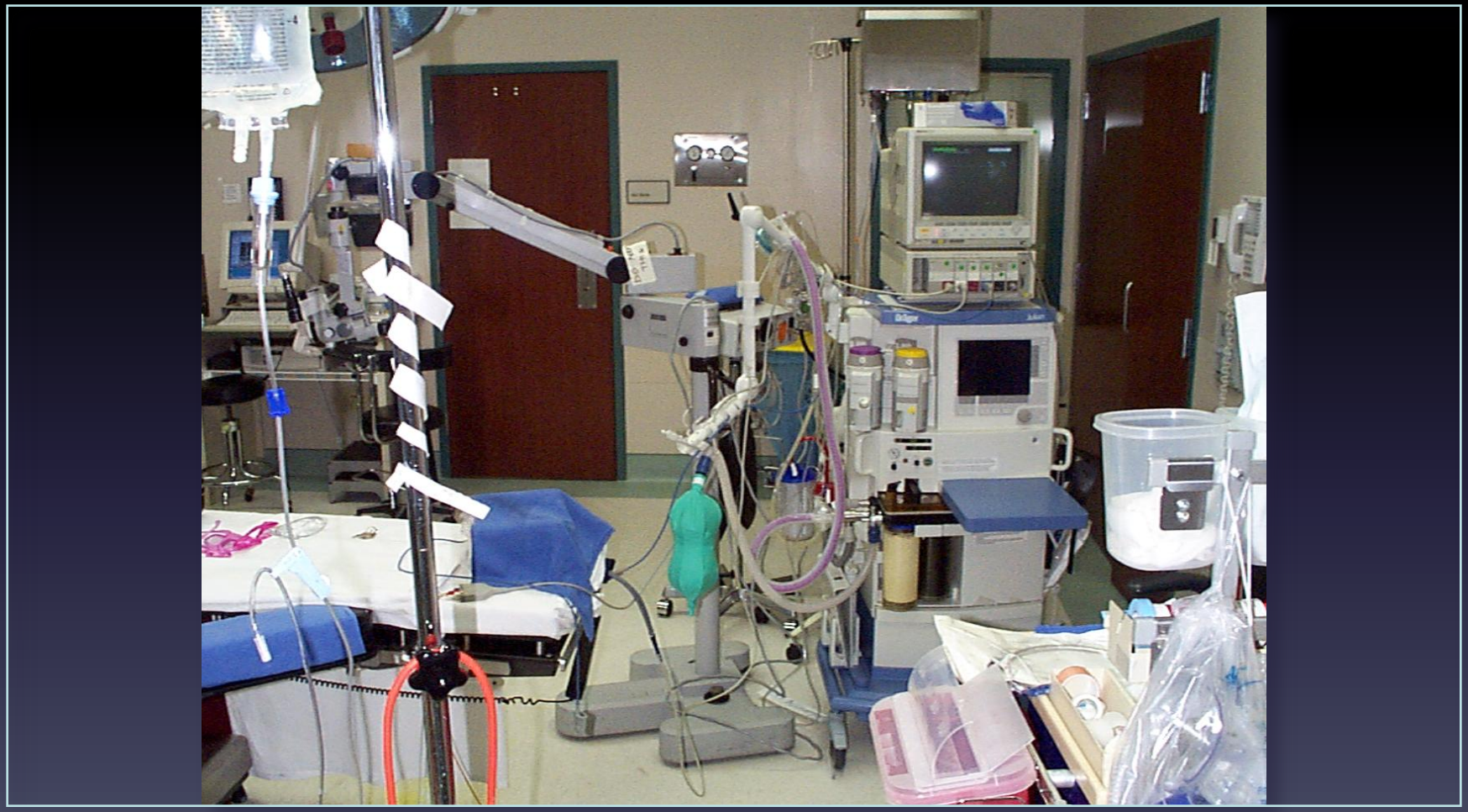
6. Feedback


Infection Control
Environmental Service Staff
Environmental Service Supervisors

7. Audit the Process

- Review the data for integrity
- Modify goals in conjunction with EVS

Is Manual Cleaning Enough?



Potential Adjuncts to Terminal Cleaning

- Hydrogen Peroxide Vapor (HPV)
- Ultraviolet Germicidal Irradiation (UVGI)

Hydrogen Peroxide Vapor

- 5 wards with a high incidence of *C. difficile*
- HPV was injected into sealed wards and individual patient rooms using generators until approx 1 micron film of HP was achieved on the surface
- 11/43 (25.6%) surface samples yielded *C. difficile* compared to 0/27 (0%) after HPV decontamination
- The incidence of nosocomial *C. difficile* infection was significantly lower during the intervention period
- Conclusion
  - HPV was efficacious in eradicating *C. difficile* from contaminated surfaces

Boyce et al. *Infect Cont Hosp Epidemiol* 2008;29:723

HPV Decontamination

- Pros
  - Extensively studied and efficacious
- Cons
  - Longer room turn-over time (up to 6 hours)
  - Requires complete sealing of rooms when this vapor is deployed
  - Specific intensive education of staff

UVC-Emitting Devices and Decontamination

- UV light damages nucleic acid and destroys the ability of bacteria/viruses to replicate
- The UVC (254nm) bandwidth is highly and predictably germicidal
- UV light in this spectrum rapidly removes >99% of microbial contamination from the air and on surfaces
- New technology has extended the use of UVGI to eradicate pathogens in the hospital environment

UVC-Emitting Devices and Decontamination

- Determine effectiveness of UVC-emitting device on pathogens
- MRSA, VRE, multidrug-resistant (MDR) *Acinetobacter baumannii,* or *C. difficile* spores
- Measured presence of bacteria and colony counts

Rutala et al. *Infect Control Hosp Epidemiol* 2010; 31(10):1025-1029

UVC Decontamination

TABLE 1. UV-C Decontamination of Formica Surfaces in Patient Rooms Experimentally Contaminated with Methicillin-Resistant *Staphylococcus aureus* (MRSA), Vancomycin-Resistant *Enterococcus* (VRE), Multidrug-Resistant (MDR) *Acinetobacter baumannii*, and *Clostridium difficile* Spores

		UV-C line of sight						
		Total		Direct		Indirect		
Organism	Inoculum	No. of samples	Decontamination, $\log_{10}$ reduction, mean (95% CI)	No. of samples	Decontamination, $\log_{10}$ reduction, mean (95% CI)	No. of samples	Decontamination, $\log_{10}$ reduction, mean (95% CI)	*P*
MRSA	4.88 $\log_{10}$	50	3.94 (2.54–5.34)	10	4.31 (3.13–5.50)	40	3.85 (2.44–5.25)	.06
VRE	4.40 $\log_{10}$	47	3.46 (2.16–4.81)	15	3.90 (2.99–4.81)	32	3.25 (1.97–4.62)	.003
MDR *A. baumannii*	4.64 $\log_{10}$	47	3.88 (2.59–5.16)	10	4.21 (3.27–5.15)	37	3.79 (2.47–5.10)	.07
C. difficile spores	4.12 $\log_{10}$	45	2.79 (1.20–4.37)	10	4.04 (3.71–4.37)	35	2.43 (1.46–3.40)	<.001

NOTE. Patient rooms had a mean area of 12.1 m^2 including bathroom. CI, confidence interval.

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UVC Decontamination

TABLE 2. UV-C Decontamination of Surfaces in 8 Patient Rooms That Had Been Occupied by Patients under Contact Precautions for Methicillin-Resistant *Staphylococcus aureus* (MRSA)

Site	Total CFUs per site, mean		MRSA-positive plates/total plates	
	Before UV-C	After UV-C	Before UV-C	After UV-C
Sink ($n = 8$)	134	11	7/40	0/40
Toilet seat ($n = 6$)	559	9	1/30	0/30
Tray table ($n = 8$)	171	4	1/40	0/40
Bedside rail ($n = 7$)	497	16	7/35	0/35
Chair arm ($n = 12$)	276	11	12/60	0/60
Bathroom floor, in front of toilet ($n = 6$)	940	53	16/30	1/30
Floor near bed ($n = 8$)	967	76	23/40	1/40
Monitor ($n = 4$)	24	2	0/20	0/20
Medical cart ($n = 7$)	351	9	5/35	0/35
Laundry bin top ($n = 5$)	442	8	1/25	0/25
Sink counter ($n = 1$)	12	1	0/5	0/5
Chair seat ($n = 1$)	95	2	1/5	0/5
Blood pressure machine ($n = 1$)	111	8	1/5	0/5
Bedside dresser ($n = 4$)	176	5	1/20	0/20
Floor at foot of bed ($n = 1$)	668	14	4/5	0/5
Floor at sink ($n = 1$)	729	82	1/5	0/5
Total	384	19	81/400	2/400

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LUMALIER
UV AIR & SURFACE DISINFECTION

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UV AIR & SURFACE DISINFECTION

UVC Decontamination

- Pros
  - Highly effective at killing resistant pathogens
  - Fully automated and does not require extensive training
  - Safe for the disinfection of highly contaminated hard-to-clean electronic healthcare equipment
  - A single UVGI emitter can clean up to 48 rooms per day
  - Useful adjunct to routine cleaning in its ability to overcome common current problems with "routine" terminal cleaning
    - inadvertent inadequate cleaning and/or disinfection of high-risk, high-touch objects
    - inadvertent inadequate "dwell [contact] times" for chemical disinfectants
- Cons
  - Units are costly
  - Room turnover time increased
  - No data to show clinical significance at this time

Adjunctive room decontamination strategies DO NOT replace terminal cleaning.

The mechanical action of cleaning remains an integral step that must be completed for adjuncts to be effective.

Key Points

- It is reasonable and logical to focus on cleaning the hospital environment to reduce transmission of *C. difficile* and other pathogens
- Environmental contamination with *C. difficile*, VRE, MRSA and *Acinetobacter* can result in disease transmission to patients
- Programs to improve the adequacy of environmental cleaning are effective and likely cost-neutral.

Key Points

- Better cleaning methods (UVGI and others) are needed. Technology may be the answer to this problem.
- Cleaning hospitals better may have important secondary effects of reducing the frequency of poor hand hygiene and poor compliance with isolation precautions. (e.g. culture change)

Thank You!

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