

Importance of Environmental Cleaning and Disinfection in reducing transmission of HAI

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Objectives

- Review the role of the environment in transmission of healthcare-associated infections (HAI)
- Understand best practices for cleaning the patient and resident environment
- Discuss strategies to ensure effectiveness of cleaning and disinfection
- Understand elements of effective cleaning and disinfection programs
- Describe technologies, policies, and protocols to monitor and improve cleaning and disinfection

Role of Environmental Surfaces in Disease Transmission

Contaminated Environmental Surface Leading to Patient or Resident Infection

1. Surface must become contaminated by contact or droplet spread
2. Organism must survive on the surface
3. Surface must be touched by another person who picks up sufficient inoculum
4. Person must omit or poorly perform hand hygiene
5. Person must transmit the organism to another person or object in sufficient quantity to cause disease

The Inanimate Environment. , Bennett & Brachman's Hospital Infections 6th Ed. 2014
Chou. APIC Text of Infection Control & Epidemiology. 2013
HICPAC /CDC Isolation Guidelines. 2007

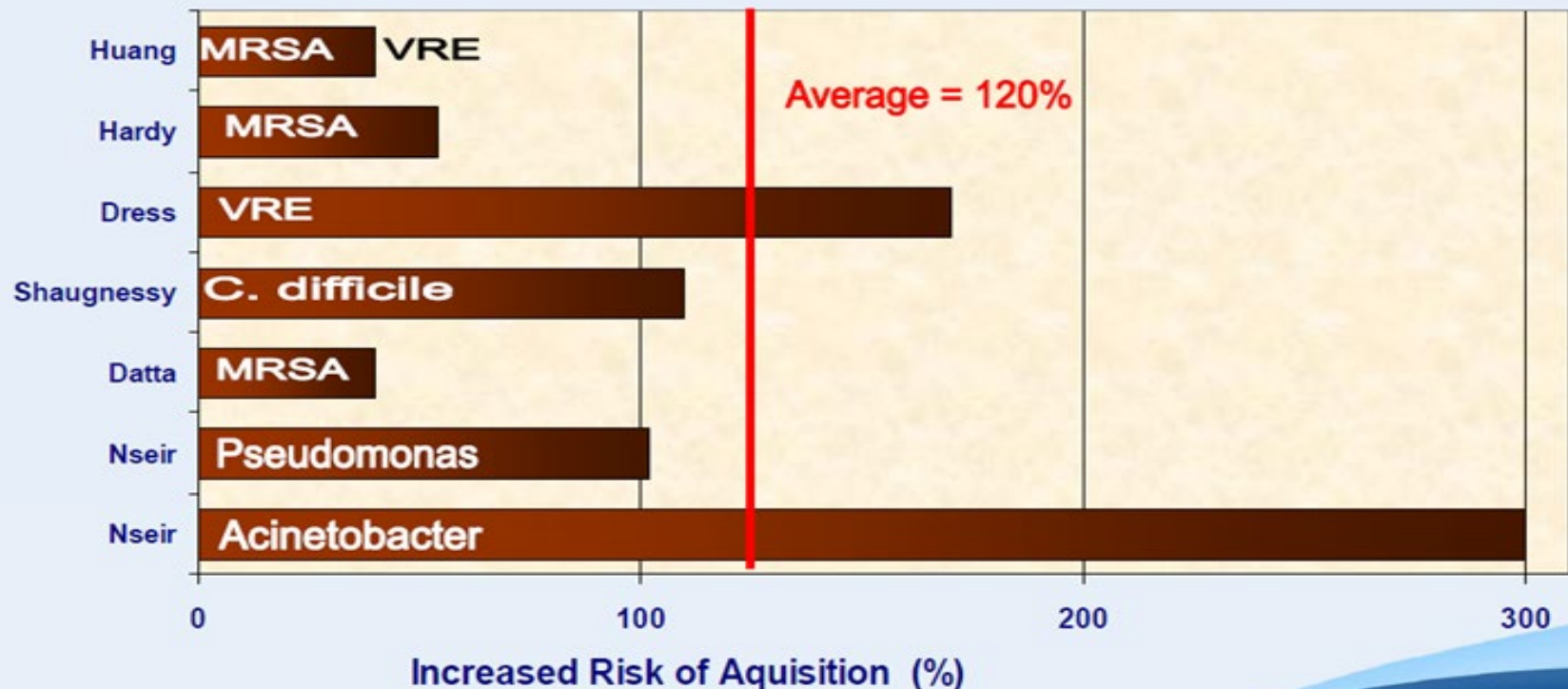
Pathogen Survival in the Environment

- Multiple factors influence duration of survival:
 - Type of microbe
 - Temperature
 - Humidity
- *C.difficile* spores are shed in high numbers, are resistant to desiccation and some disinfectants, and can live on surfaces for up to 5 months

Kramer et al. BMC Infect Dis. 2006

Increased Acquisition Risk from Prior Infected Room Occupant

Increased acquisition risk from prior room occupant
6 studies as of January 2011



MMWR: Notes from the Field: Ongoing Transmission of *Candida auris* in Health Care Facilities — US, June 2016–May 2017

- Environmental testing of patients' rooms identified *C. auris*
 - Mattresses
 - Beds
 - Windowsills
 - Chairs
 - Infusion pumps, and countertops
- *C. auris* was not isolated from rooms after thorough cleaning with a sodium hypochlorite–based disinfectant.

Environmental Sampling Study at Ventilator Skilled Nursing Facility

- Only a single colonized patient in March 2017, but now almost ~70% of residents colonized
- Environmental sampling
 - Doorknob
 - Right and Left Bedrail
 - Windowsill
- 100% of culture positive patients had culture positive handrail

Effective Cleaning Strategies

MDRO Prevention – What works?

- Best sources for developing evidence-based HAI prevention practice recommendations
 - **Centers for Disease Control and Prevention (CDC)**
 - **Healthcare Infection Control Practices Advisory Committee (HICPAC)**
 - **Infectious Diseases Society of America (IDSA) / Society for Healthcare Epidemiology of America (SHEA)**

APIC develops guidelines for implementing HAI prevention recommendations

Environmental Disinfection- *Candida auris*

- Some common disinfectants like quaternary ammonia compounds are not effective against *Candida auris*
- *C. difficile* spores are difficult to kill and adhere to environmental surfaces for extended periods
- Use an EPA registered antimicrobial products effective against *C. difficile* spores
 - List K

<https://www.epa.gov/pesticide-registration/list-k-epas-registered-antimicrobial-products-effective-against-clostridium>

Environmental Disinfection-

- Use of a 1:10 dilution of bleach (500 ppm) for cleaning reduces surface contamination
 - May be instrumental in outbreak control
- Data on hands-free disinfection methods, like germicidal UV irradiation, are limited
 - May require cycle times similar to those used to inactivate spores like *C. difficile*
- When use of products on List K is not feasible, published research found that the some products led to a substantial reduction of *C. auris* in lab testing

<https://www.cdc.gov/fungal/candida-auris/c-auris-infection-control.html>

How to Reduce Environmental Bioburden

- Clean and disinfect high-touch surfaces daily
- Improve cleaning and disinfection of rooms after discharge of patients/residents known to carry healthcare-associated pathogens
- Clean and disinfect portable equipment
- Improve cleaning and disinfection of all rooms

Donskey. AJIC. 2013

Cleaning Policy Considerations

- Include the surfaces and equipment that can reasonably be expected to be contaminated by bacteria (high touch surfaces)
 - Bedrail
 - Call bell
 - Light switches
 - Doorknobs
 - TV remote
 - IV pump
 - Toilet, commode chair
 - IV poles
 - Computer keyboard
 - Telephone
 - Over bed table
 - Respiratory and other bedside equipment
 - Chairs
- Define responsibility and frequency for cleaning and disinfecting patient care equipment and surfaces

Clean *Before* Disinfecting

- Cleaning removes large numbers of microorganisms from a surface that would otherwise interfere with the disinfection process
- Disinfectants are not as effective in the presence of organic material

Important:

A thorough cleaning must occur before a surface can be disinfected!

HICPAC /CDC 2003

HICPAC /CDC 2008

Detergents and Disinfectants

- Detergent
 - Used for cleaning
 - Contains surfactants, lifts dirt
 - Can become easily contaminated
 - Does not kill microorganisms
 - Less toxic, generally less odor, and less costly than disinfectant
- Disinfectant
 - Inhibits growth or kills microorganisms
 - More toxic and more costly than detergent

<http://hygienesolutions.com/wp-content/uploads/2015/09/Emerging-Pathogens-Environmental-Cleaning.pdf>

Chou. APIC Text of Infection Control & Epidemiology. 2013

Importance of Wet Contact Time

- Wet contact times is the time required for a disinfectant to kill microorganisms on a pre-cleaned surface
- Disinfectant must remain wet long enough to achieve the claimed level of surface disinfection
- Follow manufacturer's guidelines for achieving the appropriate wet contact time

Rutala et al. ICHE. 2014

Best Practices for Cleaning a Room

- Ensure proper **hand hygiene** and use of **gloves**
- Focus on **frequently touched surfaces**
 - See example list in [CDC Environmental Cleaning Toolkit](https://www.cdc.gov/hai/toolkits/Evaluating-Environmental-Cleaning.html):
<https://www.cdc.gov/hai/toolkits/Evaluating-Environmental-Cleaning.html>
- Work from **clean-to-dirty** and **high-to-low** areas
- Avoid generating aerosols
- **Change** cleaning cloths
http://www.healthunit.org/professionals/resources/2013_environmental_cleaning.pdf

Best Practices for Cleaning a Room (continued)

- Ensure cleaning **equipment and supplies are clean**
- Ensure **proper use of cleaning and disinfecting products**
- ***Remember:*** A surface must be physically cleaned before it can be disinfected
- **Communicate** issues to your supervisors

http://www.healthunit.org/professionals/resources/2013_environmental_cleaning.pdf

Ensure Environmental Cleaning Staff Perform Hand Hygiene

- Emphasize the importance of hand hygiene for EVS staff
- Change perception that hand hygiene is to protect staff → **hand hygiene is to protect the patient/resident**
- Orient EVS staff to the moments in their work flow process where hand hygiene must be preformed.
- All staff should have regular training regarding cleaning and disinfection and how their efforts help to reduce disease tranmission

http://www.infectioncontrolday.com/articles/2015/09/hand-hygiene-evs-personnel-play-key-role-in-preventing-spread-of-infection.aspx_environmental_cleaning.pdf

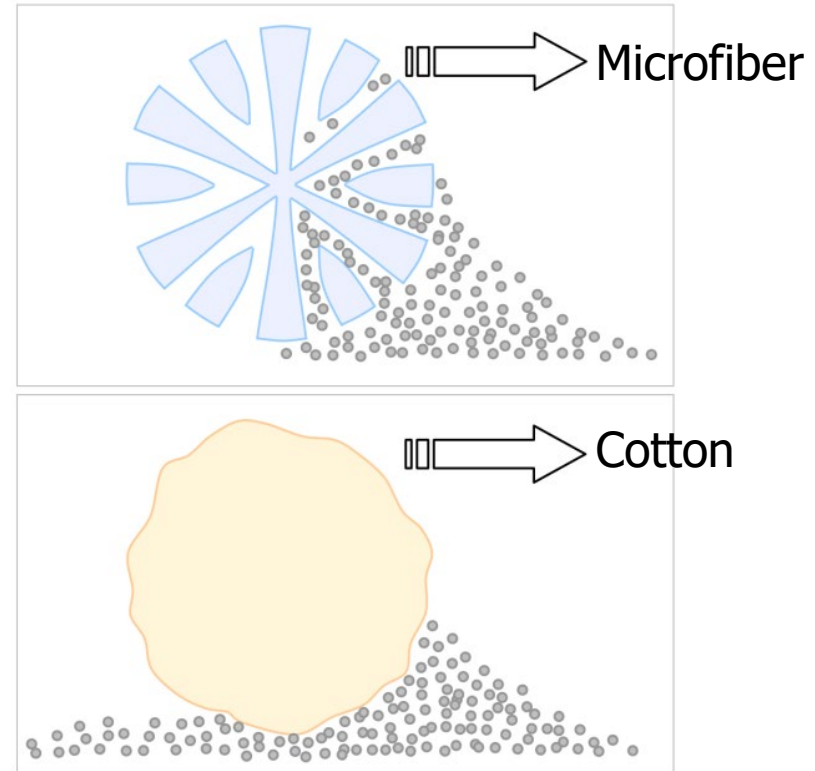
PPE for Cleaning

- Select PPE based on:
 - Type of infection prevention precautions assigned to the patient
 - Chemicals to be used to clean the room
- Appropriate use of PPE is critical
 - In one study, lapses resulted in worker contamination in 53% of glove removals and 38% of gown removals
- Refer to the Material Safety Data Sheet (MSDS), directions sheet, and facility policy

Tomas et al. JAMA Int Med. 2015

Microfiber vs. Cotton

- Microfiber is comprised of densely constructed synthetic strands
- Microfiber cleans 50% better than comparable cotton
 - Attracts dust
 - Easier to use, lighter
 - Designed for repeat usage
- UC Davis study found microfiber was initially more expensive than cotton, but cleaned better, used less water and chemicals, and decreased labor costs.



Cleaning Porous Surfaces

- Fabric
 - Vacuum regularly and re-cover when worn
 - Organic material and excess liquid should be extracted as much as possible
- Carpets
 - Steam cleaning is recommended for as appropriate
 - Allow to dry for 72 hours to prevent growth of fungi
- No epidemiological evidence to show that pathogens found on fabric are linked to increased risk of HAI

MMWR. 2003

Chou . APIC Text of Infection Control and Epidemiology. 2013

Cleaning and Disinfecting Medical and Patient Care Equipment, High Touch Surfaces

Care Practices	Examples
<ul style="list-style-type: none">• Dedicate daily care equipment, as much as possible, to the high-risk resident• Clean, disinfect shared items between uses• Regularly clean, disinfect high touch surfaces using EPA– approved healthcare grade product• Ensure reusable equipment is cleaned with a sporicidal disinfectant• Identify and remove unnecessary equipment that can be environmental sources of <i>C. auris</i> transmission	<ul style="list-style-type: none">• Dedicated equipment: commodes, stethoscopes, blood pressure cuffs, thermometers, pulse oximeter probes• Shared equipment that must be cleaned and disinfected between uses: bladder scanner, weigh scales, glucometer, resident lifts

Effective Cleaning and Disinfection Programs

Cleaning Responsibility

- **All personnel are responsible** for cleaning the environment
 - Nursing services
 - Environmental services
 - Physical therapy
 - Respiratory therapy
 - Sterile processing
- Put individual responsibilities into **policy**; assign responsibilities with **checklist**
- **All personnel must be oriented** to proper cleaning methods

Holmer. AJIC, 2014

Allotted Cleaning Times

- **Proper cleaning requires adequate time**
 - **Daily** cleaning can take **20-25 minutes** per room
 - **Terminal** cleaning will take **40-45 minutes**
- **Create an individualized benchmark time** for the facility based on time needed to expediently complete a checklist of items to be cleaned and disinfected
 - Input from front line staff is essential
 - Consider room size, amount of equipment, furniture and clutter that need to be cleaned or cleaned around
 - Disseminate information to all nursing units

http://www.ahe.org/ahe/learn/press_releases/2009/20090924_minimal_time_guidelines.html

Monitoring the Thoroughness of Cleaning

How Do You Know if a Patient Room is Clean?

- Appears **visually** clean or finger-swipe clean
 - Fast and inexpensive, but lacks objectivity
- Confirmed via **technology**
 - Increasingly becoming the community standard

Fluorescence

Environmentally stable marker is visible to UV light if still present after cleaning

Adenosine Triphosphate

(ATP) monitoring

Measures residual organic matter left on a surface after cleaning

<http://www.cdc.gov/hai/toolkits/Evaluating-Environmental-Cleaning.html>

Lillis. ATP Testing: A Proven Method to Measure Cleanliness. 2015

Monitoring Cleaning

Comparison of Methods

	Visual	Fluorescence	ATP
1. What is measured?	impression of cleanliness	whether fluorescent residual has been removed	biological matter remaining on surface after cleaning
2. Can it be used by persons of differing skill levels?	no technical training required	some technical training needed	some technical training needed
3. How objective is the method? (Can results be changed to appear more positive?)	can be subjective	objective, but marks could have been removed prior to reading	very objective
4. Can the amount of time spent on monitoring be minimized?	yes	room must be pre-marked and read after cleaning	yes

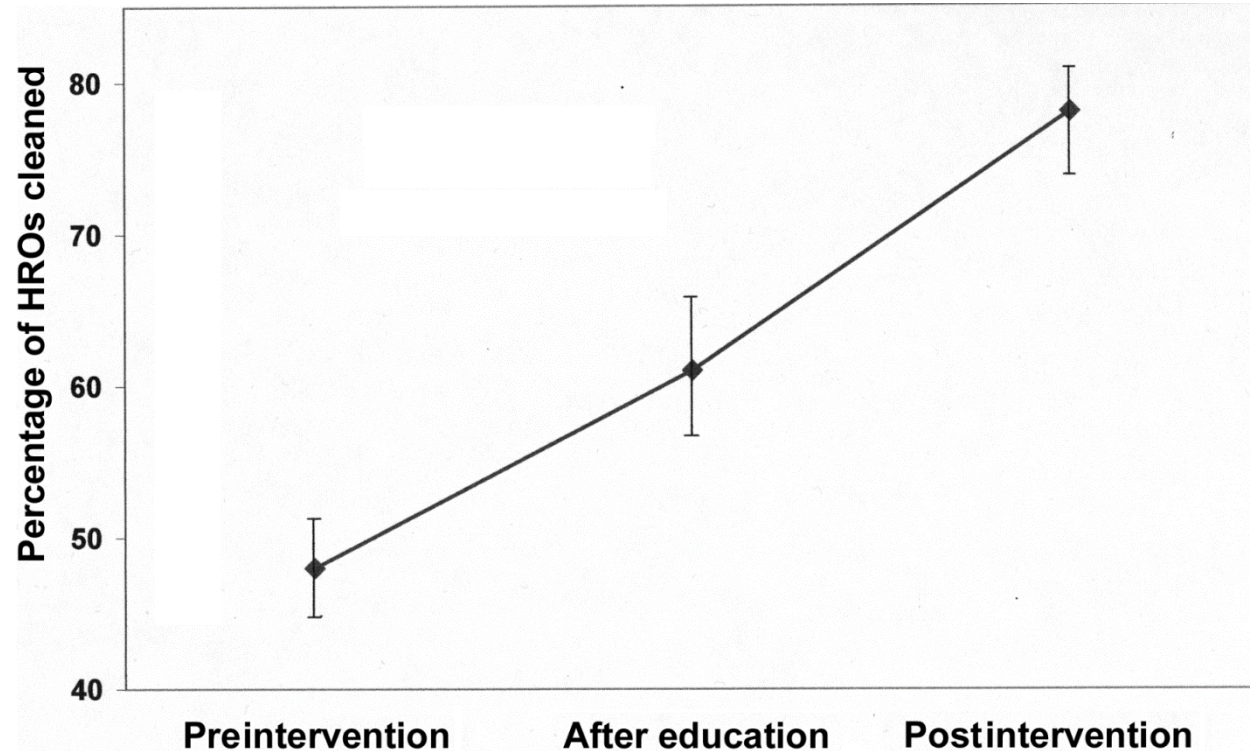
Monitoring Cleaning (continued)

Comparison of Methods

Method	Visual	Fluorescence	ATP
5. How are results presented?	pass/fail	pass/fail	numeric value
6. Is software needed for the monitoring process?	no	can be used, but not required	yes
7. How well can it be used for a training tool?	results immediate with visual cues	results immediate with visual cues	results delayed, no visual cues usually available from surface
8. How affordable is the method?	no monetary investment	materials inexpensive; if formal program including staff education purchased, expenses will be higher	cost of machine and swabs is substantial

Does Monitoring Improve Cleaning?

- In 36 hospitals, mean percentage of high-risk objects cleaned was
 - 48% **prior to** intervention
 - 78% **after** intervention



Carling. ICHE. 2008

Adherence Monitoring

What is Adherence Monitoring?

CDC definition

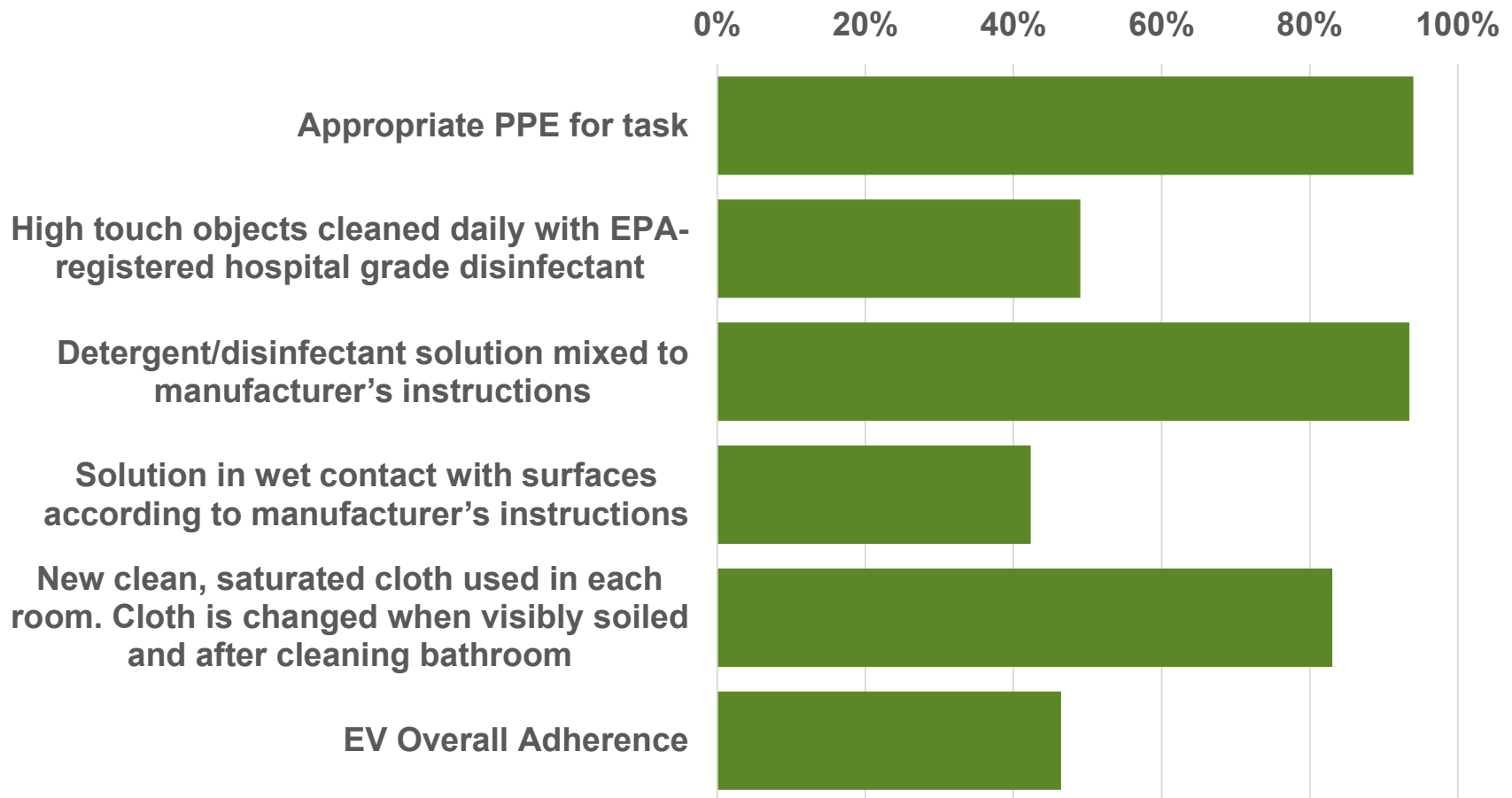
- Used by healthcare facilities to conduct internal quality improvement audits
 - **Audit (adherence monitoring):** Direct observation or monitoring of healthcare personnel adherence to job-specific infection prevention measures
 - **Feedback:** A summary of audit findings that is shared with staff and leadership helps target performance improvement

Why is Adherence Monitoring Important?

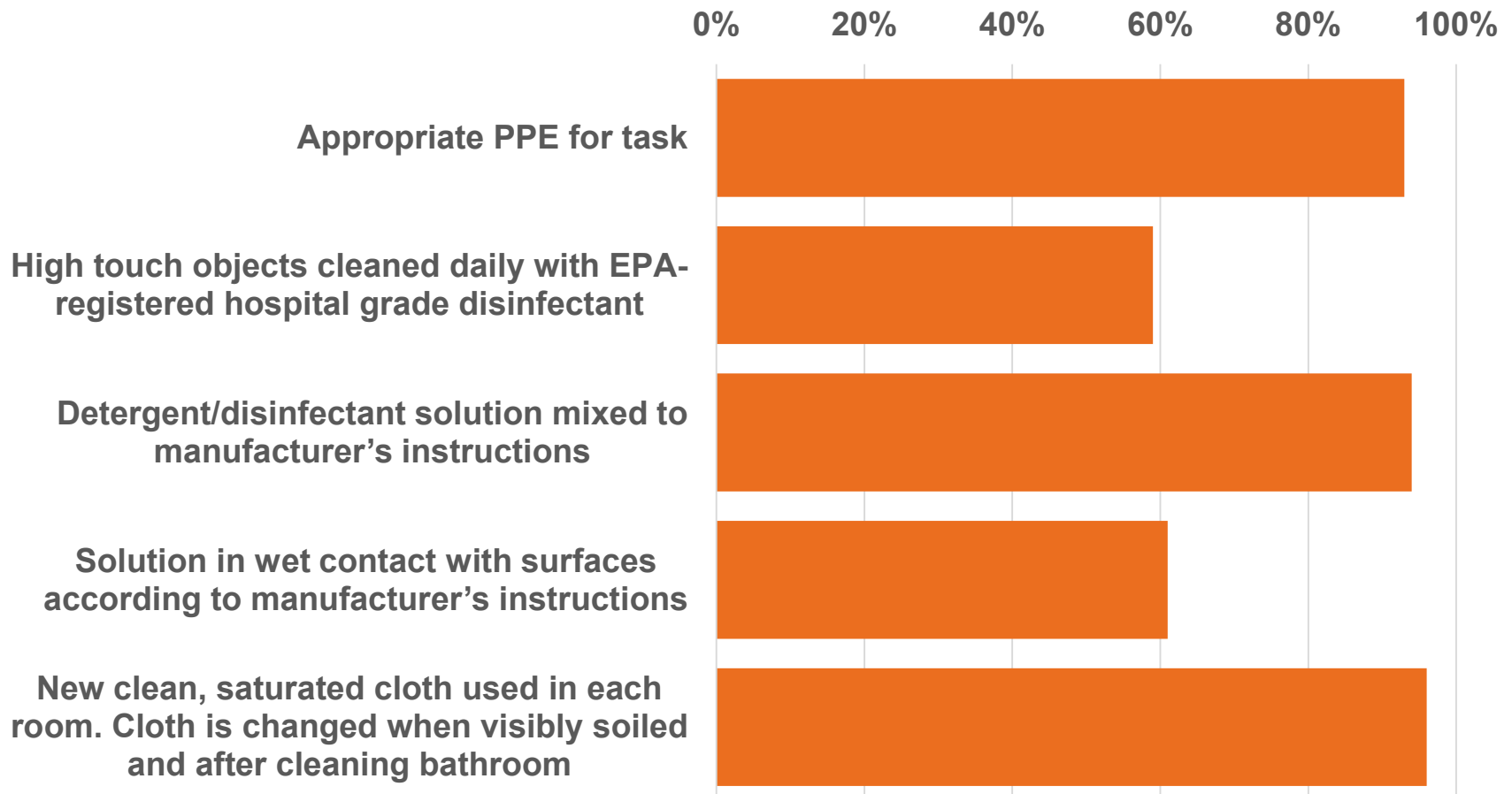
- Infection prevention policies are most likely in place
- Preventable HAI continue to occur in healthcare facilities
- Even if you have implemented evidence-based recommendations, **start monitoring infection prevention care practices to assess if adherence is consistent**

You won't know if you don't monitor!

Environmental Services at Skilled Nursing Facilities



Environmental Services at Acute Care Hospitals



Keys to Improving Environmental Cleaning

- Ensure clean, saturated cloth used in each room
- Cloth is changed when visibly soiled and after cleaning bathroom
- Solution in we contact with surfaces according to manufacturers instruction
- Detergent/disinfectant solution mixed to manufactures instructions



Healthcare-Associated Infections Program Adherence Monitoring Environmental Cleaning and Disinfection

Assessment completed by:

Date:

Unit:

Regular monitoring with feedback of results to staff can maintain or improve adherence to environmental cleaning practices. Use this tool to identify gaps and opportunities for improvement. Monitoring may be performed in any type of patient care location.

Instructions: Observe at least two different environmental services (EVS) staff members. Observe each practice and check a box if adherent, Yes or No. In the column on the right, record the total number of "Yes" for adherent practices observed and the total number of observations ("Yes" + "No"). Calculate adherence percentage in the last row.

Environmental Cleaning Practices		EVS Staff 1	EVS Staff 2	EVS Staff 3	Adherence by Task	
					# Yes	# Observed
ES1.	The room is clean, dust free, and uncluttered.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
ES2.	Detergent/disinfectant solution is mixed and stored according to manufacturer's instructions.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
ES3.	Solution remains in wet contact with surfaces according to manufacturer's instructions.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
ES4.	Cleaning process avoids contamination of solutions and cleaning tools; a clean cloth is used in each patient area, and the cloth is changed when visibly soiled.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
ES5.	Environmental Services staff use appropriate personal protective equipment (e.g. Gowns and gloves are used for patients/residents on contact precautions upon entry to the contact precautions room.)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
ES6.	High-touch surfaces* are thoroughly cleaned and disinfected after each patient.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		

***Some examples of high touch surfaces:**

Bed rails	Chair	Room inner door knob/handle	PPE container(s)	Toilet bedpan cleaner
Tray table	Room sink	Bathroom door knob/handle	Bathroom sink	In-room medical carts
IV pole ("grab area")	Room light switch	Bathroom light switch	Toilet seat	In-room cabinets
Call button	TV remote	Bathroom handrails	Toilet flush handle	In-room computers/keyboards
Bedside table handle				

of Correct Practice Observed ("# Yes"): _____

Total # Environmental Services Observations ("# Observed"): _____

Adherence _____%

(Up to 15 Total)

(Total "# Yes" ÷ Total "# Observed" x 100)

If practice could not be observed (i.e. cell is blank), do not count in total # Observed.

HEALTHCARE-ASSOCIATED INFECTIONS (HAI) PROGRAM

Additional Resources: www.CDPH.ca.gov/HAI

Environmental Cleaning

Welcome to the California Department of Public Health (CDPH) Healthcare-Associated Infections (HAI) Program environmental cleaning in healthcare facilities web page. The purpose of this page is to answer questions and provide information on maintaining a clean and sanitary environment in healthcare facilities for patients, visitors and staff. Reducing bioburden in the environment decreases potential for transmission of harmful organisms. Information is presented as frequently asked questions (FAQ) with references and links to additional information. The initial content on this page will emphasize the importance of environmental cleaning for stopping the spread of *C. difficile* diarrheal infections (CDI).

Additional content will be added in the coming months. For questions, suggestions, or more information, please email HAIProgram@cdph.ca.gov.



Role of Environmental Surfaces in Disease Transmission



Effective Cleaning Strategies



Monitoring Cleaning

Emerging Cleaning Technologies

Whole-Room Disinfection Technologies

- Developed because adequacy of manual cleaning and disinfection is often suboptimal
 - Example, wet contact time is not always achieved
- “Touchless” or non-manual techniques can provide a higher level of disinfection or decontamination
- Types include
 - Hydrogen peroxide fogging (dry mist or vapor)
 - Ultraviolet light (continuous emitting or pulsed xenon-UV)
- Effective in stopping CDI outbreaks

<http://www.cadth.ca/sites/default/files/pdf/htis/nov-2014/RC0545%20Room%20Disinfection%20Final.pdf>

Caveats to Whole-Room Disinfection Technologies

- Whole room disinfection technologies cannot substitute for
 - good physical cleaning practices
 - high level compliance to hand hygiene
 - avoidance of cross-contamination
 - staff education and competencies
- Infection preventionist, industrial hygienist, and environmental services supervisors should determine if temporary relocation of patients is needed when disinfecting rooms
 - Need to assess cleaning procedures, chemicals used, safety issues

Summary

- A **properly cleaned care environment** is essential to prevent or contain HAIs
- **Preventing transmission of *Candida auris* is similar to other MDROs**
 - Use a sporicidal agent effective against *C. difficile*
- **Use of technologies** such as **microfiber, monitoring systems,** and **whole-room disinfection** after cleaning are increasingly becoming the community standard of care
- **Adherence monitoring with feedback of results to staff** can maintain or improve adherence

Questions?

For more information,
please contact any
HAI Liaison IP Team member.

Or email

HAIProgram@cdph.ca.gov