

Environmental Cleaning and Disinfection

Last Updated 2017

Basics of Infection Prevention
Healthcare-Associated Infections Program
Center for Health Care Quality
California Department of Public Health



Objectives

- Recognize the role of the environment in transmission of healthcare-associated infections (HAI)
- Understand best practices for cleaning patient/resident rooms
- Understand the role of technologies in cleaning and disinfection and monitoring effectiveness
- Discuss strategies to ensure effectiveness of cleaning and disinfection

Role of Environmental Surfaces in Disease Transmission

Contaminated Environmental Surface Leading to Patient/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

Evidence of Environment Playing a Role in Disease Transmission

- Admission to a room previously occupied by a colonized or infected patient is a significant risk factor for infection
- *C.difficile* acquisition
 - 11% of ICU patients admitted to a room previously occupied by a CDI patient developed CDI
 - 4.6% of ICU patients admitted to a room without a prior CDI positive occupant developed CDI

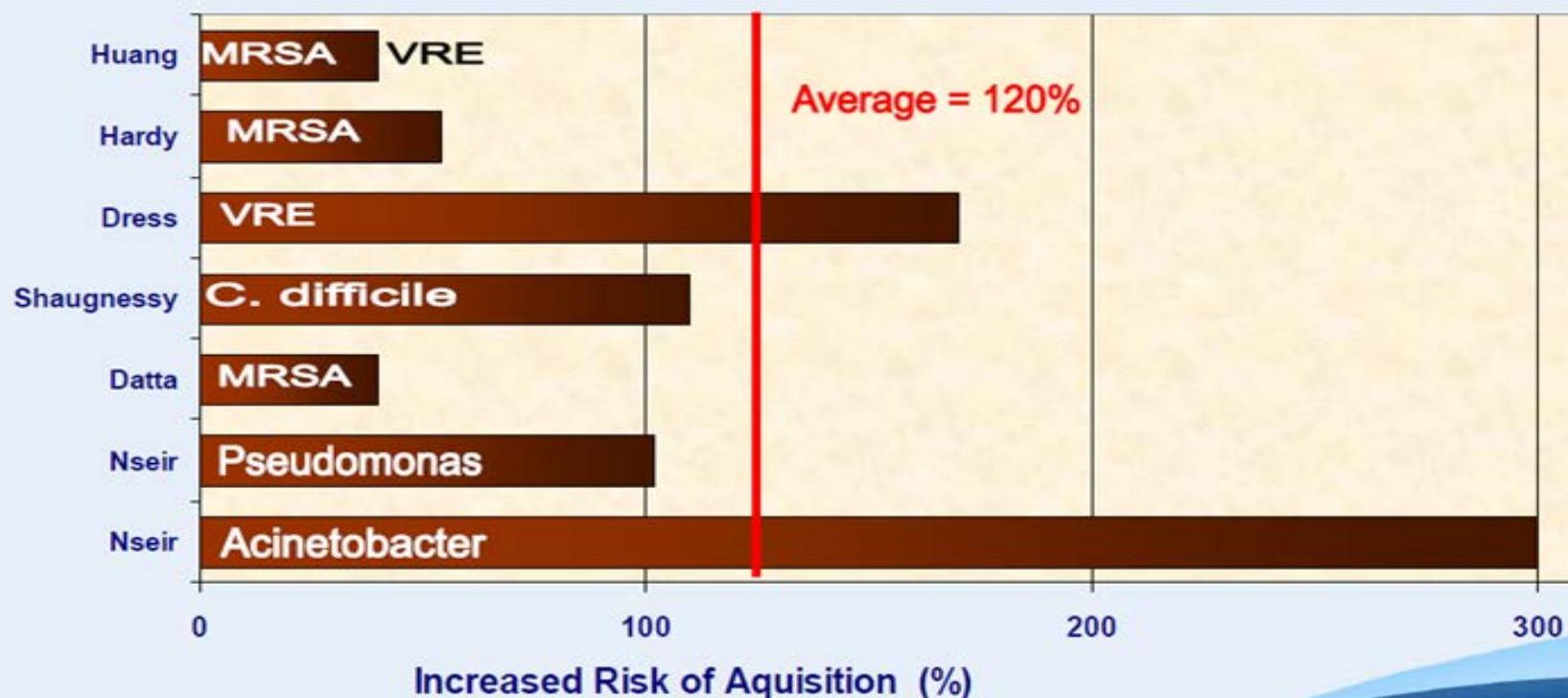
http://www.idse.net/download/HAI_IDSE13_WM.pdf

Weber DJ et.al. AJIC 2013

Shaughnessy et al. Infect Contr Hosp Epidemiol. 2011

Increased Acquisition Risk from Prior Infected Room Occupant

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



Linen

- New laundry technologies allow linen washing without requirements for hot water and chlorines
 - Hot water: 160°F x 25 minutes
 - Cold water: 71-77°F with 125ppm chlorine bleach rinse or equivalent detergent
 - Detergents not required to have stated antimicrobial claims
 - Follow manufactures instructions for use

CDC Guidelines for Environmental Infection Control in Health-Care Facilities

<https://www.cdc.gov/infectioncontrol/pdf/guidelines/environmental-guidelines.pdf>

Title 22, Division 5, Chapter 1, Article 8 §70825. Laundry Service

<https://govt.westlaw.com/calregs/Document>

Bedside Curtains

- Bacteria and fungi can survive on polyester, cotton, wool, and other fabrics
- Privacy curtains are considered high-touch surfaces and can become rapidly contaminated especially when used in transmission-based precautions isolation rooms
- Hands can become contaminated after handling curtains
 - Study found 50% of hands contaminated after handling curtains

Ohl et.al. Am J Infect Control. 2012

https://www.inspq.qc.ca/pdf/publications/1729_NoticeRecommCINQ_DividCurtainsInfectRisk.pdf

Koca et.al. Eurasian J Med. 2012

Floors and Carpets

- Non-carpeted floors
 - Disinfection of floors offers no advantage over regular detergent/water cleaning

Carpets

- Carpets have been shown to become contaminated
- Vacuuming and steam cleaning temporarily reduces the number of organisms
- Evidence linking carpets to HAI rates is limited; no recommendation against use

CDC. MMWR. June 6, 2003

The Inanimate Environment, Bennett & Brachman's Hospital Infections 6th Ed. 2014

Effective Cleaning Strategies

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 in policy 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

Cleaning *Before* Disinfection

- 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, less costly than disinfectant
- Disinfectant
 - Inhibit growth or kill microorganisms
 - More toxic, more costly than detergent

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

Chou. APIC Text of Infection Control & Epidemiology. 2013

Selection of Disinfectant

Consider

- Nature of the item to be disinfected
- Amount of organic soil present
- Number of microorganisms present
- Innate resistance of microorganisms to the inactivating effects of the germicide
- Type and concentration of germicide used
- Duration of germicide contact
- Other specific indications and directions for use

HICPAC /CDC 2003

Disinfectant	Strengths	Concerns
Quaternary Ammonium Products (Quats)	<ul style="list-style-type: none"> • Widely used • Bactericidal, fungicidal, and virucidal. Hospital-grade quats are tuberculocidal • Safe for computer keyboards 	<ul style="list-style-type: none"> • Hard water and cotton or gauze pads can reduce effectiveness • Generally not sporicidal • Occupational asthma documented
Phenolics	<ul style="list-style-type: none"> • Bactericidal, viricidal, fungicidal, tuberculocidal; not sporicidal at recommended dilution 	<ul style="list-style-type: none"> • Absorbed by porous materials, can irritate tissue • Unsafe for use in nurseries
Chlorine-based	<ul style="list-style-type: none"> • Have broad antimicrobial activity • Does not leave toxic residues • Inexpensive, fast acting • Removes dried organisms and biofilm 	<ul style="list-style-type: none"> • Can cause eye irritation and gastric burns • Inactivated by organic matter • Discolors fabrics • Wet contact time 10 minutes • Corrosive in high concentrations • Can release toxic chlorine gas when mixed with ammonia
Hydrogen peroxide, Accelerated H₂O₂	<ul style="list-style-type: none"> • Effective against a wide range of microorganisms • Bactericidal/virucidal at 30- 60 sec, fungicidal at 10 min • Low EPA toxicity rating 	<ul style="list-style-type: none"> • Expensive

EPA Label Claim for Disinfectant

- The EPA label claim states if the product is
 - Bactericidal
 - Virucidal
 - Tuberculocidal
 - Fungicidal
 - Sporicidal
- Clarifies manufacturer's instructions for use, including wet contact time required to achieve the desired degree of microbial killing

CDC. MMWR. Dec 19, 2003

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

Rutala et al. ICHE. 2014

Why is Bleach Used for *C. difficile*?

- *C. difficile* spores are difficult to kill and adhere to environmental surfaces for extended periods
- Use of a 1:10 dilution of bleach (500 ppm) for cleaning
 - Reduces surface contamination
 - Instrumental in outbreak control
- EPA list of alternate disinfectants with a label claim for killing *C. difficile* spores:

<http://www.epa.gov/oppad001/chemregindex.htm>

Hota. CID. 2004.
CDC. MMWR. Dec 19, 2003
Rutala et al. Clinical Micro

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](#)
- 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 all staff in infection prevention
- Change perception that hand hygiene is to protect staff -> hand hygiene is to protect the patient/resident
- Orient EVS staff thoroughly to infection control principles and practices prior to starting work in a clinical area

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

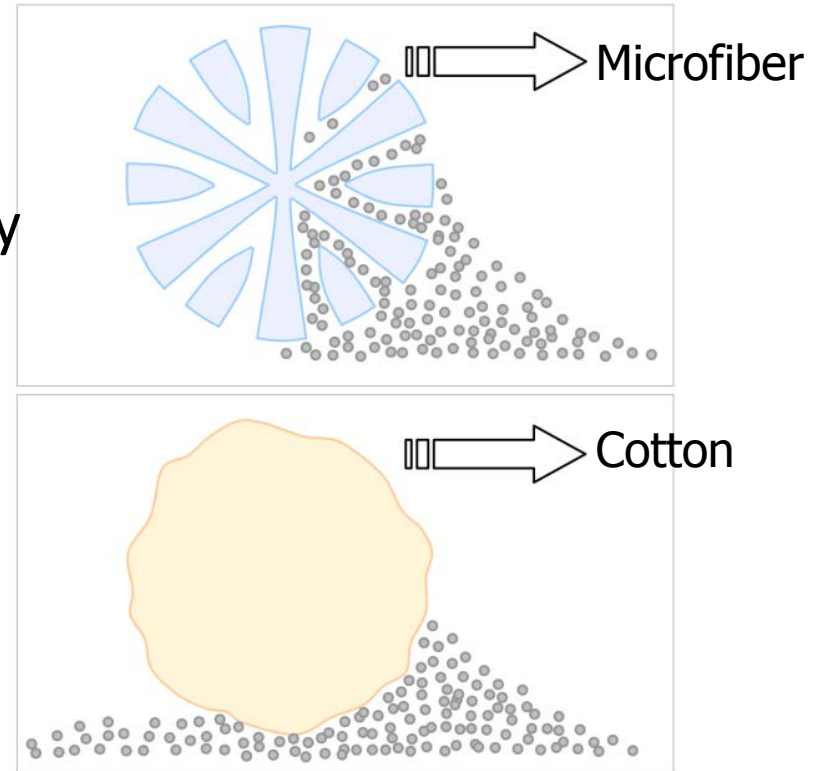
PPE for Cleaning

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

Tomas et al. JAMA Int Med. 2015

Microfiber vs. Cotton

- Microfiber 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.



UC Davis Case Study. Nov 2002; Trajtman. AJIC. 2015;
Smith. J Hosp Infect. 2011; HICPAC/CDC 2008

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 HAIs

MMWR. 2003

Chou . APIC Text of Infection Control and Epidemiology. 2013

Monitoring the Thoroughness of Cleaning

How Do You Know 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

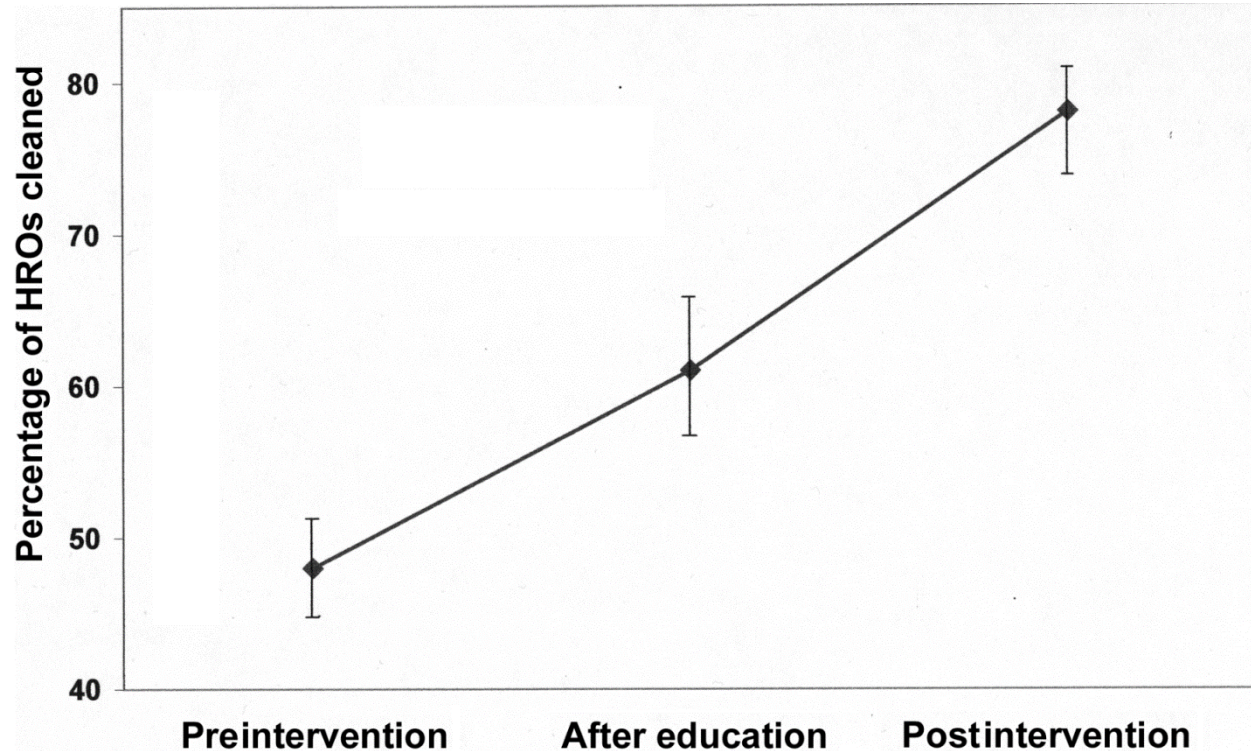
Monitoring Cleaning (continued)

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

Emerging Cleaning Technologies

Whole-Room Disinfection Technologies

- Developed because adequacy of manual cleaning and disinfection is often suboptimal
 - e.g., 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 needed when disinfecting rooms
 - Need to assess cleaning procedures, chemicals used, safety issues

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

Monitor Adherence

- CDPH HAI Program developed a tool to monitor adherence of cleaning practices
<http://www.cdph.ca.gov/programs/hai/Pages/AdherenceMonitoringTools.asp>

Adherence Monitoring Tool-Environmental Cleaning

Environmental Cleaning Practices	EVS Staff 1		EVS Staff 2		Adherence by Task	
	Yes	No	Yes	No	# Yes	# Obs
Detergent/disinfectant solution is mixed according to manufacturer's instructions.	Yes	No	Yes	No		
Solution remains in wet contact with surfaces according to manufacturer's instructions.	Yes	No	Yes	No		
A new clean, saturated cloth is used in each room. The cloth is also changed when visibly soiled and after cleaning the bathroom.	Yes	No	Yes	No		
Environmental Services staff use appropriate personal protective equipment (<i>e.g. Gowns and gloves are used for patients/residents on contact precautions upon entry to the contact precautions room.</i>)	Yes	No	Yes	No		
Objects and environmental surfaces in patient care areas that are touched frequently* are cleaned and then disinfected when visibly contaminated or at least daily with an EPA-registered disinfectant.	Yes	No	Yes	No		
# Yes _____ # Observed _____ #Yes/#Observed = % Adherence _____ %						

Summary

- A **properly cleaned care environment** is essential to prevent or contain HAIs
- A **surface must be physically cleaned before it can be disinfected**
- **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

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

Reprocessing of Reusable Medical Equipment

Last Updated 2017

Basics of Infection Prevention
Healthcare-Associated Infections Program
Center for Health Care Quality
California Department of Public Health



Objectives

- Discuss appropriate reprocessing of reusable medical equipment and devices (disinfection and sterilization)
- Review examples of non-critical, semi-critical, and critical devices
- Identify determinants for low, intermediate, and high level disinfection
- Discuss methods for sterilizing instruments

Terminology

- Cleaning: removal of debris (e.g., dirt, food, blood, saliva); reduces the amount of organic matter that contributes to proliferation of bacteria and viruses
- Disinfection: removes most organisms present on surfaces that can cause infection or disease
- Sterilization: Killing or removal of all organisms

Cleaning, Disinfection, and Sterilization in Healthcare Settings

- Health care devices and equipment are designated
 - Non-critical
 - Semi-critical
 - Critical
- Categories determine level of reprocessing required

Spaulding's classification system

Non-Critical Devices

- In contact only with intact skin
- Require intermediate- or low-level disinfection
- Examples
 - Blood pressure cuffs
 - Stethoscopes
 - Durable mobile patient equipment

Semi-Critical Devices

- In contact with non-intact skin or mucous membranes
- Require **high level disinfection** or sterilization
- Examples
 - Bronchoscopes
 - GI endoscopes
 - Vaginal ultrasonic probes
 - Respiratory therapy equipment
 - Anesthesia equipment

Critical Devices

- Enter sterile tissue or the vascular system
- Require sterilization
- Examples
 - Surgical instruments and accessories
 - Biopsy forceps
 - Cardiac and urinary catheters
 - Implants

Cleaning Medical Instruments and Devices

- Disinfection or sterilization cannot be achieved without cleaning first
 - Organic material dilutes disinfectants
 - Bioburden must be reduced for processes to be effective
- Clean all medical instruments and devices by
 - Removing visible soil
 - Disconnecting or separating instrument parts
 - Avoiding organic material drying on equipment by rinsing or soaking in an enzymatic solution

Personal Protection

When cleaning soiled medical instruments, wear:

- Long-sleeved impervious gowns
- Eyewear
- Mask or mask with face shield
- Gloves
- Cap
- Chemical goggles (when mixing or changing solution)

Disinfecting Medical Devices

- Disinfection eliminates or kills most bacteria, many virus types, some fungi (not prions)
- Cannot be accomplished without first cleaning
- Time-dependent process
- High, intermediate, and low levels of disinfection
- Must use EPA-approved disinfectant products
 - Product must have a tuberculocidal label claim

Low-Level Disinfection

- For non-critical devices and equipment (e.g., blood pressure cuffs, stethoscopes, patient care equipment)
- EPA-approved products for low-level disinfection include
 - Quaternary ammonium compounds (QUATS)
 - Phenolic compounds
 - Iodophor
- Ensure achievement of dilution and contact or “wet” time requirements

CDC Guideline for Disinfection and Sterilization, February 15, 2017

Intermediate-Level Disinfection

- For non-critical and some semi-critical devices and equipment
- EPA-approved products for intermediate-level disinfection include
 - Alcohols
 - Aldehydes
 - Chlorine compounds
 - Iodophor
 - Peracetic acid
 - Hydrogen Peroxide
 - Phenolic
- Ensure achievement of dilution and contact or “wet” time requirements

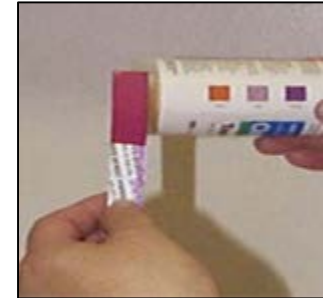
High-Level Disinfection

- For semi-critical devices and equipment (e.g., scopes)
- EPA-approved products for high-level disinfection include
 - Gluteraldehyde
 - Ortho-phthaldehyde (OPA)
 - Peracetic acid
 - Hydrogen peroxide
- Ensure achievement of temperature requirements

CDC Guideline for Disinfection and Sterilization, February 15, 2017

High-Level Disinfection - 2

- Test disinfectant product prior to each use
 - Can get diluted with frequent use
 - Follow facility policy
 - Test strips expire; monitor dates
- Change product as indicated by test and as manufacturer requires
- Maintain monitoring results log
- Ensure competency of staff



Endoscopes and Bronchoscopes

- 14.4 million gastrointestinal endoscopic procedures are performed annually in the U.S.
 - Including 500,000 ERCPs ¹
- From 2013-2015, 69 CRE infections related to duodenoscopes
 - 13 deaths may have been partially attributable to the infection that developed after exposure to the scope²
- **Adequate reprocessing** requires
 - **Competency of personnel** performing process
 - Cleaning process
 - Minimum high-level disinfection

Endoscopy-Associated Infections

- More healthcare-associated outbreaks are associated with endoscopes than any other medical device
 - Outbreaks often associated with disinfection process failures
- Scopes acquire high levels of contamination with use (bioburden) due to high bacteria levels in areas explored

Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008
https://www.cdc.gov/hai/pdfs/disinfection_nov_2008.pdf

Bronchoscopy-Associated Infections

Evidence of transmission of pathogens from inadequately processed bronchoscopes including:

- *Mycobacteria* resistant to many disinfectants
- *Pseudomonas aeruginosa* (problematic MDRO)

Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008
https://www.cdc.gov/hai/pdfs/disinfection_nov_2008.pdf

Endoscope Reprocessing

Perform steps in order. Do not skip steps!

1. Clean

- Remove debris and tissue which can impede the disinfection process
- Flush all lumens (water & enzymatic cleaner)

2. Disinfect

- Perfuse high-level disinfectant through all channels

Endoscope Reprocessing - 2

Perform steps in order. Do not skip steps!

3. Rinse all channels

- Use sterile or filtered water
- Follow with alcohol rinse

4. Dry

- Force air through all channels

5. Store

- Hang vertically in a closed cabinet to promote drying and avoid recontamination

Factors Leading to Outbreaks from Endoscope and Bronchoscope Contamination

- Contaminated water supply
- Contaminated brushes for cleaning scope lumens
- Improper manual cleaning prior to disinfection
- Biofilm inside automatic washer
- Improper use of automatic washer
- Contaminated or expired disinfection reagent
- Inability or neglect to clean the suction channel
- Mechanical or design issues related to the endoscope/bronchoscope



Reprocessing Duodenoscopes

- Duodenoscopes are used for endoscopic retrograde cholangiopancreatography (ERCP) procedures

To reprocess

- Inspect and manually clean the elevator mechanism
 - Perform in open/raised and closed/lowered positions
- Ensure that all channels of the scope and elevator mechanism are thoroughly dried before storage

Interim Protocol for Healthcare Facilities Regarding Surveillance for Bacterial Contamination of Duodenoscopes after Reprocessing

<https://www.cdc.gov/hai/pdfs/cre/interim-duodenoscope-surveillance-Protocol.pdf>

Essential Elements of a Reprocessing Program for Flexible Endoscopes

<https://www.cdc.gov/hicpac/pdf/flexible-endoscope-reprocessing.pdf>

Reprocessing Duodenoscopes

- Culture ERCP scopes to ensure effectiveness of reprocessing
 - See CDC suggested algorithm
 - Take remedial action if a scope is culture-positive for high concern organisms or if unacceptable colony counts of low-concern organisms

Interim Protocol for Healthcare Facilities Regarding Surveillance for Bacterial Contamination of Duodenoscopes after Reprocessing

<https://www.cdc.gov/hai/pdfs/cre/interim-duodenoscope-surveillance-Protocol.pdf>

Essential Elements of a Reprocessing Program for Flexible Endoscopes

<https://www.cdc.gov/hicpac/pdf/flexible-endoscope-reprocessing.pdf>

Sterilization

Achieved by

- Steam
- Dry Heat
- Ethylene Oxide
- Peracetic Acid
- Plasma Gas (vaporized hydrogen peroxide)
- Glutaraldehyde (using higher concentrations and exposure times than for high-level disinfection)



Steam Sterilization by Autoclave

- Achieves rapid heating and penetration
 - Short exposure times (<20 minutes) but temperature must be maintained throughout
 - No toxicity to workers
 - Inexpensive
 - Can damage delicate instruments

Steam Sterilization by Autoclave - 2

- Items to be sterilized must be:
 - Clean and free of protein or other organic material
 - Packaged so that the steam can penetrate
- Autoclave must be loaded correctly

Rapid Cycle or Flash Sterilization

- Unwrapped steam sterilization
- Should only be used when **absolutely** necessary
 - **Do not flash whole trays of instruments**
 - Items must be used immediately
 - Avoid flash sterilization by keeping adequate supply of frequently dropped items
- Maintain records or “flash logs”
 - Include all implants
 - Requires same monitoring processes as routine steam sterilization in hospital
 - Use to support need for additional instruments

Monitoring Sterilization

- **Mechanical** indicators
 - Gauges, displays, printouts
 - Indicates if device working properly
 - Not indicator of sterility
- **Chemical** indicators
 - Change color with timed exposure to heat, steam
 - Used to show items have gone through sterilization process
 - Not indicator of sterility



Monitoring Sterilization - 2

- **Biological** indicators
 - Demonstrates bacterial spores on test strips or in vials/containers have all been killed
 - Indicator of sterility

Storage of Sterile Items

- Protect sterility until ready to use
 - Store to protect packages from dust, moisture, falling on floor
 - Transport only covered, dry packages
 - Handle to protect package integrity
 - Refrain from crushing packages or rubber-banding them for storage
 - Wrap sharp points in gauze

Storage of Sterile Items - 2

- Rotate sterile items: first in, first out
- Store and label for effective recall system
- Expiration date versus event-related sterilization
 - Needs a program flex from L&C



Are Reusable Medical Devices and Equipment Reprocessed Appropriately in YOUR facility?

- Educated, competent reprocessing staff
- Devices properly cleaned before disinfection/sterilization
- Use of appropriate PPE
- Low, intermediate, and high-level disinfectants used according to manufacturers instructions
- Sterile packages stored appropriately

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

Adherence Monitoring Tools- Device Reprocessing

HEALTHCARE-ASSOCIATED INFECTIONS (HAI) PROGRAM

Monitoring Adherence to Health Care Practices that Prevent Infection



Device Reprocessing

Many areas of the healthcare facility may be performing device reprocessing. These adherence monitoring tools may be used in any area where device reprocessing, or high-level disinfection or sterilization of reusable devices are performed. Select the monitoring tool that best applies to the reprocessing area being observed.

- [Device Reprocessing Adherence Monitoring Tool \(PDF\)](#)
- [High-Level Disinfection of Reusable Devices Adherence Monitoring Tool \(PDF\)](#)
- [Sterilization of Reusable Devices Adherence Monitoring Tool \(PDF\)](#)
- [CDC Guideline for Disinfection and Sterilization in Healthcare Facilities \(PDF\)](#)
- [FDA regulations on reprocessing of single-use devices](#)

CDPH Adherence Monitoring tools: cdph.ca.gov/hai

Summary

- Be aware of all locations performing sterilization and disinfection (e.g., radiology, outpatient clinics, GI department, emergency room, cardiac cath lab, same day procedures, wound care center, ambulatory surgery)
- Ensure staff competency in appropriate reprocessing upon hire and annually
- Perform periodic adherence monitoring of reprocessing practices and provide feedback to staff
- Adherence monitoring tools available at: cdph.ca.gov/hai



Addressing Other Infection Hazards in the Health Care Environment

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Objectives

- Identify and address other infection hazards in the health care environment
- Discuss the importance of a multidisciplinary team
- Review steps of an environmental assessment
- Discuss importance of heating, ventilation, and air conditioning (HVAC) requirements in patient care areas
- Discuss impact of water systems in infection prevention
- Review infection prevention risk assessment and mitigation during construction

Many Disciplines Care for the Environment

- Facilities engineering
- Employee health
- Bio-medical
- Clinical engineering
- Safety
- Security
- Environmental services
- Administration
- Linen/laundry
- Construction
- Sterile processing
- Materials management

Environmental Assessment

- Tour all areas at least annually
- Tour clinical areas twice a year
- Opportunity for multidisciplinary, multifunctional, multipurpose inspection
 - Life Safety
 - Environmental Services effectiveness
 - Infection Control issues
 - Clinical Issues
 - Patient Safety
 - Utility Management
- Required for accreditation by The Joint Commission

Environmental Assessment - 2

Look for:

- Federal Environmental Protection Agency (EPA) disinfecting products
- Disinfectants readily available where equipment disinfection is being performed and used per manufacturers directions
- Standard and transmission-based precautions followed
- Regular cleaning and dusting (high and low)
- Environmental services carts kept clean and locked when unattended



Search EPA website by product name

www.epa.gov/pesticide-registration/selected-epa-registered-disinfectants

Environmental Assessment - 3

Sharps containers

- Place appropriately (i.e., not too high, not directly under glove box or electrical outlet)
- Secure
- Change when $\frac{3}{4}$ full
- Replace regularly
- User friendly
- Safety devices accessed prior to disposal



Environmental Assessment - 4



Medical (biohazardous) waste

- Contain in covered, leak-proof container with biohazard symbol
- Store separately from other waste, in red bags
- May contain sharps containers, pharmaceutical waste, and pathology waste
- Store on-site for no longer than 7 days
 - 90 days if stored at 0°C, temperature; log required
 - High heat treatment prior to disposal or incineration
- Ensure signage on rooms where biohazardous materials are contained or stored

Environmental Assessment - 5

Hand hygiene areas

- Adequate in number and evidence of use
- Adequate soap, paper towels, trash cans
- Alcohol hand rub at or near appropriate room entrances and in patient rooms
- Placement of alcohol-based hand rubs dispensers in compliance with fire code
 - Seek assistance from facilities engineering or safety officer

National Fire Protection Association, www.nfpa.org
American Society for Healthcare Engineering , www.ashe.org

Environmental Assessment - 6

Medical equipment reprocessing areas

- Ensure appropriate cleaning, decontamination, disinfection, and sterilization
- Staff training, competency, and certification
- Quality control (e.g., biological indicators, test strip, time logs)
- Appropriate reprocessing area
 - Separate areas for cleaning and decontamination, packaging, sterilization, storage of sterile supplies
 - Air flow from clean to soiled areas
 - Temperature and humidity per regulations

Heating, Ventilation, and Air Conditioning (HVAC)

Filtration

- Describes removal of particles from air
- Minimum efficiency reporting value(MERV)

Pressure Relationships (positive or negative)

- Describes the movement of air between the room and the corridor

Room type	ACH/ <u>hr</u>	Pressure
Operating Room	15	Positive
Airborne isolation	12	Negative
Patient room	6	Negative

Heating, Ventilation, and Air Conditioning (HVAC) - 2

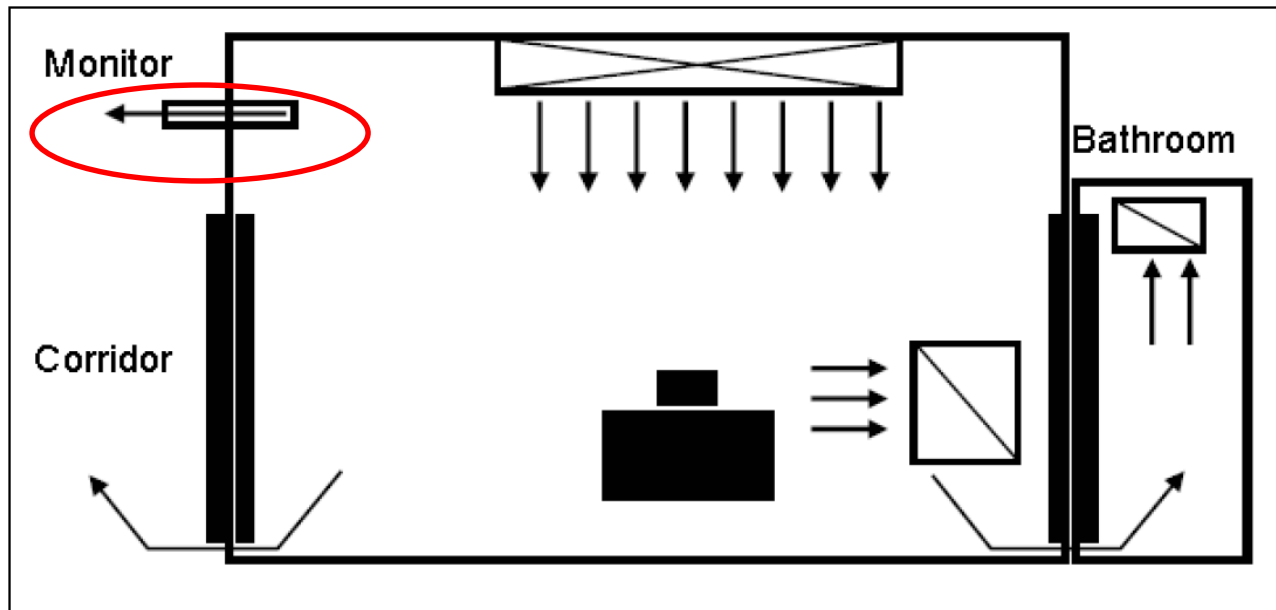
Air Changes

- Describes movement of air to dilute air contaminants
- Air can either be moved and filtered in the room or exhausted to the outside
- Requirements for air changes per hour (ACH) differ by room type and use

Room type	ACH/ <u>hr</u>	Pressure
Operating Room	15	Positive
Airborne isolation	12	Negative
Patient room	6	Negative

Positive Air Pressure

- Air moves **out** of the room
- Includes: operating rooms, C-section suites, protective environments (e.g., bone marrow transplant unit)

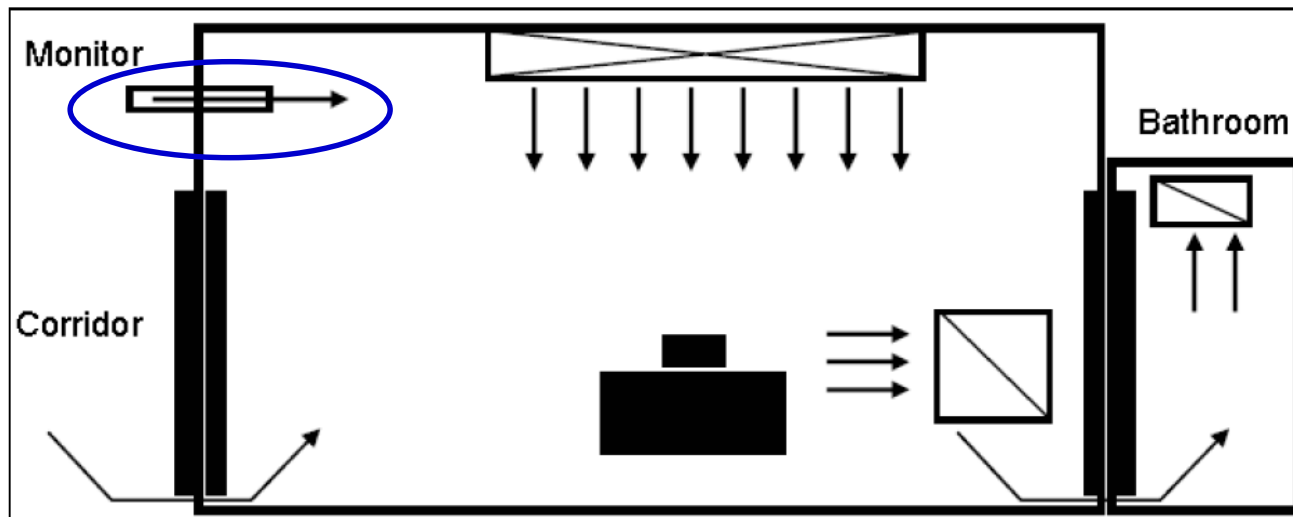


CDC/HICPAC Guidelines for Environmental Infection Control in Healthcare Facilities, 2003

<https://www.cdc.gov/infectioncontrol/guidelines/environmental/index.html>

Negative Air Pressure

- Air moves **into** the room
- Includes: airborne infectious isolation rooms (AIIR), areas where coughing may be induced (e.g., bronchoscopy suite, endoscopy suite, sputum induction room)



CDC/HICPAC Guidelines for Environmental Infection Control in Healthcare Facilities, 2003

<https://www.cdc.gov/infectioncontrol/guidelines/environmental/index.html>

HVAC Maintenance

- Belts, filters, and other moving parts should have scheduled inspection and maintenance
- Monitor for negative pressure daily when airborne infectious isolation rooms are in use
 - Establish policy and procedure
 - Must have component of manual testing if room occupied
 - Document and report to Infection Control Committee
 - Plan for when readings/results are not within desired range
- All patient care areas scheduled frequent inspections
- Vents, grates, and air ducts should be periodically cleaned

Water Systems and Infection Prevention

- Stagnant water allows formation of biofilms
 - Contain fungi, gram-negative bacteria, legionella, other organisms
 - Infrequently used fixtures are more prone
- Flush and clean sinks, eyewash stations, ice machines regularly
- Do not use tap water to rinse semi-critical devices after disinfection
- Remove aerators from faucets
- Avoid decorative fountains/ waterfalls
- Monitor dialysis fluid and dialysate monthly
 - Pathogen limits are: <200 bacteria/ml for fluid
< 2000 bacteria/ml dialysate

Flood Response

Policies and procedures should

- Define roles of multidisciplinary response team
 - Environmental services
 - Maintenance/engineering
 - Construction company
 - Consulting disciplines
 - Infection prevention
 - Safety
 - Define what constitutes a flood
 - Identify first responders, escalation determinants, who reports to local public health, who determines when its safe to go back into affected space
-
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Infection Prevention During Construction

- Provisions must be made for protection of patients and staff during renovations or new construction due to
 - Generation of moderate to high levels of dust
 - Infection Risk to vulnerable patients from aerosolized organisms (e.g., aspergillosis)

CDC/HICPAC Guidelines for Environmental Infection Control in Healthcare Facilities, 2003
<https://www.cdc.gov/infectioncontrol/guidelines/environmental/index.html>

Infection Prevention During Construction - 2

- Ensure facility-wide awareness of construction process
- Educate patient care staff on risks, mitigation strategies
- Mitigation strategies determined by:
 - Patient risk (as determined by care area)
 - Construction activity level

CDC/HICPAC Guidelines for Environmental Infection Control in Healthcare Facilities, 2003
<https://www.cdc.gov/infectioncontrol/guidelines/environmental/index.html>

Infection Control Risk Assessment (ICRA) for Construction

- Develop risk assessment process to monitor and evaluate renovation and construction projects
 - Include all stakeholders in the evaluation process
- Define responsibilities for assessment, monitoring, enforcement, and evaluation of projects in policy
- Determine who keeps copies and where ICRA will be filed (e.g., safety department)
- Report status to infection control committee

Environmental Assessment of Construction Areas

For long-term projects, include:

- Containment barriers made of fire-rated wallboard supported with stud frame
- Sealed edges of construction area
- Door installed opening into the work area
- Daily rounds by construction supervisor
- Copy of the ICRA posted at the construction site

Risk Categories by Patient Care Areas

- Low Risk
 - Office areas, dining hall
 - Medium Risk
 - Cardiology, echocardiography, endoscopy, nuclear medicine, physical therapy, radiology, respiratory therapy
 - High Risk
 - ICU, ED, labor and delivery, specimen labs, nursery, outpatient surgery, pediatrics, pharmacy, PACU, surgery units
 - Highest Risk
 - Burn unit, cardiac cath lab, sterile central supply, ICU, medical units, oncology, operating room, any area for immunocompromised patients
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Risk Categories by Construction Activity Type

- A. Non-invasive activities and inspection
- B. Small scale, short duration activities, create minimal dust
- C. Generates moderate to high levels of dust, requires demolition, or removes fixed building components or assemblies
- D. Major demolition and construction projects

APIC Infection and Prevention Manual for Construction and Renovation

Mitigation Activities Determined by Construction Type and Patient

- Once the risk has been assessed by patient care area (Low risk to Highest risk)
and
- The risk by construction activity has been determined (A-D),
then
- Determine appropriate prevention measures to ensure patient and staff safety (Class I-IV)*

Sample ICRA and Construction Permit:

<http://www.premiersafetyinstitute.org/wp-content/uploads/ICRA-MatrixColorRevised-091109.pdf>

Summary

- Engage with directors of environmental services, sterile processing, operating room, endoscope services, facilities management
- Ensure adherence to policies and procedures related to infection prevention for HVAC, water management, and construction projects

Questions?

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

Or email

HAIProgram@cdph.ca.gov