Role of the Environment

The Role of the Environment in the Transmission of Infections

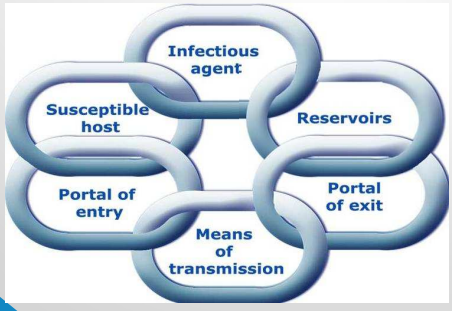
Infection Prevention & Control
Boot Camp For Long-Term Care Facility
Infection Preventionists

Objectives

At the conclusion of this presentation, participants will be able to:

- Understand the role the environment plays in infection prevention
- Discuss the IP's role in conducting Environmental Rounds
- Explain the differences between cleaning and disinfection terminology and practices
- Describe which environmental surfaces are considered “high touch”
- Discuss the role of the environment in transmission of healthcare-associated infections (HAIs)
- Review management of Infectious waste
- Discuss proper handling of linen

Chain of Infection



Role of the Environment

Is There a Link between HAI Acquisition and Environmental Contamination?

Patients admitted to rooms previously occupied by patients with Methicillin-resistant *Staphylococcus aureus* (MRSA), Vancomycin-resistant *Enterococcus* (VRE), *Acinetobacter baumanii* are at risk of acquiring organisms from the environment[1,2,3]

1. Huang S, et al. Risk of acquiring antibiotic-resistant bacteria from prior room occupants. Archives of Internal Medicine 2006;166:1945-1951.
2. Hardy KJ, et al. A study of the relationship between environmental contamination with methicillin-resistant staphylococcus (MRSA) and patients' acquisition of MRSA. 2006 Infection Control Hospital Epidemiology;27 (02):pp 127-132
3. Sexton T, et al. Environmental reservoirs of methicillin-resistant staphylococcus aureus in isolation rooms: correlation with patient isolates and implications for hospital hygiene. 2006 Journal of Hospital Infection; 62 (02): pp 187-194

Summary of Survival Time Versus Prior Room Occupancy Risk for HAI Acquisition[5]

Organism	Survival Time	Prior Room Occupancy Risk Increase
MRSA	7 days to >12 months	1.5
Vancomycin-Resistant *Enterococcus* (VRE)	5 days to >46 months	2.25
Pseudomonas aeruginosa	6 hours to >16 months	1.75
Clostridium difficile	>5 months (spores)	2.5
Acinetobacter baumanii	3 days to 11 months	3.5
Carbapenem-resistant *Enterobacteriacea* (CRE)	19 days	
Norovirus	6 to 60 days	Limited data

5. Chemaly RF, et al. The role of the healthcare environment in the spread of multidrug resistant organisms: update on current best practices for containment. Therapeutic Advances in Infectious Disease. 2014 June;2(3-4):79-90 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4232378/

Role of the Environment[7]

- Residents shed microorganisms into the health care environment through coughing, sneezing, and diarrhea[7]
- Designation of what is considered the "environment" differs depending on the nature of the healthcare setting[7]

7. Joseph A. Health promotion by design in Long-term care settings. Published by The Center for Health Design, August 2006. http://www.healthdesign.org/sites/default/files/Health_Promotion_Design_LTC_0.pdf

Role of the Environment

Role of the Environment[7] (continued)

- Different environments: areas which may be considered as "patient environment[7]"
  - Long-term Care[7]
    - Bed space, and bathroom, and personal mobility devices, and dining areas
  - Acute care[7]
    - Inside the curtain of the resident's room and bathroom
  - Mental health[7]
    - Bed space, shared space (group rooms, dining areas, common showers and bathroom)

Environment of Care[4]

- Clear responsibilities
  - What to clean
  - When to clean
  - Who is responsible for the cleaning
  - How to clean
  - What to use
    - Equipment and chemicals
- Sustaining and Validation
  - Objective measurement of cleaning and disinfection

4. Schweon S, Bursdall D, Greene D, et al. 2013. APIC. Infection preventionist's guide to long-term care. Chapter 10: pp 153-171.

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What to Clean

- Dedicated equipment
  - Items that remain in resident's room
- Shared equipment
  - Moveable medical equipment
  - "Orphan" equipment
- High touch areas[8]
  - Bed rails
  - Call light
  - Telephone
  - Bedside table
  - Over bed table
  - Light switches
  - Door handles
  - Sinks
  - Around toilet area
  - Bathroom sink

8.Minnesota Hospital Association. Environmental Services Cleaning Guidebook. "Controlling CDI" Project. www.mnhospitals.org/Portals/0/Documents/ptsafety/CDICleaning/4.%20Environmental%20Services%20Cleaning%20Guidebook.pdf

Environment of Care[4]

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When to Clean and Responsibility

- When to clean
  - Daily room cleaning process
  - Daily room cleaning – isolation rooms
  - Terminal room cleaning process
    - Bed or room is no longer occupied
    - Discontinuation of isolation
  - Intensified interventions[4,10]
    - During outbreaks
    - Clean rooms more than once a day when needed
- Who is responsible for the cleaning
  - Nursing staff or housekeeping
  - Training required
  - Competencies

Role of the Environment

Environment of Care[4]

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How to Clean – General Principles[4]

- **Clean** surfaces before **disinfecting**
- Select appropriate products for the surface to be cleaned and the organism to be targeted
  - Always follow manufacturer's recommendations for use
- If preparing solutions, e.g., mixing bleach with water, do so in a clean container
  - Follow manufacturer's instructions for proper mixing, diluting, reconstituting, etc.
  - Make sufficient solution for daily cleaning
  - Discard after 24 hours

How to Clean – General Principles[4] (continued)

- Change cleaning solutions (e.g., water in bucket) at a minimum of every 3 rooms and whenever needed
- Determine proper order of cleaning
  - Clean from clean areas to dirty
  - Change mop heads according to policy
- Change cleaning rags/cloths with each resident
  - Use separate cloths for restroom areas

Role of the Environment

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What to Use

- Equipment needed
  - Cloths
  - Mops
  - Buckets
  - Proper storage
- Chemicals
  - Cleaning versus disinfecting
  - Appropriate for use
  - Proper dilution or constitution
  - Proper storage of all chemicals
  - Safe and proper use of chemicals

Microfiber or Cotton[11]

- Microfiber has densely made synthetic strands
- Microfiber attracts dust, cleans 50% better than comparable cotton cloth
- Microfiber is easier to use, lighter, and designed for repeat usage
- In a study from UC Davis, microfiber was initially more costly than cotton, but cleaned better, used less water and chemicals, and decreased labor cost

11 UC Davis pioneers use of microfiber mops in hospitals. June 23, 2006. www.ucdmc.ucdavis.edu/publish/news/newsroom/2329.

Role of the Environment

Chemicals

Select the right product

- Cleaning versus disinfecting
- Selecting which chemicals to use and when
  - Appropriate chemicals to address the targeted organisms
- Dwell time (contact time, wet time, kill time)
- Compatible with surfaces – will not harm

Chemicals (continued)

- Accessibility
  - Provides point-of-care disinfection
  - Concentrated or ready-to-use
- Safe and pleasant for staff and residents
  - Non irritating to eyes, skin or respiratory tract
  - Pleasant odor
- Cost

Let's Understand Terminology[6]

Sanitize	Sterilize
Sanitization is the process whereby the number of microbes are reduced to a safe level For inanimate surfaces	**Sterilization** is the process whereby ALL microorganisms are inactivated or killed
Clean	**Disinfect**
Cleaning is the process of removing visible soil, proteinaceous material, microorganisms and other debris from surfaces, crevices and lumens of instruments & equipment	**Disinfection** is the process which destroys pathogenic and other types of microorganisms (thermally or chemical) Considered less lethal that sterilization Does not necessarily destroy all microbial forms (i.e., spores)

6. Rutala WA, Weber R, et al. Guideline for disinfection & sterilization in Healthcare facilities. 2008.. http://www.cdc.gov/hicpac/pdf/guidelines/disinfection_nov_2008.pdf

Role of the Environment

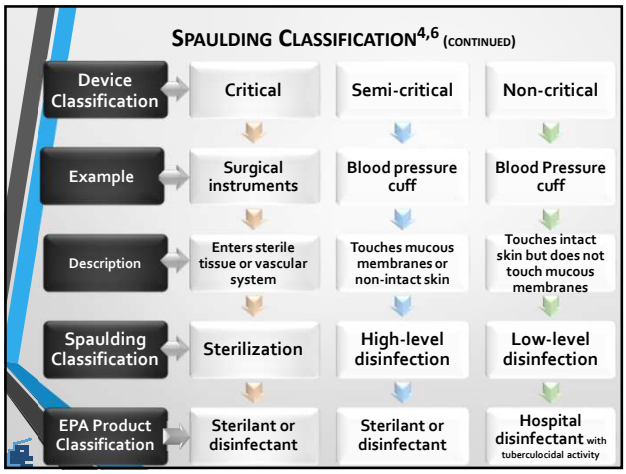
Spaulding Classification[4,6]

- Dr. Earle Spaulding devised this classification system in the 1970s
- Categories according to degree of risk of infection
- Level of disinfection depends on intended use of the item

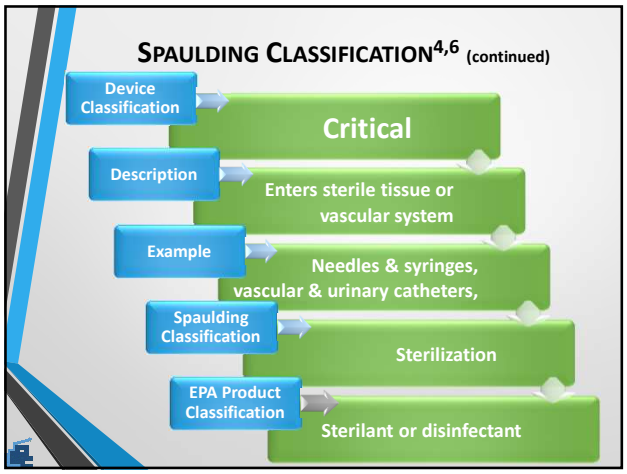
Spaulding Classification[4,6] (continued)

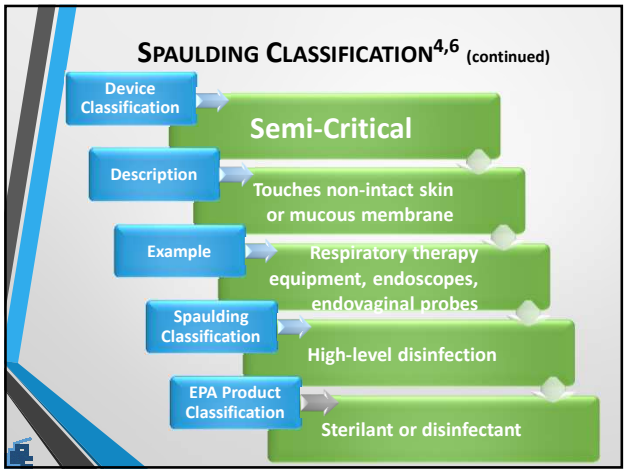
Device Classification	Spaulding Classification	EPA Product Classification
Critical • Enters sterile tissue or vascular system	Sterilization • Sporicidal chemical • Prolonged contact	Sterilant/ disinfectant
Semicritical • Touches mucous membrane or non-intact skin	High-level disinfection • Sporicidal chemical • Short contact	Sterilant/ disinfectant
Noncritical • Touches intact skin but not mucous membranes • Divided into non-critical patient care items and non-critical environmental surface items	Intermediate-level disinfection Low level disinfection	Hospital disinfectant with tuberculocidal activity

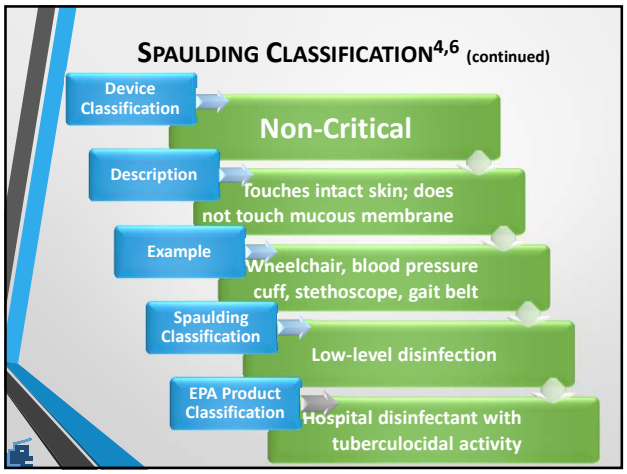
Spaulding Classification[4,6] (continued)



Role of the Environment



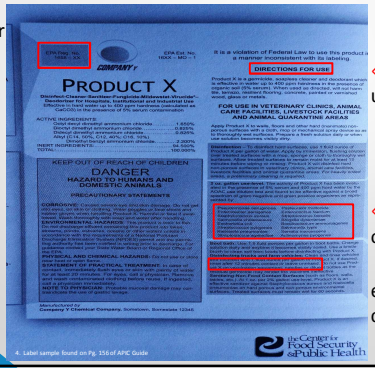




Role of the Environment

How to Read a Label

Check for EPA ⇨ approval number



⇦How to use product

⇦Targeted organisms

⇦Check each label for contact time

How to Read a Label

Check ⇨ for EPA approval number

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Disinfectants[4]

Disinfectant	Use	Advantage	Disadvantage
Alcohol	Disinfect small surfaces Disinfect thermometers, stethoscopes, & external surfaces of some equipment	Tuberculocidal, and kills bacteria, virus and fungi Fast acting easy to use, no toxic residue	Not EPA registered Not sporicidal, affected by organic material, flammable
Chlorine	Disinfect environmental surfaces (floors & counters) 1:10 sodium hypochlorite solution used for blood spills and kills spores	EPA registered Broad spectrum bacteriocidal, viricidal & fungicidal Fast acting with no toxic residue	Corrosive to metals Inactivated by organic materials Discolors fabrics Must be mixed freshly daily
Hydrogen Peroxide	Disinfects inanimate objects Can be used for spot-disinfecting on fabrics	EPA registered Bactericidal, virucidal, fungicidal, sporicidal Fast acting Not affected by organic material Stable and non corrosive Non staining Lowest EPA toxicity category	Can be more expensive than other low level disinfectants Contact with eyes causes severe damage May be incompatible with some materials including brass, zinc, copper & nickel/silver

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Role of the Environment

Disinfectants[4]

Disinfectant	Use	Advantage	Disadvantage
Iodophors	More commonly used as antiseptic Used to disinfect blood culture bottles & hydrotherapy tanks	Bactericidal, mycobactericidal, and virucidal	Not sporicidal Prolonged contact time needed to kill fungi Damages silicone catheters Not suitable for hard surface disinfection
Quarternary Ammonium Compounds	Cleans disinfects floors, walls, & furnishings Can be used to disinfect medical equipment that comes into contact with intact skin	EPA registered Bactericidal, fungicidal, virucidal against enveloped viruses Surface compatible	Not sporicidal, tuberculocidal, or virucidal against non-enveloped viruses Poor mycobacteria activity Affected by organic material Documented reports of asthma caused by exposure to benzalkonium chloride

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New Technologies[4]

- Hydrogen peroxide vaporization (HPV)
  - Uses hydrogen peroxide (H_2O_2) vapors which is dispersed by a machine
- Ultraviolet (UV) light
  - This technology uses a mobile unit for decontaminating an unoccupied room (inhibits replication of organisms)
- Hydrogen peroxide aerosolization
  - Generates a fine mist by aerosolizing a solution containing 5% H_2O_2 (considered a fogging process by EPA)
- Antimicrobial-coated surfaces
  - Use of copper or silver coating (impregnating hard surfaces)

Don't Forget

- Items that are used for more than one resident require disinfection in between each use[4]
  - Blood pressure cuffs and machines
  - Stethoscopes
  - Glucometers
  - Gait belts and lift slings

- Check for appropriate products for soft surfaces and refer to manufacturer's recommendations for disinfection[4]
- For isolation residents, dedicate non-critical care items[4]

Role of the Environment

Questions to Ask

- Which disinfectants to use and when?
- Who is responsible for cleaning?
- Which areas to clean first?
- Contact time for chemicals?
- Proper storage of cleaning items and chemicals?
- Proper mixing of chemicals?
- Process for
  - Daily room cleaning?
  - Terminal room cleaning?
  - Isolation room cleaning?
- Intensified interventions[4,10]

Safety Data Sheets[9] (SDS)

- Maintain SDS book on all chemicals used which communicate the hazards of chemical products used[9]
- Make available to all staff (bilingual, if needed)
- Educate staff on correct usage of these data sheets
- Ensure all disinfectant dispensing containers are appropriately labeled
  - With manufacturer's label – **not hand written**
- Ensure staff stores all chemicals safely

Microsoft clipart Office 2013

9. Occupational Safety and Health Association. Hazard Communication Safety Data Sheets. https://www.osha.gov/Publications/osha3514.html

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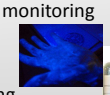
Role of the Environment

Sustaining and Validation[4]

- Sustaining
  - Provide frequent opportunities for training
  - Monitor practices of housekeeping often
    - Direct observation: visual assessment, observation of performance of each housekeeper, and resident/family satisfaction survey
  - Provide checklists for monitoring documentation
- Validation
  - Environmental marking
    - Fluorescent marking



Take Away Points

- The environment plays a significant role in transmission of infection
- Always clean before disinfecting
  - Disinfection will not be effective if organic material is not removed first
- Effective cleaning and disinfection requires appropriate product and good practices
- Environmental services (EVS) must be monitored regularly in order to sustain effective EVS program
- Validate the training given to keep EVS program at its best!

Linen[10]

- Soiled linen
  - All soiled linen should be treated as if it were infectious
  - No need for having special barrels for isolation rooms
  - Linen should be washed at temperatures of 160°F or low temperature washing at 71-77° F plus 125 parts-per million (ppm) of chlorine bleach rinse
  - Laundry hampers should be located close to the point-of-use (no further than 20 feet away from resident room)
- Clean linen
  - Handle clean linen with newly washed hands
  - Stored in a clean, covered closet or cart
  - Do not leave linen on the floor, tabletops or chairs

Role of the Environment

Slide from Employee – ? Biohazardous?

Infectious Waste

According to OSHA's Bloodborne Pathogens Standard 29 CFR 1910.1030, infectious waste is[13]:

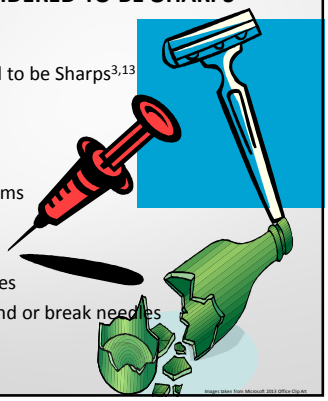
- Liquid or semi-liquid blood or potentially infectious materials
- Contaminated items capable of releasing blood if compressed
- Contaminated sharps
- Pathological and microbiological wastes
- Other Potentially Infectious Materials (OPIM) including:
  - All body fluids including secretions and excretions (except sweat) are considered to be infectious waste, i.e., semen, vaginal secretions, etc.

13.Medical Waste Management Act. https://www.cdph.ca.gov/certlic/medicalwaste/Documents/MedicalWaste/2013/MWMARealign-2016.pdf.

Slide from Employee

What are considered to be Sharps[3,13]

- What are considered to be Sharps[3,13]
  - Needles
  - Scalpels, lancets
  - Syringes
  - Needleless systems
  - Broken glass
- Handling of sharps
  - Use safety devices
  - Never recap, bend or break needles



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Infectious Waste

Storage[13]:

- Sharps – rigid, puncture-proof container, labeled
  - Locked
  - Appropriate placement of containers
- Non-sharps – red bag
- Covered barrel
- Locked room
- Incinerated or taken by a licensed company

Role of the Environment

Slide from Employee

Sharps Disposal[3]

- Use proper sharps disposal containers
- Dispose only sharps into containers
- Do not remove needles from sharps containers – or any inappropriate contents
- Do not overfill sharps containers
- Change when container is ¾ full

Slide from Employee

Red Bagging

Biohazardous red bags

- Are to be used:
  - When there is copious amounts of red liquid blood[13]
- Are **NOT** to be used for:
  - MDRO dressings unless saturated with blood[13]
  - Tubing, IV's, ostomy bags, catheters, linen, etc.[13]

Construction and Renovation

- Participate in any construction or renovation projects
  - Planning phase
  - Active construction phase
  - Education
  - Appropriate barriers
  - Placement of
    - Sinks, soap, paper towels
    - Hand sanitizer/ alcohol-based hand rub (ABHR)
    - Sharps disposal containers
    - Trash cans, biohazardous waste

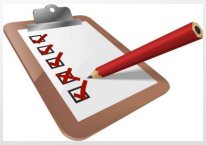
Role of the Environment

Other Facility Environmental Issues

- Water
  - Outage or planned water shut-off
- Leaks or floods
  - Water
  - Sewage
- Water cooling towers
- HVAC (heating, ventilation, air conditioning) system

Environmental Rounds

- Conduct routinely
  - Formal or informal
  - Team or solo
  - Photos or notes
- Check list
- Reporting
- Follow-up
- Check list example



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9. Occupational Safety Hazard Association. Hazard Communication Safety Data Sheets. https://www.osha.gov/Publications/OSHA3084.html
10. Cahill C, et al. California Department of Public Health. 2010. Enhanced Standard Precautions http://www.cdph.ca.gov/programs/hai/Documents/ESPforLTCFacilities_2010.pdf
11. www.ucdmc.ucdavis.edu/publish/news/newsroom/2379. UC Davis pioneers use of microfiber mops in hospitals. June 23, 2006.

Questions?