INFECTION TRANSMISSION IS A CONTACT SPORT

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DISCLOSURE

• I am a paid employee of the clinical team of PDI Healthcare. The content of this presentation is not representative of the views of PDI or its ownership.

• There will be NO discussion of any PDI products and/or solutions in accordance with CE Requirements.

• Presentation will incorporate best practices from a variety of information sources that bridge medical disciplines.

AFFILIATIONS

• Member of the Association for Professionals in Infection Control and Epidemiology (APIC)
  Member of APIC Southern Nevada and APIC Sierra chapters

• Member of the Northern Nevada Infection Control (NNIC) network

• Member of the Infusion Nurses Society (INS)

• Member and Industry partner of the Association for Vascular Access (AVA)
PROGRAM OBJECTIVES

• Understand the role of surface disinfection in healthcare today
• Describe recommendations for special pathogens
• Discuss current disinfection & prevention technology and factors to consider when choosing disinfectants

IS INFECTION TRANSMISSION A CONTACT SPORT?

Patient(s) contaminate surfaces or medical equipment
Environmental surfaces/inanimate objects are reservoirs (fomites)
Healthcare workers contact contaminated surface & patients
Environmental Contamination + Poor Hand Hygiene
Contributes to the spread of resistant pathogens

THE DIRTY DOZEN

Kitchen Sink  Women’s purse
Airplane bathrooms  Playgrounds
Wet laundry  Health club (mats/machines)
Public drinking fountains  Your bathtub
Shopping cart handles  Office telephone
ATM buttons  Hotel Room Remote
HIGH TOUCH SURFACE CLEANING EVALUATION

Figure 1. Overall percentage of high risk objects determined to have been cleaned in each of the 23 acute care hospitals.


FREQUENCY OF WORKER CONTACT OF CONTAMINATED ENVIRONMENTAL SURFACES


WHAT DOES THIS MEAN TO YOU?
EPA CATEGORY - DISINFECTANTS

**DISINFECTANT:** an agent that destroys or irreversibly inactivates infectious or other undesirable bacteria, pathogenic, or viruses, but not necessarily bacterial spores, on surfaces or inanimate objects

- EPA registers three types of disinfectant products based upon submitted efficacy data

**LIMITED DISINFECTANT:** Agent limited to either gram-positive or gram-negative microorganisms.

- Example: Pine oil toilet bowel products effective against gram-negative bacteria

**GENERAL OR BROAD SPECTRUM DISINFECTANT:** Agent that is effective against both gram-positive and gram-negative bacteria

- Most household disinfectants and disinfectants for swimming pools and water purifiers

EPA CATEGORY - DISINFECTANTS

**HOSPITAL DISINFECTANT:** An agent effective against:
- Gram negative organism (Salmonella choleraesuis)
- Gram positive organism (Staphylococcus aureus)
- Pseudomonas aeruginosa

Contains certain claims that it destroys or eliminates all forms of microbial life in the inanimate environment, including all forms of vegetative bacteria, bacterial spores, fungi, fungal spores, and viruses

- Used in all healthcare facilities

**Virucide claim**: product must be effective against specific virus the company wishes to list on label

**Tuberculocide claim**: product must be effective against a Mycobacterium that EPA accepts as a surrogate for the actual tuberculosis bacterium

**Fungicidal claim**: product must be effective against Trichophyton mentagrophytes

EPA CATEGORY - DISINFECTANTS

**SANITIZER:** Agent that reduces, but does not necessarily eliminate, the microorganisms in the inanimate environment to levels considered safe by public health codes or other regulations

- EPA registers many sanitizers i.e., non food contact surfaces, food contact surfaces
- Performance standard for food contact surfaces is 99.999% (5-log reduction) within 30 sec
- Performance standard for non-food use sanitizer is 99.9% (3-log) reduction in 5 min
KILL CLAIMS VS. CONTACT TIMES

**KILL CLAIM:** Defined when a disinfectant product is tested to have 100% efficacy against a specific organism at a determined contact time; and the testing data has been accepted by the EPA

**Bridging of Data for Label Claims – What does this mean?**
Similar product application

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**CONTINUED**

• **Contact Time:** The time needed for the germicide solution to remain wet on the surface to achieve disinfection of the stated kill claims on the manufacturer’s label

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**MECHANISM OF ACTION - DISINFECTANT**

**SURFACE DISINFECTANTS**
- Disinfectants typically have a positive charge
- Gram-negative bacteria typically have a negative charge

Disinfectant is drawn to the bacteria

Disinfectant then...
- Attacks and adsorbs through the cell wall
- Disrupts the cell membrane which release potassium ions and other cell components

Results in cell death
"Disinfect noncritical surfaces with an EPA-registered hospital disinfectant using the label’s safety precautions and use directions. Most EPA-registered hospital disinfectants have a label contact time of 10 minutes. However, many scientific studies have demonstrated the efficacy of hospital disinfectants against pathogens with a contact time of at least 1 minute. By law, the user must follow all applicable label instructions on EPA-registered products. If the user selects exposure conditions that differ from those of EPA-registered products label, the user assumes liability for any injuries resulting from off-label use and is potentially subject to enforcement action under FIFRA".


**INFLUENCING FACTORS FOR DISINFECTION EFFICACY**

- Cleaning of object
- Bioburden (organic or inorganic load present)
- Type and level of organism contamination
- Concentration of product
- Exposure time
- Nature of object
- Temperature and relative humidity

**DISINFECTANTS USED IN HEALTHCARE**

- Phenolics
- Quaternary ammonium compounds
- Iodophors
- Alcohols
- Chlorine and chlorine compounds
- Combination e.g., Alc/Quat
- Hydrogen peroxide

Disinfectants are not interchangeable. Select an appropriate disinfectant for any item and use.

Caution: some disinfectants may cause respiratory breathing problems (e.g. chlorines)
APPROACH TO DISINFECTION AND STERILIZATION

Spaulding’s Classification: >30 yrs old

• **CRITICAL ITEMS**: High risk of infection – sterile tissue
• **SEMI-CRITICAL ITEMS**: Contact with mucous membranes or non-intact skin
• **NON-CRITICAL ITEMS**: Contact with intact skin (environmental disinfection; inanimate objects)

LEVELS OF DISINFECTION

• **STERILIZATION**
• **HIGH-LEVEL DISINFECTION**: Expected to destroy all microorganisms except high numbers of bacterial spores
• **INTERMEDIATE-LEVEL DISINFECTION**: Inactivates *Mycobacterium tuberculosis*, vegetative bacteria, most viruses, most fungi.
• **LOW-LEVEL DISINFECTION**: Can kill most bacteria, some viruses, and some fungi, but cannot be relied on to kill resistant microorganisms such as tubercle bacilli or bacterial spores

APIC HIERARCHY OF PATHOGENS

Descending Order of Resistance to Germicidal Chemicals.

Rutala, W. APIC Guideline for Selection & Use of Disinfectants-1996
NEW CONCEPT FOR ORGANISM LIST

Prions
• Bacterial spores (C. difficile)
• Protozoan oocysts
• Helminth eggs
• Small, non-enveloped viruses (Norovirus)
• Mycobacteria
• Protozoan cysts
• Fungal spores
• Gram negative bacilli (Acinetobacter, ESBL E. Coli, KPC)
• Vegetative fungi and algae
• Large, non-enveloped viruses
• Gram positive bacilli (MRSA, VRE)
• Enveloped viruses

PATHOGENS OF CONCERN

VIRUSES

NON-ENVELOPED (non-lipid)
• Generally transmitted by fecal-oral route and contaminated fomites
• Sturdy
• Can withstand drying, effects of detergents, extremes of pH, and temperature
• Can withstand acid environment of stomach

ENVELOPED (lipid)
• Fragile (they require an intact envelop for infectivity)
• Must remain wet and are spread in:
  • Respiratory droplets, blood, mucus, saliva, and semen
  • Injection
  • organ transplants

VIRUSES

**NON-ENVELOPED (non lipid)**
- Norwalk Virus/Norovirus (*Caliciviridae*)
- Adenovirus
- Rhinovirus
- Rotavirus
- Enterovirus
- Hep A

**ENVELOPED (lipid)**
- Herpes Simplex
- HIV
- CMG
- Influenza
- Coronavirus
- Hep B, C
- RSV

VEGETATIVE BACTERIA

- MRSA
- VRE
- ESBL producing *E. Coli; Klebsiella pneumoniae*
- Carbapenem-Resistant *Enterobacteriaceae* (CRE)
- *Acinetobacter baumanii*
- *Pseudomonas aeruginosa*
- *E. Coli 0157:H7*

*Clostridium difficile*
INACTIVATION OF *C. DIFFICILE*

• *C. difficile* spores are more resistant than vegetative cells to commonly used surface disinfectants
• Environment may be an important source of *C. difficile* spores
• Three EPA-registered products specific for inactivating *C. difficile* spores
• **Recommendations:** Use of diluted sodium hypochlorite (1:10 dilution of bleach) in units with high endemic rates and outbreaks

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CLOSTRIDIA DIFFICILE (CONTINUED) 2008 EPA MANDATES

• EPA has determined all pesticide products that are registered for use against *C. difficile* must demonstrate efficacious performance against the spore form
• Vegetative form is not the organism of concern for infection control processes
• Efficacy testing performed on the vegetative form of the organism will not support a claim for *C. difficile* spores
• EPA notified manufacturers with vegetative label claims to remove these claims
• EPA has developed guidelines to address label claims for *C. difficile* spores

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CLOSTRIDIUM DIFFICILE

In units with **high rates of endemic** Clostridium *difficile* infection or in an **outbreak setting**, use dilute solutions of 5.25%–6.15% sodium hypochlorite (e.g., 1:10 dilution of bleach) for routine environmental disinfection.

➤ **Note that there are now EPA registered products available that have claims for *C. difficile* spores.**
CURRENT PRACTICE

- Clean noncritical medical equipment surfaces with a detergent/disinfectant.
- May be followed by an application of an **EPA-registered hospital disinfectant** with or without a tuberculocidal claim, in accordance with germicide label instructions
- **Do not use alcohol** to disinfect large environmental surfaces
- Clean and disinfect high-touch surfaces (e.g., doorknobs, bed rails, light switches, and surfaces in and around toilets in patients’ rooms) on a more frequent schedule than minimal-touch housekeeping surfaces.

2008 CDC Guidelines for Disinfection & Sterilization

CDC RECOMMENDATIONS

- **Clean noncritical medical equipment surfaces with a detergent/disinfectant.**
- **May be followed by an application of an EPA-registered hospital disinfectant** with or without a tuberculocidal claim, in accordance with germicide label instructions
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2008 CDC Guidelines for Disinfection & Sterilization

CDC RECOMMENDATIONS FOR SPECIAL ORGANISMS

- Thoroughly clean and disinfect environmental and medical equipment surfaces on a regular basis by using **EPA-registered disinfectants in accordance with manufacturers’ instructions**
- **Do not use high-level disinfectants** (i.e., liquid chemical sterilants) on environmental surfaces; such use is inconsistent with label instructions because of the toxicity of the chemicals
- **Use standard cleaning and disinfection** protocols to control environmental contamination with **antibiotic-resistant**, gram-positive cocci (e.g., MRSA, VRE) organisms.
AHE 2008 & 2012 PRACTICE GUIDELINES

• Establish cleaning checklists
• Disinfectants should be applied using pour bottles, not sprays.
• Never re-immersing cloth (cloth & bucket systems)
• Cotton decreases efficacy of Quats
• Establish who cleans what and how
  • EVS Staff
  • Nursing Staff
• Clean and disinfect as usual for C. diff and then disinfect high touch areas with bleach
• Understand which products are compatible with equipment
• Training (new hire, annual, as needed)

www.ahe.org

Approach to Emerging Pathogens

Disinfectant Selection
CURRENT DISINFECTANTS

- Quaternary ammonium compounds
- Quaternary/Alcohol formulations
- Sodium hypochlorite formulations (bleach)
- Phenolics
- Hydrogen Peroxide formulation(s)

**New Technology:** Accelerated Hydrogen Peroxide, UV Light, Copper, Silver

SELECTING DISINFECTANTS

A dilemma for Facilities
- Many types of equipment and end users
- Confusion about regulatory compliance (CMS, TJC)
- IC involvement in product and equipment selection?

Focus on Practice or Product or Both?
- Monitor Practices
- Education of staff and their involvement in prevention initiatives
- Who is responsible for cleaning/disinfecting environmental surfaces and equipment?

SELECTING DISINFECTANTS CONTINUED

- Should one disinfectant be used hospital-wide?
- Medical equipment specifying specific product to use (e.g., IV pumps, Patient Monitoring Equipment)
- Consider safety and precautionary factors
- Consider stability and shelf life of product
- Consider convenience and ease of use
GOING GREEN?

• Hospitals moving toward green initiatives
  − building materials
  − lighting
  − water usage (more efficient toilets, faucets)
• Insure “green” initiatives don’t inadvertently place infection control and prevention efforts at risk
• Green cleaners are “cleaners” – not approved for hospital disinfectant


NEW TECHNOLOGY

Copper and Silver impregnated materials:
• Lack of consensus on percentage required for effectiveness
• Has not been proven to reduce the incidence of HCAIs

Automated Room Disinfection Systems:
Aim is to improve disinfection, remove/reduce operator reliance, prevent increased risk from prior room occupant
✓ UV-C radiation: Use as an adjunctive disinfectant, does not show reproducible significant reduction of bacterial contamination to date, costly.
✓ Hydrogen Peroxide Vapor Aerosolization: Improves disinfection, costly, time consuming.

NEW TECHNOLOGY – UNANSWERED QUESTIONS

• Cleaning process before disinfection
• Room turnover
• Assessment
• Cost
• Responsibility
• Maintenance and Repair
• Lifespan


Destrez P. J Hospital Infect. 2012;82(1):68.
Improved thoroughness of cleaning results in:

- Decreased infections (improved patient outcomes)
- Decreased cost (HAIs often not reimbursable; 1 HAI equivalent to EVS FTE)
- Improved patient satisfaction (patients equate dirty rooms with poor care)
- Meets CMS/TJC requirements

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

**PRACTICE MONITORING**

Visual Assessment: Not a reliable indicator of surface cleanliness

Microbiological Methods: What are acceptable results (<2.5 CFUs/cm² pass?), costly, pathogen specific

ATP bioluminescence: Measures organic debris (alive & dead), does not detect viruses, each unit has own reading scale (<250-500 RLU), chlorine (bleach) gives false “zero” reading

Fluorescent Marker: Pre-placement of markers is time consuming, punitive, good teaching tool

**SUMMARY**

- The environment and fomites play a role in infection transmission thus a “contact sport”.

- Understanding the rules and regulations for surface disinfectants, kill claims, contact times and product labels is key to making good choices in selecting disinfectants.

- In dealing with problem pathogens, understand that it is important to focus on practices & products.


QUESTIONS

ADDED REFERENCES

- CDC Guidelines for environmental infection control in healthcare facilities. MMWR 2003;52(RR 10):1-42. Available at: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm