Medical Waste Management Refresher

in Collaboration with
Al-Essa Medical and Scientific Equipment Company

Decontamination, Antisepsis, Sterilisation

Kuwait University
Health Science Center
19 March – 23 March 2017
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Activities for the next week

Sunday March 19\textsuperscript{th}

Presentations – Cleaning and Disinfection/Disease Transmission
Journal articles!
Pipetting technique (Trolley Walk)/Donning Doffing PPE
Waste Management Review

Monday March 20\textsuperscript{th} – Wednesday March 23\textsuperscript{rd}

“Trolley Walk”
   Pipetting exercise
   Hand Hygiene
   How good is your cleaning technique? – Protein swabs
   Waste management review

Thursday March 24\textsuperscript{th}

Recap of events from the “Trolley Walk”

1. Team Competition – What do you remember from this past week?
2. Team competition Hand Hygiene Competition – Take 2!
Mika!

Quinnah!
Laser Protective Eyewear

Protective laser eyewear must always be Marked with Optical Density and Wavelength.

Must be worn anytime there is a Possibility of viewing the beam.

Must meet ANSI Z87.1 standards.

Is Not the Primary Line of Defense.
Vice President’s Office

Health, Safety & Environment

The Vice President Office for Health Sciences is keen on enhancing environmental health and safety at HSC through:

- HSC Medical Waste Management System
- Environmental and Occupational Health
- Facility Safety

Announcement:

**Announcement**
**Date:** April 2 - 4, 2017  
**Time:** 02:00 PM-06:00 PM  
**Venue:** AbdulRazzaq Auditorium, Faculty of Medicine, Jahraa, Kuwait University  
**Contact:** Dr. Wafa Aljumail  
Department of Microbiology,  
Faculty of Medicine Kuwait University  
University Tel: 2463-6515;  
Fax: 2533-2719; E-mail: wjajmal@hsceu.edu.kw  
**Speaker:** Professor Kamal Elhag, MD, DipBact, DipHIC,  
FRCPath Soba University  
Hospital Khartoum, Sudan Dr.
Risk Tolerance
SIMPLE DEFINITION OF RISK

Hazard = The Inherent Potential to Cause Damage (Physical / Biological)

Risk = The Actual Chances of Circumstances Occurring that the Hazard Will Cause Damage
Infectious agent

Susceptible host

Reservoir

Portal of entry

Portal of exit

Mode of transmission

Chain of infection
Decontamination

- **Encompasses:**
  - antisepsis, disinfection, decontamination, and sterilization
  - **Antisepsis**
    - chemical applied to living tissue that will control or arrest the growth of a microorganism
  - **Decontamination**
    - disinfection or sterilization of contaminated materials
Decontamination

- **Disinfection**
  - To free from infection, reduction of contaminant load to a safe level, does not imply total destruction of all microorganisms. Will not always destroy spores.

- **Sterilization**
  - The destruction of all forms of microbial life. Difficult to achieve (usually referred to a very low chance that a microbe survived).
Disinfection in Healthcare

- **High-Level Disinfection**
  - sporicidal/tuberculocidal (but used for shorter times than required for sterility). Equipment that will have invasive contact with patient.

- **Intermediate**
  - tuberculocidal (equipment that will contact mucous membranes of patient)

- **Low-level (kills vegetative bacteria)**
  - for non-critical equipment (no invasive contact)
Sterilants - Physical Methods

- Steam Autoclave
  - Steam under pressure --> moist heat
  - 121 C/250 F @ 15 psi for 30 - 60 minutes
- Dry Heat
  - 160 - 170 C/320 - 356 F for 2 - 4 hours
- Incineration
  - 2 stage burn, 1400 & 1800 F
Sterilants - Gases

- Formaldehyde gas
  - heat formalin to vaporize it (1 ml/ft$^3$)
  - heat paraformaldehyde (0.3 g/ft$^3$)
  - 2 hour exposure time required (8 hour or overnight contact period recommended)
  - can neutralize HCHO (toxic, suspect carcinogen) with ammonium bicarbonate
  - room temperature $\geq$ 70 F, %RH - $\geq$ 70%
Sterilants - Gases

- **Ethylene Oxide**
  - 400 - 800 mg/L
  - 35 - 60 C temperature, 30 - 60% RH
  - contact time up to 4 hours

- **Hydrogen Peroxide**
  - vaporize from 30% H2O2
Liquid Disinfectants

- Surface treatment or to treat liquid waste
- Inactivate by
  - coagulation, denaturation, lysis, enzyme inactivation
- Factors to consider:
  - temperature, humidity, pH
  - contact time, concentration
  - penetrability
  - presence of organic material
What comes to mind?
Liquid Disinfectants

Alcohol

- Ethanol, Isopropanol (70 - 85%)
  - requires presence of water for protein denaturation
- bactericidal (vegetative bacteria)
- virucidal (enveloped viruses)
- Not sporicidal
- Not as effective against non-enveloped viruses)
- flammable
- low BP, higher evaporation rate, difficult to get 10 minute contact time
What comes to mind?
Liquid Disinfectants

- Glutaraldehyde
  - stable in and stored in acid pH range
  - activated by adding sodium bicarbonate to elevate pH to $\geq 7.5$ (14 day shelf-life)
  - contact time (10 - 180 minutes)
  - sporicidal at longer contact times
  - sterility requires 6 - 10 hours
  - non-corrosive
  - effective in presence of organic material
What comes to mind?
Liquid Disinfectants

- Formaldehyde (4 - 8 %)
  - active in alkaline pH range, non-corrosive
  - effective in presence of organic material
  - diminished activity in colder temperatures
  - 10 - 30 minute contact time required
  - fixative (penetration rate of 8mm/24 hours in tissue specimens)
  - wide spectrum disinfectant
  - suspect carcinogen, toxic at low levels
What comes to mind?
Jospeh Lister / Carbolic acid
Liquid Disinfectants

- **Phenol (0.2 - 3%)**
  - Not sporicidal, not effective against non-enveloped viruses
  - Tuberculocidal, fungicidal, bactericidal
  - Not affected by presence of organic material
  - Hard water can affect effectiveness
  - Toxic, can be absorbed through skin (large spills to skin can be fatal)
What comes to mind?
Liquid Disinfectants

- Quaternary Ammonium Compounds (0.1 - 2%)
  - cationic detergents, very good cleaning agents
  - inactivated by organic material
  - bactericidal, algicidal, fungicidal, will destroy enveloped viruses
  - not tuberculocidal or sporicidal
  - low-level disinfectant
  - good for general surfaces and floors
  - very toxic to eyes (a few drops can lead to blindness)
What comes to mind?
Liquid Disinfectants

- Halogens - chlorine (0.01 - 5%)
  - wide spectrum of activity
  - acts rapidly at low concentrations (10 - 30 min.)
  - inactivated by organic material (use more)
  - will lose chlorine upon exposure to light/air
  - more cidal at low pH, good at lower temps.
  - very corrosive
What comes to mind?
Liquid Disinfectants

- Halogens - Iodine (0.47%, 75 - 1600 PPM)
  - inactivated by protein
  - 1600 PPM inactivates wide spectrum of agents
  - effective over wide pH range
  - tuberculocidal, sporicidal
  - corrosive, will stain, toxic, allergenic
  - Dilution issue - must follow recommended dilutions for iodophors (or iodophor may not be as effective)
Liquid Disinfectants

- Hydrogen Peroxide (3% - 25%)
  - stable, non-toxic, fast acting
  - 10 - 25% solutions are sporicidal
  - inactivated by organisms that produce catalase
Rank Order of Resistance to Disinfection

- Prions
- Protozoan cysts
- Bacterial spores
- Non-enveloped (hydrophilic) viruses
- Mycobacteria
- Fungal spores, fungi
- Vegetative bacteria
- Enveloped viruses (lipophilic)
Verification of Decontamination

- Autoclave tape
  - time/temperature/date records on chart
- Chemical indicators (diack melt pellets)
  - fuse if temperature reached for at least 1 second
- Biological Spore indicators
  - *Geobacillus stearothermophilus*
  - *Bacillus atrophaeus*
- Manifest for biomedical waste (incineration)
Spill Decontamination

- COVER
  - cover spill area with paper towels

- DISINFECT
  - slowly pour disinfectant around perimeter and into the center of spill area. 10-15 minute contact time.
  - Clean/disinfect surrounding areas

- CLEAN
  - absorb spill and paper towels and place in biohazard bag. Sharps placed in sharps container.

- DISINFECT
  - spray spill area with disinfectant, allow to air dry
The most important step in instrument reprocessing or surface management is….

Cleaning!!
Environmentally Transmitted Infections

- Healthcare workers and patients can be infected directly or indirectly from environmental sources
  - Sources can be air, fomites, instruments, or aerosols

Fomite: An inanimate object or substance capable of carrying infectious organisms and hence transferring them from one individual to another
### Environmental Sites Positive for MRSA in Endemic and Outbreak Situations

<table>
<thead>
<tr>
<th>Item or Surface</th>
<th>Mean %</th>
<th>Range %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor</td>
<td>34.5</td>
<td>9.0 – 60.0</td>
</tr>
<tr>
<td>Patient Gown</td>
<td>40.5</td>
<td>34.0 – 53.0</td>
</tr>
<tr>
<td>Bed Rails</td>
<td>27.0</td>
<td>1.0 – 60.0</td>
</tr>
<tr>
<td>Bed Linens</td>
<td>41.0</td>
<td>34.0 – 54.0</td>
</tr>
<tr>
<td>Overbed Table</td>
<td>40.0</td>
<td>18.0 – 67.0</td>
</tr>
<tr>
<td>Bathroom Door Knob</td>
<td>14.0</td>
<td>8.0 – 24.0</td>
</tr>
<tr>
<td>Room Door Knob</td>
<td>21.5</td>
<td>4.0 – 59.0</td>
</tr>
<tr>
<td>Furniture</td>
<td>27.0</td>
<td>11.0 – 59.0</td>
</tr>
<tr>
<td>Flat Surfaces</td>
<td>21.5</td>
<td>7.0 – 38.0</td>
</tr>
<tr>
<td>Sink Taps</td>
<td>23.5</td>
<td>14.0 – 33.0</td>
</tr>
<tr>
<td>Infusion Pump Button</td>
<td>19.0</td>
<td>7.0 – 30.0</td>
</tr>
</tbody>
</table>

Adapted from: Dancer SJ. The Lancet Infectious Diseases: epub 10/31/07
Antimicrobial Resistance And Emerging Pathogens

- Newly discovered pathogens or organisms that acquire antimicrobial resistance are usually erroneously assigned extraordinary resistance to commonly used disinfection and sterilization procedures.

- Examples: SARsCo-V, HIV, HBV, Ebola virus, Hantavirus, MDR-Tb, VRE, MRSA, VRSA
Drug Resistant Pathogens

- No correlation to drug resistance and resistance to disinfection
- Some organisms may develop tolerance at concentrations hundreds to thousand folds below use dilution
- Current protocols do not have to be altered; use products per manufacturer’s label or per laboratory protocols
Cleaning and Disinfecting of the Housekeeping Surfaces

- Clean on a regular basis to remove soil and dust
- Physical removal of microorganisms and organic soil is as important as the antimicrobial effect of the disinfecting agent
- Surfaces not touched frequently by hand (i.e., floors) in general care areas are cleaned and disinfected
- *This is controversial – routine disinfection of floors is not supported by epidemiology; lack of consensus among infection control staff and hospital epidemiologists BUT....*
Brief Report

Are hospital floors an underappreciated reservoir for transmission of health care-associated pathogens?

Abhishek Deshpande MD, PhD a,b, Jennifer L. Cadnum BS b,c, Dennis Fertelli BS b,c, Brett Sitzlar BS, MPH b,c, Priyaleela Thota MD b,c, Thriveen S. Mana MS, MBA b,c, Annette Jencon MT, CIC c, Heba Alhmidi MD c, Sreelatha Koganti MD c, Curtis J. Donskey MD b,d,*

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c Research Service, Cleveland VA Medical Center, Cleveland, OH
d Geriatric Research, Education, and Clinical Center, Cleveland Veterans Affairs Medical Center, Cleveland, OH

Key Words:
Clostridium difficile
Methicillin-resistant Staphylococcus aureus
Vancomycin-resistant enterococi

In a survey of 5 hospitals, we found that floors in patient rooms were frequently contaminated with pathogens and high-touch objects such as blood pressure cuffs and call buttons were often in contact with the floor. Contact with objects on floors frequently resulted in transfer of pathogens to hands.

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An Example on Why Instructions are so Important

- EPA-registered products labeled as “cleaner/disinfectants:”
  - Label clearly distinguishes between use of the product as a cleaner OR as a disinfectant
  - Level of soil, precleaned surface
  - Contact time
  - Surface is to remain WET for the full contact time
Clinical Contact Surfaces

Dentistry
Housekeeping Surfaces
General Cleaning Recommendations

- Use barrier precautions (e.g., heavy-duty utility gloves, masks, protective eyewear) when cleaning and disinfecting environmental surfaces

- Physical removal of microorganisms by cleaning is as important as the disinfection process

- Follow manufacturer’s instructions for proper use of EPA-registered hospital disinfectants

- Do not use sterilant/high-level disinfectants on environmental surfaces
Cleaning Clinical Contact Surfaces

- Risk of transmitting infections greater than for housekeeping surfaces
- Surface barriers can be used and changed between patients
  OR
- Clean then disinfect using an EPA-registered low- (HIV/HBV claim) to intermediate-level (tuberculocidal claim) hospital disinfectant
A Searchable Laboratory-Acquired Infection Database

David Gillum¹, Partha Krishnan², and Karen Byers³

Abstract
Published peer-reviewed accounts of laboratory-acquired infections (LAIs) are difficult to track and assess due to several underlying factors. Reports of LAI in peer-reviewed journals are recognized as “goal posts” for biosafety programs and may contain invaluable information for proactive steps to take to prevent a potential incident in the laboratory. Objectively reviewing published studies enhances prevention efforts and reinforces training by providing examples of LAI and associated procedures. In an effort to make this information more accessible, ABSA International has developed an online searchable database of peer-reviewed published LAIs. This article presents the questions included in the repository and discusses the need for consistency in the data being collected for LAIs. In addition, this article presents historical information leading up to the development of these questions, as well as the formalization of the online database of published LAIs.

Keywords
laboratory-acquired infection, ABSA International, training, prevention, infectious disease reporting
Cleaning and Disinfecting of the Housekeeping Surfaces

◆ Follow manufacturer’s instructions if using proprietary cleaners or disinfectants
  ◦ Use conditions (e.g., concentration, contact time)
◆ Clean and disinfect surfaces that are touched by hand on a frequent and regular basis
  ◦ Door knobs, light switches, bed rails
  ◦ Surfaces around the toilet
Minimize Glove “Misuse”

- Failure to remove or change contaminated gloves
- 18.3% (4/22) samples showed potential transferral of microorganisms [a = from patient, b = from gloves]


<table>
<thead>
<tr>
<th>No. of Contacts Before Sampling</th>
<th>Glove Cultures</th>
<th>Environmental Cultures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bacterial Counts (CFU)</td>
<td>Pathogenic Bacteria</td>
</tr>
<tr>
<td>6</td>
<td>4,500</td>
<td><em>P. aeruginosa</em> (a), <em>Serratia marcescens</em> (a)</td>
</tr>
<tr>
<td>10</td>
<td>&gt;30,000</td>
<td><em>P. aeruginosa</em></td>
</tr>
<tr>
<td>10</td>
<td>&gt;30,000</td>
<td><em>P. aeruginosa</em></td>
</tr>
<tr>
<td>17</td>
<td>&gt;30,000</td>
<td><em>P. aeruginosa</em></td>
</tr>
</tbody>
</table>
So Why All the Fuss About Hand Hygiene?

- *Most common mode of transferral of pathogens is via the hands!*
- Infections acquired in healthcare
- Spread of resistant microorganisms
Evidence of Relationship Between Hand Hygiene and Healthcare-Associated Infections

- Substantial evidence that hand hygiene reduces the incidence of infections
- Historical study: Semmelweis
- More recent studies: rates lower when antiseptic handwashing was performed
How to Handrub?

RUB HANDS FOR HAND HYGIENE! WASH HANDS WHEN VISIBLY SOILED

Duration of the entire procedure: 20-30 seconds

1a
Apply a palmful of the product in a cupped hand, covering all surfaces;

1b
Rub hands palm to palm;

2
Palm to palm with fingers interlaced;

3
Right palm over left dorsum with interlaced fingers and vice versa;

4
Backs of fingers to opposing palms with fingers interlocked;

5
Rotational rubbing of left thumb clasped in right palm and vice versa;

6
Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;

7
Once dry, your hands are safe.

8

World Health Organization
Patient Safety
SAVE LIVES
A World Alliance for safer health care
Clean Your Hands

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Hand Hygiene With Alcohol-Based Hand Rub: How Long Is Long Enough?

Daniela Pires, MD;1,2 Hervé Soule, PharmD;1 Fernando Bellissimo-Rodrigues, MD,PhD;1,3 Angèle Gayet-Ageron, MD,PhD;1 Didier Pittet, MD,MS1

BACKGROUND. Hand hygiene is the core element of infection prevention and control. The optimal hand-hygiene gesture, however, remains poorly defined.

OBJECTIVE. We aimed to evaluate the influence of hand-rubbing duration on the reduction of bacterial counts on the hands of healthcare personnel (HCP).

METHODS. We performed an experimental study based on the European Norm 1500. Hand rubbing was performed for 10, 15, 20, 30, 45, or 60 seconds, according to the WHO technique using 3 mL alcohol-based hand rub. Hand contamination with E. coli ATCC 10536 was followed by hand rubbing and sampling. A generalized linear mixed model with a random effect on the subject adjusted for hand size and gender was used to analyze the reduction in bacterial counts after each hand-rubbing action. In addition, hand-rubbing durations of 15 and 30 seconds were compared to assert non-inferiority (0.6 log10).

RESULTS. In total, 32 HCP performed 123 trials. All durations of hand rubbing led to significant reductions in bacterial counts (P < .001). Reductions achieved after 10, 15, or 20 seconds of hand rubbing were not significantly different from those obtained after 30 seconds. The mean bacterial reduction after 15 seconds of hand rubbing was 0.11 log10 lower (95% CI, −0.46 to 0.24) than after 30 seconds, demonstrating non-inferiority.

CONCLUSIONS. Hand rubbing for 15 seconds was not inferior to 30 seconds in reducing bacterial counts on hands under the described experimental conditions. There was no gain in reducing bacterial counts from hand rubbing longer than 30 seconds. Further studies are needed to assess the clinical significance of our findings.
Letters to the Editor

Orthodontic instruments and supplies: Are they semicritical or critical items?

To the Editor:

Rutala and Weber recently stated: “Semicritical items represent the greatest risk of disease transmission because far more health care-associated infections have been caused by reusable, semicritical items than critical or noncritical items” and that “strict adherence to current guidelines is required for semicritical items because more outbreaks have been linked to inadequately cleaned or disinfected semicritical items, such as endoscopes undergoing high-level disinfection, than any other reusable medical device.”

Here, we discuss these statements concerning orthodontic items. It is only recently that the reprocessing of orthodontic instru-

Fig 1. A standard kit for fixed orthodontics with an integrator and green silicon mat.

Routine quality control is achievable by inserting appropriate controls for cleaning efficacy and the moist heat process inside the cassette. Nevertheless, some disadvantages are the overall working time, higher requirement of OIs, and the overall weight (number of orthodontic kits, cassettes, and containers) in light of the maximum load of small steam autoclaves.
Strategies to Enhance the Safety and Efficacy of Cleaning and Disinfecting

- Be familiar with the product’s MSDS and instructions for proper and safe application
- Be familiar with the item to be cleaned and decontaminated
How to Determine if Cleaning Products Are Hazardous or Contain Hazardous Substances

Review ingredients on material safety data sheet (MSDS). You can check products or ingredients against the following databases or lists.

- NTP – National Toxicology Program; http://ntp-server.niehs.nih.gov
- OSHA – Occupational Safety and Health Administration: www.osha.gov
- IRIS – EPA Integrated Risk Information System: www.epa.gov/iris
- NIOSH – National Institute of Occupational Health and Safety: www.cdc.gov/niosh
- ACGIH – American Conference of Governmental Industrial Hygienists: www.acgih.org
- CleanGredients Database – Green Blue Institute: www.greenblue.org
- Green Seal: www.greenseal.org
- IRCHS - Indiana Relative Chemical Hazard Score: www.ecn.purdue.edu/CMTI/IRCHS/
- TURI – Toxic Use Reduction Institute: www.cleanersolutions.org
- WHO – World Health Organisation www.who.org
Safety Assessment of Cleaning and Disinfectant Products

- How is the product diluted and how frequently is it being used?
- What is the product’s intended use?
- What is the likelihood it will be misused?
- What is the experience level of users?
- What are the hazard ratings for the product?
- What does the MSDS say about the product safety?
- Does the product present an acceptable level of risk?
- What do others report about the product safety?
Strategies to Enhance the Safety and Efficacy of Cleaning and Disinfecting

- Be familiar with the product’s MSDS and instructions for proper and safe application
- Look for opportunities to prevent surface contamination from occurring
Cleaning and Disinfecting of Medical Equipment

- FOLLOW THE MANUFACTURER’S INSTRUCTIONS!!!
- In the absence of instructions, clean and follow with low- to intermediate-level disinfection depending on the degree of contamination
- Consider covering those surfaces that are frequently touched during delivery of care
Strategies to Enhance the Safety and Efficacy of Cleaning and Disinfecting

- Be familiar with the product’s MSDS and instructions for proper and safe application
- Look for opportunities to prevent surface contamination from occurring
- Look for opportunities to reduce the amounts of chemicals used
# Microorganism Removal with Microfiber

<table>
<thead>
<tr>
<th>Cleaning Solution</th>
<th>Cleaning System</th>
<th>Dry Time (mins)</th>
<th>Mean % Reduction CFU ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUAT</td>
<td>Cotton string mop/standard bucket with wringer</td>
<td>2:48</td>
<td>94.84 ± 4.8</td>
</tr>
<tr>
<td>QUAT</td>
<td>Microfiber mop/standard bucket with wringer</td>
<td>2:13</td>
<td>87.94 ± 17.2</td>
</tr>
<tr>
<td>QUAT</td>
<td>Microfiber mop/microfiber bucket</td>
<td>7:04</td>
<td>95.31 ± 5.7</td>
</tr>
<tr>
<td>Detergent</td>
<td>Cotton string mop/standard bucket with wringer</td>
<td>2:48</td>
<td>67.75 ± 31.6</td>
</tr>
<tr>
<td>Detergent</td>
<td>Microfiber mop/standard bucket with wringer</td>
<td>2:23</td>
<td>79.74 ± 24.8</td>
</tr>
<tr>
<td>Detergent</td>
<td>Microfiber mop/microfiber bucket</td>
<td>8:03</td>
<td>94.50 ± 4.6</td>
</tr>
</tbody>
</table>

- QUAT = 1:128 dilution of product containing 5.15% didecyl dimethyl ammonium chloride, 3.43% dimethyl benzyl ammonium chloride. Detergent was a neutral cleaner with no germicidal properties.
- RODAC plates with D/E Neutralizing agar; CFU compared before and after cleaning.

BACKGROUND. Transmission of pathogens within the hospital environment remains a hazard for hospitalized patients. Healthcare personnel clothing and devices carried by them may harbor pathogens and contribute to the risk of pathogen transmission.

OBJECTIVE. To examine bacterial contamination of healthcare personnel attire and commonly used devices.

METHODS. Systematic review.

RESULTS. Of 1,175 studies screened, 72 individual studies assessed contamination of a variety of items, including white coats, neckties, stethoscopes, and mobile electronic devices, with varied pathogens including *Staphylococcus aureus*, including methicillin-resistant *S. aureus*, gram-negative rods, and enterococci. Contamination rates varied significantly across studies and by device but in general ranged from 0 to 32% for methicillin-resistant *S. aureus* and gram-negative rods. *Enterococcus* was a less common contaminant. Few studies explicitly evaluated for the presence of *Clostridium difficile*. Sampling and microbiologic techniques varied significantly across studies. Four studies evaluated for possible connection between healthcare personnel contaminants and clinical isolates with no unequivocally direct link identified.

CONCLUSIONS. Further studies to explore the relationship between healthcare personnel attire and devices and clinical infection are needed.

*Infect Control Hosp Epidemiol* 2016;37:1367–1373
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- 20 programmable sample plans
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- Stores 2000 results
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E. coli 15597 1:1
E. faecalis 19433
4/27/16 > 10^9 CFU/mL
SOIL +

NO3C
The chain of infection includes:
- Infectious agent
- Reservoir
- Portal of exit
- Portal of entry
- Susceptible host
- Mode of transmission
Chain of Infection

1. Infectious Agents - Bacteria, Fungi, Viruses
   - Rapid, accurate identification of organism

2. Reservoirs - People, Equipment, Water
   - Employee health, Environmental Sanitation, Disinfection, Sterilization

3. Portal of Exit - Excretions, Secretions, Skin, Droplets
   - Proper attire, Handwashing, Control of excretions & secretions, Trash & waste disposal
Chain of Infection

4. Means of Transmission - Direct contact, ingestion, fomites, airborne

Handwashing, Sterilization, Isolation, Foodhandling, Air flow control

5. Portal of Entry - Mucous membrane, GI tract, Respiratory tract, Broken skin

Aseptic technique, Personal Protective Equipment

6. Susceptible Host - Immunocompromised, Diabetes, Nutritional status, Age

Recognition of high risk patient, Treating underlying diseases
Final Points

- Clean before you disinfect/sterilize
- Always wear appropriate Personal Protective Equipment
- Understand the products/equipment you are using whether they be a chemical or physical device
- Determine a way to evaluate your process