Cleaning and Disinfecting: Choosing the Right Product

Image credit: Public Health Ontario 2013

Francine Paquette
Infection Control Consultant
South Western Ontario Infection Control Network
Public Health Ontario
For today...

- Overview of Disinfectants
- Kill Claims and Contact Times
- Chemical Dispensing and Ease of Use
- Special Circumstances for Disinfection
Overview of Disinfectants

1. Sterilants (sporicide)
2. High Level disinfectants
3. Low level disinfectants
4. Sanitizers

Cleaning: “The physical removal of foreign material (e.g., dust, soil) and organic material (e.g., blood, secretions, excretions, microorganisms). Cleaning physically removes rather than kills microorganisms. It is accomplished with water, detergents and mechanical action.”

<table>
<thead>
<tr>
<th>CLASS OF MICROORGANISM</th>
<th>MOST RESISTENT</th>
<th>LEAST RESISTENT</th>
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<tbody>
<tr>
<td><strong>Prions</strong> e.g. Creutzfeldt-Jakob disease (CJD) and variant CJD</td>
<td>Prion Reprocessing Required</td>
<td><strong>Low Level Disinfection</strong></td>
</tr>
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<td><strong>Bacterial spores</strong> e.g., <em>Clostridium difficile</em></td>
<td><strong>Sterilization</strong></td>
<td><strong>Low Level Disinfection</strong></td>
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<td><strong>Protozoa with cysts</strong> e.g., Giardia, Cryptosporidium</td>
<td><strong>High Level Disinfection</strong></td>
<td><strong>Low Level Disinfection</strong></td>
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<td><strong>Mycobacteria</strong> e.g., TB</td>
<td><strong>High Level Disinfection</strong></td>
<td><strong>Low Level Disinfection</strong></td>
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<td><strong>Non-lipid or small viruses</strong> e.g., polio virus, coxsackie</td>
<td><strong>High Level Disinfection</strong></td>
<td><strong>Low Level Disinfection</strong></td>
</tr>
<tr>
<td><strong>Fungi</strong> e.g., Candida, Aspergillus</td>
<td><strong>High-level Disinfection, some Low Level Disinfection</strong></td>
<td><strong>Low Level Disinfection</strong></td>
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<tr>
<td><strong>Lipid or medium sized virus</strong> e.g., herpes, HIV, hepatitis B/C</td>
<td><strong>Low Level Disinfection</strong></td>
<td><strong>Low Level Disinfection</strong></td>
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<tr>
<td><strong>Vegetative bacteria</strong> e.g., Staphylococcus, Pseudomonas</td>
<td><strong>Low Level Disinfection</strong></td>
<td><strong>Low Level Disinfection</strong></td>
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</table>
1-Step versus 2-Step Products

Cleaning: visible soil must be removed first

• 1-Step Disinfection
  • pre-cleaning is not required because these products include soap (detergent or emulsifier) to break up organics

• 2-Step Disinfection
  • Cleaning is required first
  • Once the surface or object has been cleaning, the disinfectant chemical can be applied to kill the remaining microbes

Follow the manufacturer's instructions.
Instructions for use as a one-step cleaner disinfectant

a. Pre-clean heavily soiled areas.

b. Pull towelette from canister and wipe hard non-porous environmental surfaces.

c. All surfaces must remain visibly wet for 1 minute.

d. Allow to air dry or rinse with potable water if necessary.

In this example, the manufacturer’s instructions explicitly advise the user to remove any heavy soils and then clean and disinfect in a single step.
Appendix E: Advantages and Disadvantages of Hospital-grade Disinfectants and Sporicides Used for Environmental Cleaning

<table>
<thead>
<tr>
<th>Process Option</th>
<th>Uses/Comments</th>
<th>Advantages/Comments</th>
<th>Disadvantages/Comments</th>
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</thead>
<tbody>
<tr>
<td>Alcohols</td>
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<tr>
<td>• 60-90% ethyl or isopropyl alcohol</td>
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<td>Chlorine</td>
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<tr>
<td>• Sodium hypochlorite (‘bleach’)</td>
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<tr>
<td>• Calcium hypochlorite</td>
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<tr>
<td>Hydrogen peroxide enhanced action formulation*</td>
<td>(HP-EAF) (various concentrations)</td>
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<tr>
<td>Hydrogen peroxide</td>
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<td>Iodophors</td>
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<td>Phenolics</td>
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<td>Quaternary ammonia compounds (QUATS) **</td>
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<tr>
<td>Search Tips</td>
<td>DPD Terminology</td>
<td>DPD Data Extracts</td>
<td>MedEffect Canada</td>
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<tr>
<td>Adverse Drug Reaction - Veterinary Drugs</td>
<td>NOC Database</td>
<td>Content Support</td>
<td>Technical Support</td>
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<tr>
<td>LNHPD Database</td>
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### Search Criteria

You may search by **either** a) Drug Identification Number (DIN), b) Anatomical Therapeutical Chemical (ATC) Code, or c) by company or one or more of the various other product characteristics listed. When typing inside fields, do not include punctuation marks such as hyphens, commas, colons, brackets and wildcard characters (%).
Let’s look at an example:

### 3. Composition/Information On Ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS No.</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isopropanol</td>
<td>67-63-0</td>
<td>17.2%</td>
</tr>
<tr>
<td>Ethylene Glycol Monobutyl Ether (2-Butoxyethanol)</td>
<td>111-76-2</td>
<td>1-5%</td>
</tr>
<tr>
<td>Diisobutylphenoxyethoxyethyl dimethyl benzyl ammonium chloride</td>
<td>121-54-0</td>
<td>0.28%</td>
</tr>
<tr>
<td>Water</td>
<td>7732-18-5</td>
<td>70-80%</td>
</tr>
</tbody>
</table>

### List of Active Ingredient(s)

<table>
<thead>
<tr>
<th>Active Ingredient(s)</th>
<th>Strength</th>
</tr>
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<tbody>
<tr>
<td>BENZETHONIUM CHLORIDE</td>
<td>0.28 %</td>
</tr>
<tr>
<td>ISOPROPYL ALCOHOL</td>
<td>17.20 %</td>
</tr>
</tbody>
</table>
Disinfectants

- compatible with items being disinfected
- compatible with cleaning agent(s)
- properly diluted according to manufacturer’s instructions
- appropriate personal protective equipment (PPE) according to manufacturer’s instructions

*Best Practices for Environmental Cleaning for Prevention and Control of Infections, May, 2012, p 33*
“Ideally, equipment should be disinfected with a cloth and disinfectant, allowing adequate contact time with the disinfectant.

Disinfectant wipes may be used for items that cannot be soaked, but it is difficult to attain adequate disinfectant contact time using disinfectant wipes.”
“Disinfectant wipes should be used by the primary care giver for point of care cleaning and disinfecting of patient equipment.

They should not be used as a routine cleaning disinfectant tool.”

Best Practices for Environmental Cleaning for Prevention and Control of Infections, May, 2012 p 33
When using disinfectant wipes:

- the active ingredient must be an appropriate hospital-grade disinfectant
- wipes must be kept wet and discarded if they become dry
- wipes must have an MSDS and be used according to the MSDS (e.g., wear gloves when handling, if recommended)

Image Credit: Public Health Ontario, 2014

Best Practices for Environmental Cleaning for Prevention and Control of Infections, May, 2012 p 33
Factors that influence the choice of disinfectant:

- **duration of contact time required for efficacy at the usual ambient temperature of the health care setting**
- **the innate resistance of expected microorganisms to the inactivating effects of the disinfectant (e.g., a sporicidal agent to remove spores)**
“The defined time for which surfaces of the medical device are exposed to a chemical or thermal disinfection process to achieve the appropriate level of disinfection.”

Best Practices for Cleaning, Disinfection and Sterilization in All Health Care Settings, May 2013, p 3

“Time a disinfectant is in direct contact with the surface or item to be disinfected. For surface disinfection, this period is framed by the application to the surface until complete drying has occurred.”

APIC Text of Infection Control and Epidemiology, June 2014, Chapter 107 Environmental Services, Chapter 10
Contact Time Claims for Wipes:

**Claims:**
- **3 Minutes:** Bactericidal, General Virucidal, Fungicidal and Tuberculocidal
- **30 Seconds:** Broad Spectrum Sanitizing

<table>
<thead>
<tr>
<th>Effective Against</th>
<th>Kill Time</th>
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<tbody>
<tr>
<td>Acinetobacter baumannii</td>
<td>1 min</td>
</tr>
<tr>
<td>Clostridium difficile spores</td>
<td></td>
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<tr>
<td>Enterobacter aerogenes</td>
<td>5 min</td>
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<tr>
<td>Vancomycin resistant Enterococcus faecium (VRE)</td>
<td>1 min</td>
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<tr>
<td>ESBL producing Escherichia coli</td>
<td>1 min</td>
</tr>
<tr>
<td>Hepatitis B Virus (HBV)</td>
<td></td>
</tr>
<tr>
<td>Hepatitis C Virus (HCV)</td>
<td></td>
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<tr>
<td>Human Immunodeficiency Virus</td>
<td></td>
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<tr>
<td>Herpes Simplex Virus Type 1</td>
<td></td>
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<tr>
<td>Herpes Simplex Virus Type 2</td>
<td></td>
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<tr>
<td>Influenza Virus (Influenza)</td>
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<tr>
<td>Influenza B Virus (HIB)</td>
<td>1 min</td>
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<tr>
<td>Norovirus</td>
<td>1 minute</td>
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<tr>
<td>Staphylococcus aureus</td>
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<td>Staphylococcus epidermidis</td>
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<td>Staphylococcus saprophytic</td>
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<td>Staphylococcus sciuri</td>
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<td>Staphylococcus lugdunensis</td>
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<td>Staphylococcus hominis</td>
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<td>Staphylococcus haemolytic aureus</td>
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<td>Staphylococcus carnosus</td>
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<td>Staphylococcus warneri</td>
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<td>Staphylococcus intermedius</td>
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<td>Streptococcus pneumoniae</td>
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<td>Trichophyton mentagrophytes</td>
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<tr>
<td>Candida albicans</td>
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<tr>
<td>Multi-Drug Resistant Acinetobacter baumannii</td>
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<tr>
<td>Methicillin Resistant Staphylococcus aureus</td>
<td></td>
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<td>Methicillin Resistant Staphylococcus epidermidis</td>
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<tr>
<td>Vancomycin Resistant Enterococcus faecium</td>
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<td>Vancomycin Intermediate Spectrum Enterococcus faecium</td>
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Other factors that influence the choice of disinfectant:

Physical and Chemical Factors
• temperature,
• pH
• relative humidity
• water hardness

Organic Matter

Biofilms
Chemical Dispensing – Ease of Use:

- Automated dispensing system
- Calibration of dispensing system
- Refillable bottles – no topping up
- Clean, dry bottles – label and date

*Best Practices for Environmental Cleaning for Prevention and Control of Infections, May, 2012 p 58*
“Do not apply cleaning chemicals by aerosol or trigger sprays.”

Best Practices for Environmental Cleaning for Prevention and Control of Infections, May, 2012 p 81
Occupational Health Considerations

• many surface disinfectants contain quaternary ammonium compounds (QUATs), phenolics, hydrogen peroxide or sodium hypochlorite which can cause skin and respiratory irritation

• disinfectants are one of the leading allergens affecting health care providers

• staff will be more likely to use products that are non-toxic and not irritating

Special Circumstances for Disinfection

1. Blood & Body Fluids
2. *Clostridium difficile* infections - CDI
3. Diarrheal Outbreaks – Norovirus
4. *Mycobacterium tuberculosis*
5. Nurseries
6. Creutzfeldt-Jakob disease - CJD
7. Novel respiratory viruses
8. AROs
1. Blood and Body Fluids

“Disinfect the entire spill area with a hospital-grade disinfectant and allow it to stand for the amount of time recommended by the manufacturer.”

Best Practices for Environmental Cleaning for Prevention and Control of Infections, May 2012, p 116
Against C. difficile bacterium: hospital grade disinfectants

Against C. difficile spores: sporicidal products

- sodium hypochlorite (1,000 - 5,000 ppm) for 10 to 30 min. (depending on concentration)
- hydrogen peroxide enhanced action formulation (4.5%) for 10 min.
- peracetic acid (0.26%) for 5 minutes
2. *Clostridium difficile* infections (CDI)

For adequate control of *C. difficile*, a sporicide should be used:

- for daily cleaning of CDI patient/resident bathrooms
- for disinfection after the room has been cleaned for each CDI patient discharged or transferred to another room, including transfer to initiate Contact Precautions
- prior to discontinuing Contact Precautions

*Best Practices for Environmental Cleaning for Prevention and Control of Infections, May, 2012 p 112*
3. Gastrointestinal Outbreaks: Norovirus

“Removing all organic matter before disinfecting the area. Then disinfecting the area using a freshly prepared hypochlorite solution (1 part bleach to 9 parts water), or accelerated hydrogen peroxide or hospital grade disinfectant. Household cleaners other than bleach do not work for most of the viruses that cause vomiting and diarrhea.”

Control of Gastroenteritis Outbreaks in Long-Term Care Homes, MOHLTC, 2013, p 78

“Inactivation studies with norovirus surrogate ... have shown the effectiveness of chlorine, glutaraldehyde, and iodine-based products whereas the quaternary ammonium compound, detergent, and ethanol failed to inactivate the virus completely.”

CDC Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008 p 24
4. *Mycobacterium tuberculosis*

High-level disinfection eliminates mycobacteria (e.g., *Tuberculosis*):

- 2% glutaraldehyde (20 minutes)
- 6% hydrogen peroxide (30 minutes)
- 0.2% peracetic acid (30-45 minutes)
- 2-7% hydrogen peroxide enhanced action formulation (HP-EAF)
- 0.55% ortho-phthalaldehyde (OPA)

*Best Practices for Cleaning, Disinfection and Sterilization in All Health Care Settings, May 2013, p 33*
“Products used for cleaning and disinfecting in nurseries and NICUs must not be toxic to infants (e.g., phenolics must not be used).”

PIDAC Best Practices for Environmental Cleaning for Prevention and Control of Infections, May 2012, p 106

“There is an association between the excessive use of a phenolic disinfectant and hyperbilirubinemia* in newborns.”

APIC Text of Infection Control and Epidemiology, June 2014, Chapter 107 Environmental Services, p107-6
6. Creutzfeldt-Jakob disease (CJD)

“Creutzfeldt-Jakob disease (CJD) is caused by infection with a prion, which is a fragment of protein that is resistant to most of the usual methods of reprocessing and decontamination.”

Best Practices for Cleaning, Disinfection and Sterilization in All Health Care Settings, May 2013, p 17

- are resistant to commonly used disinfectants
- no evidence that CJD has been acquired from environmental surfaces that are routinely cleaned

Health Canada/Public Health Agency of Canada, Infection Control Guideline, Classic Creutzfeldt-Jakob Disease in Canada
“Cleaning should be done using a facility-approved, hospital grade disinfectant cleaner that has virucidal and bactericidal properties and a drug identification number (DIN).”

Prevention, Surveillance and Infection Control Management of Novel Respiratory Infections, September 2015 p 21
8. Antibiotic Resistant Organisms (AROs)

• not developed resistance to disinfectants
• no single disinfectant has been specified for use on AROs


VRE -

• routine cleaning may not be adequate to remove VRE from contaminated surfaces.
• increased frequency of cleaning in OBs (double clean)

Key Considerations

“Products used for cleaning and disinfection must be approved by those responsible for product selection, an individual from ES, OHS and <IPAC>.”

PIDAC Best Practices for Environmental Cleaning for Prevention and Control of Infections, May 2012, p 34

“Hospital-grade disinfectants must have a drug identification number (DIN) from Health Canada to indicate approval for use in Canada.”

PIDAC Routine Practices and Additional Precautions in All Health Care Settings, November, 2012, p 19
Key Considerations

• Understanding of kill claims and contact times
• Occupational Health and Safety Considerations
• Chemical Dispensing/Ease of Use
Key Considerations

The manufacturer’s recommendations for chemical disinfectants must be followed pertaining to:

- usage
- contact time
- shelf life
- storage
- appropriate dilution
- required PPE
Ontario Agency for Health Protection and Promotion, Provincial Infectious Diseases Advisory Committee (PIDAC):


References


