Cleaning and Disinfection Practices

Dr. Michelle J. Alfa, FCCM
Medical Director Clinical Microbiology
Discipline, Diagnostic Services of Manitoba
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Overview: Cleaning & Disinfection of the Healthcare Environment

- What is “environmental cleaning and disinfection” anyway??
- Healthcare Environment is it a Reservoir?
  - “public” versus “patient-care” areas
- Cleaning monitoring:
  - UV marker
  - ATP
  - Bioburden
Best Practices for Environmental Cleaning for Prevention and Control of Infections: In All Health Care Settings

PIDAC: Provincial Infectious Diseases Advisory Committee, Dec 8, 2009

Queens Printer for Ontario
Toronto, Canada
What is Environmental Cleaning Anyway?

- **Cleaning: detergent & physical action**
  Removal of debris, organic material (e.g. patient secretions) and microorganisms

- **Disinfection: killing action**
  Exposure to “agent” that kills microorganisms
  → chemical (liquid, vapour, gas)
  → UV light, steam
Health Care: Cleaning & Disinfection
(PIDAC 2009)

- **Non-patient care areas:**
  - cleaning

- **Patient-care areas:**
  - cleaning & disinfection
  - high-touch surfaces
  - frequency: risk stratification
  - compliance monitoring

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Hospital grade Disinfectants:  
(DIN from Health Canada)

- **Alcohols** (60-95% ethyl or isopropyl)  
  - **USE**: some equipment;  
  - no rinse needed

- **Chlorine**: 1:10 or 1:100 use-dilution  
  - **USE**: Hydrotherapy equipment, blood spills  
  - rinse needed for 1:10 use-dilution  
  - toxic fumes → workplace safety issues  
  - PPE needed

- **Phenolics** (not in nurseries or food contact surfaces)  
  - **USE**: floors, walls, furnishing, IV poles  
  - one-step commercial formulations
Hospital grade Disinfectants:
(DIN from Health Canada)

- **Quaternary Ammonium compounds** (QUATs”)
  - USE: floors, walls, furnishing
  - narrow microbicidal spectrum

- **Iodophors** (not antiseptic formulations)
  - USE: hydrotherapy tanks, hard surfaces, & equipment that doesn’t touch mucous membranes
Hospital grade Disinfectants:
(DIN from Health Canada)

- **Accelerated Hydrogen Peroxide** (AHP)
  - not antiseptic formulations

  **0.5% (1:16 dil of 7% stock): some kill**
  - **USE**: surfaces in patient rooms
  - No rinse needed

  **0.5% (ready to use, TB claim): excellent kill**
  - **USE**: surfaces in patient rooms
  - No rinse needed

  **4.5% (ready to use, thickened):**
  - **USE**: toilet bowls, sinks, commodes ONLY
  - Rinse needed, PPE needed

  **3% (ready to use):**
  - **USE**: floors, walls, furnishings
  - PPE needed
DISINFECTANT ISSUES: BEWARE!!!

- **Contact time:**
  Liquid on a surface will dry in ~ 3mins → must be re-applied if recommended contact time is longer than 3 mins

- **Rinse off residuals:**
  Some disinfectants must be rinsed off after contact time due to irritation to patient skin (e.g. bleach 5000 ppm)

- **PPE:**
  Some disinfectants require PPE
Microfiber cloths for cleaning

- **Rutala et al 2007:**
  - String mops not as effective as microfiber mops for microbial removal
  - Microfiber effective without disinfectant

- **Moore et al 2006:**
  - Microfiber cloths vary in efficiency
  - Some microfiber cloths transfer organisms and re-contaminate surface during cleaning
Newest Aid for Healthcare??

Along with hospital-issue gown patients will get microfiber slippers!!

Available in Safeway!!

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The Healthcare Cleaning Dance:
Do you do the “watoosey” or the “two-step”??

Cleaning & Disinfection:
- **Two-step:** detergent to clean surface followed by application of disinfectant; no rinsing
- **One-step:** cleaning agent that also disinfects; no rinsing
- **Watoosey??:** detergent to clean surface followed by application of disinfectant; must be removed by rinsing

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Other Novel Methods for Environment Disinfection:

- Fogging:
  - VHP,
  - Ozone gas,
  - super-oxidized water,
- UV irradiation:
- Steam:
Room Fogging: VHP vapour

Works → but rapidly re-contaminated (both MRSA and other bacteria)

Hardy K et al Rapid recontamination with MRSA of the environment of an intensive care unit after decontamination with hydrogen peroxide vapour. J Hosp Infect 2007;66:360-368
Infection Transmission: Environmental role

“A culture report should not dictate the practice of Standard Precautions”
(Bartley et al 2008)

“A culture report should not dictate the practice of Hospital Cleaning/Disinfection”
(opinion: M. Alfa 2011)

Ensure ROUTINE cleaning/ disinfection is done well →
the highest risk of transmission is just prior to the diagnosis of the patient having an ARO
Healthcare Challenge: “Bum to Toilet Ratio”!!

- Shared toilets
  - Multiple patients in same room
  - Two rooms; one toilet

- Inadequate cleaning of one toilet facility may affect many patients!

VRE, MRSA, ESBLs, *C. difficile*, Acinetobacter spp

*Improvements in cleaning; reduce all AROs*
HEALTHCARE ENVIRONMENT
IS IT A RESERVOIR??
Is it Clean Enough???

Visual assessment: crude measure

Need to ensure surfaces are cleaned even if they don’t look visibly dirty:
You can’t see the microbes

Bedpan sprayers: phased out

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**Microbial survival on surfaces**

**Survives Years**

![Bar graph showing survival days for different organisms](chart)

- MRSA
- VRE
- ESBL
- Spores C. difficile
- Acinetobacter

**Prolonged survival when suspended in dust/organic debris of up to six months to a year has been reported (Dancer 2007, Hardy 2007)**

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Environmental detection: MRSA in Stool of patient with diarrhea

- Bedside rails: 100%
- Blood pressure cuff: 88%
- Television remote: 75%
- Bedside Table: 63%
- Toilets: 63%

"High-touch sites"

If MRSA (+) but not in stool;
~ 30% environmental contamination

Do caregivers acquire MRSA from environment?

42% of 12 nurses contaminated gloves with MRSA by touching objects in room of patients with MRSA in wound or urine

WITHOUT ANY PATIENT CONTACT!

Boyce J  Environmental contamination makes an important contribution to hospital infection  J Hosp Infect 2007;65:50-54.
Evidence of Infection Transmission

MRSA:
- Patients in ICU who acquired MRSA had same strain as found in the ICU environment
  (Hardy et al Infect Control Hosp Epidemiol 2006)

MRSA & VRE:
- Patients admitted to room previously occupied by patient with MRSA or VRE have significantly higher risk of acquiring these AROs
How to Break the Chain of Transmission?

ENSURE:
- Environmental cleaning/disinfection
- Hand hygiene

Sounds Easy!! Why isn’t it working???
Efficacy of Bleach (5,000 ppm) in presence of organic material

[killing of *C. difficile* spores]

Spray agent on surface and leave unwiped

Spray agent on surface and wipe

The Physical Action of Cleaning is critical NO MATTER WHAT AGENT is used for cleaning/disinfecting

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Monitoring Cleaning Compliance

- **Quality Program:**
  - audit cleaning compliance
  - provide weekly feedback to staff
  - part of yearly performance appraisal
Audit: Cleaning Compliance

Audit tools; recommended by PIDAC

1. **UV Marker:** [shows surface was wiped]
   - Carling et al 2008: 49% of surfaces clean after “terminal cleaning”
   - Alfa et al 2008: 20 – 50% of toilets clean after routine cleaning
   - Carling et al 2008: 57.1% ICU surfaces clean after patient discharge
   - Alfa et al 2010: UVM useful to assess clinical cleaning intervention

2. **ATP:** [measure of organic & microbe level]
   - Cooper et al 2007: < 500 RLU /cm²
   - Griffith et al 2007: 0 – 14% of surfaces “clean” after routine cleaning
   - Mulvey et al 2011: environment cleaning < 100 RLU/cm²

3. **Viable count:** [measure of microbe level]
   - Dancer et al 2004: < 5 cfu/cm²
   - Griffith et al 2007: 50 – 90% of surfaces “clean” after routine cleaning
Environmental Cleaning: UV Marker

- Visibly Clean: NOT ADEQUATE
- UV marker to audit cleaning

Non-isolation rooms

UVM Score:
(3)
(0)

www.brevis.com

Alfa et al BMC-Infectious Diseases 2008
- Staff aware of study but do not get any feedback

**Issues:**
- Dedicated ward staff pulled for discharge cleaning
- Cleaning compliance person specific
- Visibly clean may be thought to not need cleaning
- Visitors disrupt ability to clean room

**Twelve patient rooms**
Tested Mon – Fri
Four sites per bathroom
- toilet, sink, door knob, soap dispenser

192 sites tested per week

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Data from Adriana Tratjman’s M.Sc. thesis
UV Marker Audits: Impact of Feedback on Compliance

Cleaning of selected sites in the washrooms

New Staff Training: Ensure Trainers meet compliance targets

Feedback

Data from Adriana Tratjman’s M.Sc. thesis
Use of Oxivir$_{TB}$ (Accelerated Hydrogen Peroxide) as a bleach alternative

Alfa et al 2010; BMC Infectious Diseases [www.biomedcentral.com]

Arm 1: 50 patients, 133 samples
CDAD, twice daily cleaning, Oxivir$_{TB}$

Arm 2: 68 patients, 254 samples
CDAD, twice daily cleaning, PerDiem

Arm 3: 68 patients, 179 samples
Diarrhea, once daily cleaning, PerDiem
ATP monitoring of Environmental Cleaning

- ATP is present in *living* cells: both human and bacterial cells
- ATP measured by assay that detects “relative light units” or RLUs

![Human White cell](image1)

![Bacteria](image2)

**Low level of RLUs**

**High level of RLUs**

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*Pictures from Google Images*
ATP Assay

- Is **not a linear correlation** with microbial numbers [~10^3 cfu/sample to be detected]
- Reflects total human cellular and bacterial cellular residuals
- Protein, carbohydrate in pure form (i.e. not in a living cell) will NOT show any RLUs when tested by the ATP assay.
- Rapid test

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ATP Monitoring of Healthcare
Environmental surfaces

Validation for Healthcare?
- what RLU to target?
  < 500 RLUs/cm², < 100 RLUs/cm²
ATP Benchmark: Hospital clean

[Mulvey et al 2011 J Hosp Infect]

- Detergent based cleaning: reduced ATP by 32%
- Cleaning did not always eliminate MRSA or MSSA
- Limited correlation between cfu/cm² and ATP level
- Recommended 100 RLU as benchmark for adequate cleaning [Hygiena ATP assay]
- After cleaning with detergent 22% of high touch sites failed [i.e. >100 RLU]
Environmental Monitoring

- UV Marker reliably shows if surface wiped; inexpensive, easy to do
- ATP reflects viable organisms and patient secretions; easy to do, validation for appropriate healthcare benchmark still needs to be established

Use validated cutoff (manufacturer recommended or literature)

Establish accepted % compliance \(\rightarrow\) e.g. 90%

Baseline of \(~\) 1 month with feedback: develop action plan if <90%
Agent used for cleaning & disinfection

- PIDAC: recommends routine cleaning & disinfection of high risk health care areas [frequency based on risk-assessment]

- Detergents (many) at their use-dilution and usual contact times have little to no microbial killing ability

- Transfer/recontamination of surfaces during cleaning is reduced if agent has killing ability

- **Focus on optimizing routine cleaning:** risk highest is prior to implementation of isolation precautions
Environmental cleaning:

- Re-contamination from patient etc occurs rapidly; need ongoing & effective environmental cleaning process

- Whatever product used → AUDIT to ensure cleaning is done properly

- Focus cleaning on “High-touch” areas for greatest impact in reducing spread of AROs
BATTLEFRONT: INFECTI ON

HOUSEKEEPING IS THE FRONT LINE IN THE “BATTLE OF THE BUGS”!

BE SURE YOU HAVE OPTIMIZED YOUR DEFENCES!

TRAINING

OPTIMAL KILLING AGENT

FEEDBACK ON COMPLIANCE
References

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