Challenges for environmental cleaning in pediatric healthcare

Nadia Desmarais - CHU Sainte-Justine
Laurie Streitenberger - The Hospital for Sick Children (SickKids)

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Objectives

- To understand how pediatric and neonatal patients impact environmental cleaning practices and how to identify factors when choosing routine surface disinfectants;
- To identify different environmental contamination sources for pediatric and neonatal patients;
- To identify considerations when choosing novel disinfectant technologies

Role of environment in HAIs

- Environmental contamination and hospital-acquired infections: factors that are easily overlooked, Sugg C, Krabbes LD, Johnson GA, Microbes & Infection, 2015.
- And more.....
How are neonatal/pediatric patients different?

- Immature immune systems
- "Reservoir" for communicable illnesses
- Developmental behaviors

How do they contaminate their environment?

Persistence in the environment

<table>
<thead>
<tr>
<th>Organism</th>
<th>Banding of persistence</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acinetobacter spp.</td>
<td>c.1.3 months</td>
<td>Kramer et al., 2006</td>
</tr>
<tr>
<td>Klebsiella pneumoniae</td>
<td>c. 1.3 months</td>
<td></td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>1-3 months</td>
<td></td>
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<tr>
<td>Clostridium difficile</td>
<td>1-3 months</td>
<td></td>
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<tr>
<td>Enterococcus faecalis</td>
<td>1-3 months</td>
<td></td>
</tr>
<tr>
<td>Enterobacter spp.</td>
<td>c. 1.3 months</td>
<td></td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>1-3 months</td>
<td></td>
</tr>
<tr>
<td>Proteus mirabilis</td>
<td>1-3 months</td>
<td></td>
</tr>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>1-3 months</td>
<td></td>
</tr>
<tr>
<td>Stenotrophomonas</td>
<td>c. 1.3 months</td>
<td></td>
</tr>
</tbody>
</table>

Kramer et al., BMC Infectious Diseases, 2006
Factors influencing persistence

- Low temperature (4°C or 6°C);
- Higher inoculum
- High humidity (e.g., > 70%) associated for most bacteria and fungi,
  - for viruses: the influence of humidity on persistence has been described inconsistently
- Type of surface material: inconsistent data
Disinfectant history

- Girolamo Fracastoro (1478-1553):
  - Contact alone
  - Fomites (a word he first used)
  - At a distance (through the air)
- Antony Van Leeuwenhoek (1622-1723)
  - First human to see microorganisms
  - Effect of pepper on the "little animals"

Disinfectant

- A substance, or mixture of substances, capable of destroying or irreversibly inactivating pathogenic (disease-causing) and potentially pathogenic (opportunistic) microorganisms, but not necessarily bacterial spores, present on environmental surfaces and inanimate objects due to the antimicrobial action of the active ingredient(s).

Hospital grade disinfectant

- What is a hospital-grade disinfectant?
- Safety of hospital-grade disinfectants
Factors related to products
Pros and Cons

Hospital Disinfectants for Disinfection of Environmental Surfaces

<table>
<thead>
<tr>
<th>Hospital disinfectants commonly used in all health care settings include:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol (ethyl or isopropyl)</td>
</tr>
<tr>
<td>Improvised hydrogen peroxide</td>
</tr>
<tr>
<td>Iodophors</td>
</tr>
<tr>
<td>Phenolics</td>
</tr>
<tr>
<td>Quaternary ammonium compounds</td>
</tr>
<tr>
<td>Sodium hypochlorite (bleach)</td>
</tr>
</tbody>
</table>

PIDAC, Best Practices for Environmental Cleaning for Prevention and Control of Infections in All Health Care Settings, 2018

Challenges in pediatric settings

- Humanization of care
  - One room / One patient / One family
  - The child is not the only “patient”
Challenges in pediatric settings

- Family members
  - Siblings
  - Visitors

Playroom / Waiting room

Toys

- Cleaning and disinfection:
  - Who?
  - When?
  - Frequency?

BYOT?
What else makes them different?

- Specific equipment and sizing

Equipment

- Electric breastpumps
- Ventilators

Cleaning and disinfection:
- Who?
- When?
- Frequency?
**Pediatric rehabilitation and long-term care**

- Home environments
- School attendance
- Wheelchairs
- Specialized room therapy

**Contamination of Supplies/Linen**

**Animals**

- Assistive dogs for kids with autism
- Zootherapy
Key messages

- The environment can be responsible for an important proportion of HAIs;
- Neonates and pediatrics are not « little adults », their needs are different ;
- Improved cleaning and disinfection of room surfaces decreases the risk of HAIs.

Objectives revisited

- To identify different environmental contamination sources for pediatric and neonatal patients;
- To understand how pediatric and neonatal patients impact environmental cleaning practices and how to identify factors when choosing routine surface disinfectants;
- To identify considerations when choosing novel disinfectant technologies
New and Evolving Products

- Antimicrobial surfaces
- No-Touch disinfection systems
  - UV
  - Hydrogen peroxide
  - Other

Antimicrobial Surfaces

- Replacing or treating materials/surfaces traditionally used in the health care setting (e.g., plastic, stainless steel) with materials with antimicrobial properties
- Limited evidence, with the exception of copper, of persistent reduction of microbial contamination in clinical settings
- No evidence of reduction of HAIs

Ultraviolet Light (UV)

- At certain wavelengths, can kill microorganisms by destroying bonds in genetic materials
  - Bacteria and viruses > bacterial spores
- No residue
- Equipment and furniture must be moved into line of vision for disinfection to occur
Hydrogen Peroxide

- Effective against a wide range of microorganisms, including bacteria, viruses and spores, particularly those of C. difficile
- Environmentally safe residues
- No need to move furniture and equipment away from the walls BUT sealing of air ducts from the room and gaps under doors is required prior to decontamination procedure

Situation Faced

Q. Is there something else we could be doing to enhance our environmental cleaning/disinfection practices, recognizing that we’ll still need to manually clean?

- Consultation with Procurement re: Request for Proposal (RFP) considerations
  - Stakeholders:
    - Environmental Services
    - Microbiology
    - Occupational Health and Safety
    - Biohazard specialist
    - IPAC
  - Tasks:
    - Literature reviews
    - Technology/products
    - Efficacy

Product Assessment Tool®

- Six categories of assessment:
  - General usage
  - Germicidal efficacy
  - Safety
  - Environmental impact
  - Operational cost considerations
  - Customer service

*We based ours on the “Surface Disinfectant Product Assessment Tool” from PTS Professional and Technical Services*
### General Usage

- Ease of use?
- Time required per cycle?
- Does the product require alterations to the room environment e.g. HVAC, moving furniture?

### Germicidal Efficacy

- Product efficacy claims and references

### Safety

- Is the product irritating to eyes or skin?
- Does the product require PPE to be worn by the users?
Environmental Impact

- Is the product biodegradable?
- Is the product compatible with healthcare device materials?
- Is there any residual residue after use?

Operational Costs

- Are there additional operating costs outside of the product itself?
- Are there special storage or transportation considerations?
- Will implementation improve staff productivity or reduce operational costs elsewhere?

Customer Service

- What type of training does the supplier provide?
  - Initial + ongoing
- What type of additional educational material is provided?
- What type of technical support is provided?
### Scoring Process

<table>
<thead>
<tr>
<th>Score</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td></td>
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Overall Impression:

1. Product does NOT meet needs
2. Product SOMEWHAT meets needs
3. Neutral
4. Product MOSTLY meets needs
5. Product MEETS needs

Comments:

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### OK, so now you’ve chosen a product…will it work for you?

- **Product Trial**
  - Location chosen based on area with high impact but challenging to operationalize
  - Assumption was that if we could make it work there, we could use it anywhere in the facility
  - Another consideration - staff in the area were very engaged!

### Trial Evaluation – Lessons Learned

- If you’re looking to save on labour costs for room cleaning, you won’t!
  - Rooms require set-up after they’ve been manually cleaned, regardless of the option you choose
- Not a time saver!
  - In high turnover areas and seasons, there may be resistance to using this technology
- Prepare patients and families in the area beforehand
  - “Dear Parent” letter
Trial Evaluation – Lessons Learned

- Training… and not just housekeeping staff
  - Facility operators
  - Clinicians
  - Unit clerks
  - Facility Administrators – “…at worst, this will be cost neutral (hopefully)…” e.g. potentially saving $$$ with downstream costs such as not having to discard as many med/surg supplies on discharge

- Patient risk assessment for spread outside trial area – everyone wants it but not enough to go around so how to prioritize usage?
  - High risk patient areas
  - High risk events e.g. outbreaks
  - Equipment/devices that are difficult to manually clean – routine use!
Contact Information:

nadia.desmarais.hsj@ssss.gouv.qc.ca

laurie.streitenberger@sickkids.ca