TITLE: Environmentally Active Agents for Infection Prevention in Health Care Facilities: Clinical Effectiveness, Cost-Effectiveness, and Guidelines

DATE: 29 April 2015

RESEARCH QUESTIONS

1. What is the clinical effectiveness of environmentally active agents for infection prevention in health care facilities?

2. What is the comparative clinical effectiveness of environmentally active agents for infection prevention in health care facilities?

3. What is the cost-effectiveness of environmentally active agents for infection prevention in health care facilities?

4. What is the comparative cost-effectiveness of environmentally active agents for infection prevention in health care facilities?

5. What are the evidence-based guidelines regarding the use of environmentally active agents for infection prevention in health care facilities?

KEY FINDINGS

Five non-randomized studies and two evidence-based guidelines were identified regarding the use of environmentally active agents for infection prevention in health care facilities.

METHODS

A limited literature search was conducted on key resources including Medline, PubMed, The Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. Methodological filters were applied to limit retrieval to health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies,
economic studies and guidelines. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2008 and April 16, 2015. Internet links were provided, where available.

The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

**SELECTION CRITERIA**

One reviewer screened citations and selected studies based on the inclusion criteria presented in Table 1.

<table>
<thead>
<tr>
<th>Table 1: Selection Criteria</th>
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<td><strong>Population</strong></td>
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| **Intervention** | Environmentally active agents (could also be referred to as non-manual, non-touch or automated room disinfection techniques) including but not limited to:  
- steam cleaning  
- ozone  
- UV light  
- high-intensity narrow-spectrum (HINS) light  
- hydrogen peroxide  
- anti-adhesive surfaces  
- antimicrobial coatings  
  - triclosan  
  - silver  
  - copper  
- bacteriophage-modified surfaces  
- polycationic antimicrobial surfaces  
- light-activated antimicrobial surfaces  
- sharkskin |
| **Comparator** | Q1, 3, and 5: Standard procedures  
No intervention  
No comparator  
Q2, 4, and 5: Environmentally active agents including not limited to:  
- steam cleaning  
- ozone  
- UV light  
- High-intensity narrow-spectrum (HINS) light  
- hydrogen peroxide  
- anti-adhesive surfaces  
- antimicrobial coatings  
  - triclosan  
  - silver  
  - copper  
- bacteriophage-modified surfaces  
- polycationic antimicrobial surfaces  
- light-activated antimicrobial surfaces  
- sharkskin |
Table 1: Selection Criteria

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Q1-2: Clinical effectiveness: outcomes associated with infection rates (e.g., rates of hospital acquired infection, patient colonization rate), infection control, infection prevention</th>
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<tbody>
<tr>
<td></td>
<td>Harms</td>
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<td></td>
<td>Q3-4: Cost-effectiveness outcomes</td>
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<td>Q5: Guidelines and recommendations</td>
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<tr>
<td>Study Designs</td>
<td>Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies, economic evaluations, evidence-based guidelines</td>
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RESULTS

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, non-randomized studies, economic evaluations, and evidence-based guidelines.

Five non-randomized studies and two evidence-based guidelines were identified regarding the use of environmentally active agents for infection prevention in health care facilities. No relevant studies were identified regarding comparative clinical effectiveness or cost-effectiveness of environmentally active agents for infection prevention in health care facilities.

Additional references of potential interest, including studies examining surrogate outcomes, are provided in the appendix.

OVERALL SUMMARY OF FINDINGS

Five non-randomized studies were identified regarding the clinical effectiveness of ultraviolet (UV) environmental disinfection and hydrogen peroxide vapour (HPV) for infection prevention in health care facilities.

One study examined the impact of UV environmental disinfection in acute care. There was a significant decrease in the rate of multi-drug resistant organisms (MDRO) plus *Clostridium difficile* (CD) after implementation of the UV technique.

Four non-randomized studies examined the use of HPV for the disinfection of health care settings. Disinfection with HPV resulted in a significant reduction in patient infection by methicillin-resistant *Staphylococcus aureus* (MRSA), MDROs, and vancomycin-resistant enterococci. The risk of CD infection was shown to be reduced in three studies, but the reduction was only statistically significant in one. In one study, the risk of infection by MRSA and multi-drug resistant gram-negative rods was reduced but not significantly.

Two evidence-based guidelines were identified, from the Ontario Agency for Health Protection and Promotion and the Healthcare Infection Control Practices Advisory Committee.

The guidelines state that:
- Disinfectant fogging techniques (including HPV, super-oxidized water, and ozone gas) and UV surface disinfection should supplement, not replace, standard cleaning techniques.
• “More research is required to clarify the effectiveness and reliability of fogging, UV irradiation, and ozone mists to reduce norovirus environmental contamination.”\(^7\) (p. 13)
• Ozone gas may be toxic at high concentrations and must be used only in areas that can be completely sealed while in use.\(^6\)
• “Surfaces must be cleaned of visible dirt and debris before air disinfection techniques are used.”\(^6\) (p. 67)
• “Surfaces treated with antimicrobial substances are not recommended.”\(^6\) (p. 72)
REFERENCES SUMMARIZED

Health Technology Assessments
No literature identified.

Systematic Reviews and Meta-analyses
No literature identified.

Randomized Controlled Trials
No literature identified.

Non-Randomized Studies

Clinical Effectiveness


Economic Evaluations
No literature identified.
Guidelines and Recommendations

   See: D. New and Evolving Technologies, pages 64-72

   See: Environmental Cleaning #40, page 15.

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APPENDIX – FURTHER INFORMATION:

Systematic Reviews and Meta-Analyses – Surrogate Outcomes


Randomized Controlled Trials – Surrogate Outcomes


Non-Randomized Studies – Surrogate Outcomes

Comparative Clinical Effectiveness


Alternate Setting


Clinical Effectiveness


Alternate Intervention


Review Articles


22. Pulsed Xenon UV Disinfection System (Xenex Disinfection Services, LLC) and R-D Rapid Disinfector (Steriliz, LLC) for Environmental Disinfection [Internet]. Plymouth Meeting (PA): ECRI Institute; 2014 [cited 2015 Apr 28]. Available from: www.ecri.org Subscription required.


Additional References
