Disinfection of noncritical environmental surfaces in patient room and shared equipment is an essential component of an infection prevention program. Noncritical environmental surfaces and noncritical medical equipment surfaces may become contaminated with infectious agents and may contribute to cross-transmission directly or by leading to acquisition of transient hand carriage by healthcare personnel. Disinfection should render surfaces safe and free of pathogenic agents in sufficient numbers that cause human disease (i.e., pathogenically clean).

We sought to characterize the level of microbial contamination of environmental surfaces as well as the level of microbial contamination needed to be put at risk of acquiring the previous patient’s pathogens at two hospitals. We monitored four “marker” MDROs (i.e., methicillin-resistant Staphylococcus aureus [MRSA], vancomycin-resistant enterococcus [VRE], Clostridium difficile and multidrug-resistant [MDR] Acinetobacter baumannii/complex). These organisms were chosen due to their importance as pathogens in HAIs, and propensity to contaminate and persist on hospital room surfaces, making them ideal markers by which to study bacterial transmission in the hospital setting.

The current study was performed in selected hospital rooms contemporaneously with the BETR-Disinfection study (NCT01579370), a multicenter cross-over study comparing the feasibility and effectiveness of three enhanced disinfection strategies for terminal room disinfection against standard practice.

The overlap of the current study with the BETR-Disinfection study allowed us to evaluate the risk of bacterial transmission occurring during implementations of best-known strategies to disinfect environmental surfaces.

Microbial Load on Environmental Surfaces: The Relationship Between Reduced Environmental Contamination and Reduction of Healthcare-Associated Infections


Conclusions

- Our data demonstrated that a decrease in room contamination is associated with a decrease in subsequent patient colonization/infection.
- The fact this decrease did not entirely eliminate colonization/infection may have been due to other transmission mechanisms or that further reduction of epidemiologically important pathogens is required to reduce subsequent colonization/infection.
- We showed that an enhanced method of room decontamination is superior to a standard method.
- Hospitals should consider the use of an enhanced method of room decontamination to prevent terminal disinfection.

Background

- Disinfection of noncritical environmental surfaces in patient room and shared equipment is an essential component of an infection prevention program.
- Noncritical environmental surfaces and noncritical medical equipment surfaces may become contaminated with infectious agents and may contribute to cross-transmission directly or by leading to acquisition of transient hand carriage by healthcare personnel.
- Disinfection should render surfaces safe and free of pathogenic agents in sufficient numbers that cause human disease (i.e., pathogenically clean).
- We sought to characterize the level of microbial contamination of environmental surfaces as well as the level of microbial contamination needed to be put at risk of acquiring the previous patient’s pathogens at two hospitals.
- We monitored four “marker” MDROs (i.e., methicillin-resistant Staphylococcus aureus [MRSA], vancomycin-resistant enterococcus [VRE], Clostridium difficile and multidrug-resistant [MDR] Acinetobacter baumannii/complex).
- These organisms were chosen due to their importance as pathogens in HAIs, and propensity to contaminate and persist on hospital room surfaces, making them ideal markers by which to study bacterial transmission in the hospital setting.

Methods

- We performed the study in selected hospital rooms contemporaneously with the BETR-Disinfection study (NCT01579370), a multicenter cross-over study comparing the feasibility and effectiveness of three enhanced disinfection strategies for terminal room disinfection against standard practice.
- The overlap of the current study with the BETR-Disinfection study allowed us to evaluate the risk of bacterial transmission occurring during implementations of best-known strategies to disinfect environmental surfaces.

Results

Results Summary

- Our data demonstrated that the number of epidemiologically-important pathogens following disinfection was highest with use of a Quat and lowest with the use of Quat/UV.
- All enhanced disinfection interventions (i.e., Quat/UV, Bleach, Bleach/UV) were significantly superior to a Quat alone (standard method) in reducing epidemiologically-important pathogens in the patient’s room and patient’s room plus bathroom.
- However, only Quat/UV achieved a significant reduction for the bathroom alone.
- There were no statistical differences between any of the three enhanced methods (i.e., Quat/UV, Bleach, and Beach/UV) in reducing epidemiologically-important pathogens for any surfaces (i.e., patient room only, bathroom only, patient’s room plus bathroom).

Table 1. Epidemiologically-Important Pathogens (EIP) by Intervention and Contamination in Patient Rooms

<table>
<thead>
<tr>
<th>Room type</th>
<th>Pathogen</th>
<th>Treatment (mean CFUs per room)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient room only</td>
<td>MDR-Acinetobacter</td>
<td>Quat/UV: 3.72, VRE: 0.10, EIP: 0.15</td>
<td>0.017</td>
</tr>
<tr>
<td>Bathroom only</td>
<td>MDR-Acinetobacter</td>
<td>Quat/UV: 3.76, VRE: 0.10, EIP: 0.15</td>
<td>0.017</td>
</tr>
<tr>
<td>Patient room and bathroom</td>
<td>MDR-Acinetobacter</td>
<td>Quat/UV: 3.76, VRE: 0.10, EIP: 0.15</td>
<td>0.017</td>
</tr>
</tbody>
</table>

Table 2. Relationship between microbial reduction of epidemiologically-important pathogens (EIP) and colonization/infection in a patient subsequently admitted to a room of a patient colonized/infected with an EIP by decontamination method.

<table>
<thead>
<tr>
<th>Standard Method</th>
<th>Enhanced method</th>
<th>Quat</th>
<th>Quat/UV</th>
<th>Bleach</th>
<th>Bleach/UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction (%)</td>
<td>94</td>
<td>81</td>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colonization/Infection (rate)</td>
<td>2.3</td>
<td>1.5</td>
<td>1.9</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>Reduction (%)</td>
<td>35</td>
<td>17</td>
<td>14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Enhanced method is calculated compared to standard method.