BACKGROUND/OBJECTIVE:

C. difficile infections are a major concern in healthcare settings and are becoming more frequent, more severe, and more difficult to treat. Estimates of up to $3 billion annually are spent in the United States managing cases of C. difficile infection. The hospital environment has been identified as a source of transmission and numerous cleaning interventions have been recommended. However, the US Environmental Protection Agency has approved products with efficacy claims against C. difficile spores, however, many healthcare facilities continue to remediate contaminated surfaces through meticulous cleaning with reusable wipers saturated with non-sporicidal disinfectants, as has been recommended for non-outbreak situations.

It is hypothesized that when C. difficile contaminated surfaces are cleaned in this manner, although the spores may be physically removed by the wipe, they remain viable in the wipe and can contaminate other cleaned items in the laundry process. Past work has demonstrated the risk of C. difficile spore cross contamination in the laundry process associated with contaminated bed linens.

This study was conducted to evaluate the relative risk of C. difficile cross contamination in the laundry process associated with cleaning contaminated surfaces with reusable wipers saturated in either sporicidal or non-sporicidal hard surface disinfectants.

METHODS:

1. Saturate 5 Blue microfiber cloths in 1000 mL of each of four treatments
   - Sporicidal Disinfectant 1
   - Sporicidal Disinfectant 2
   - Non Sporicidal Disinfectant
   - Cold softened tap water

2. Clean inoculated stainless steel coupons with saturated microfiber cloths
   - ~1x10^5 C. difficile (ATCC 700792) spores per coupon
   - Coupons wiped with sampling swab
   - Swab incubated and tested for presence of residual C. difficile in the washer

3. Launder 5 used microfiber cloths with 20 new Yellow microfiber cloths
   - Laundered using a typical commercial wash formula for microfiber textiles
   - No disinfectant or bleach added as part of the wash process
   - Blue cloths discarded after wash cycle
   - Yellow cloths reserved for further testing after wash cycle
   - Washer cleaned between cycles by operating for 10 minutes with 1000 ppm chlorine bleach followed by two water-only rinses

4. Swab washer with sampling swab after bleaching
   - Swabs incubated and tested for presence of residual C. difficile in the washer

5. Manually agitate Yellow cloths to dislodge any transferred spores
   - Each cloth agitated for 1 minute in 200mL Letheen broth
   - Serially diluted eluent from one cloth for enumeration
   - Filters plated, incubated and tested for C. difficile

6. Vacuum filter eluant
   - 200mL eluant from each cloth split evenly into two 0.45 μm membrane filters

7. Plate resultant filter
   - Filters plated, incubated and tested for presence of C. difficile
   - Filters positive for presence of C. difficile were further evaluated for enumeration

RESULTS:

| Spores Removed/Inactivated from Stainless Coupon | Coupons cleaned with microfiber cloths saturated in sporicidal disinfectants showed 0 of 5 coupons retained viable C. difficile spores. 1 of 5 coupons cleaned with cloths saturated in non-sporicidal disinfectant showed 2 of 5 coupons cleaned with cloths saturated in water retained viable C. difficile spores. (Figure 1) |
| Cleaning Cloth Cross Contamination from Wash Process |

As shown in Figure 2, saturating cloths in a sporicidal disinfectant yielded a statistically significant reduction in the proportion of cleaning cloths that were cross contaminated from the laundry process, as compared to saturating cleaning cloths in either non-sporicidal disinfectant or water. Additionally, the number of C. difficile spores recovered from cross contaminated cloths was significantly reduced when cloths were saturated in sporicidal disinfectant vs. when saturated in either a non-sporicidal disinfectant or water (Figure 3). These results were independent of the type of sporicidal disinfectant used.

Presence of Spores Remaining the Washer

The washer was swabbed after each wash cycle as described. Viable C. difficile spores were not identified in any post wash cycle swabs.

TEST FOR STATISTICAL DIFFERENCE BETWEEN PROPORTIONS

Multiple Comparisons for Proportions

H0: There is not a significant difference between proportions

H1: There is a significant difference between proportions

| Table 1: Comparison of proportion of cloths cleaned with microfiber cloths saturated in sporicidal disinfectants and non-sporicidal disinfectants or water after the wash process. |

<table>
<thead>
<tr>
<th>Method of Disinfectant</th>
<th>Number of transferred spores</th>
<th>Number of coupons with transferred spores</th>
<th>Significance P-values</th>
<th>Significance Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sporicidal Disinfectant 1</td>
<td>0 of 5 coupons retained viable C. difficile spores</td>
<td>0 of 5 coupons retained viable C. difficile spores</td>
<td>Significant Difference</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td>Sporicidal Disinfectant 2</td>
<td>0 of 5 coupons retained viable C. difficile spores</td>
<td>0 of 5 coupons retained viable C. difficile spores</td>
<td>Significant Difference</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td>Non Sporicidal Disinfectant</td>
<td>1 of 5 coupons retained viable C. difficile spores</td>
<td>1 of 5 coupons retained viable C. difficile spores</td>
<td>Significant Difference</td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td>Cold softened tap water</td>
<td>2 of 5 coupons retained viable C. difficile spores</td>
<td>2 of 5 coupons retained viable C. difficile spores</td>
<td>Significant Difference</td>
<td>P&lt;0.001</td>
</tr>
</tbody>
</table>

CONCLUSIONS:

Microfiber wipers can remove C. difficile spores from surfaces and removal/inactivation is improved when the cloths are saturated in a sporicidal disinfectant. However, if a non-sporicidal disinfectant or liquid is used in the cleaning process, the removed spores remain viable in the wiper creating a vector for cross contamination to other textiles within the laundering process.

Saturating wipers with a sporicidal disinfectant before cleaning does not entirely eliminate the possibility of cross contamination to other textiles in the laundry process, but it does significantly reduce both the number of cloths cross contaminated and the number of spores recovered from cross contaminated cloths.

The reduction in the number of cloths exhibiting cross contamination and the reduction in the number of spores recovered from the cloths was independent of the type of sporicidal disinfectant used in this study.

REFERENCES:

4. C. difficile Cross Contamination in the Textile Laundering Process: The Importance of Selecting an Appropriate Hard Surface Disinfectant

Ecolab Inc. Employee Salary

Company Relationship What was received

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