Comparative Efficacy of Hand Rubs Containing Alcohol or Quaternary Ammonium Compounds

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ABSTRACT

Background/Objectives
Hand hygiene is critical for reducing pathogen transmission and alcohol-based hand rubs (ABHRs) are recommended and used as the primary means of hand hygiene in healthcare. However, quaternary ammonium compound-based hand rubs (QBHR) have been used in certain settings when ingestion or flammability are concerns. The objective of this study was to compare the efficacy of ABHR and QBHR formulations.

Methods
Four commercially available handrubs were tested: Product A (70% ethanol gel), Product B (0.13% benzalkonium chloride foam), Product C (0.20% benzethonium chloride gel), and Product D (0.13% benzalkonium chloride foam). Products A, B, and C were evaluated according to ASTM E1174 at a 2 ml dose. Products A and D were evaluated according to ASTM E2755 at a 1.5 ml dose. All products were evaluated after a single application and after multiple applications. Log reductions from baseline were calculated for each product and analyzed for statistical differences.

Results
Only Product A met Health Canada requirements for a ≥3 log reduction using E1174, and log reductions for Product A were statistically superior to those for Products B and C. When evaluated using E2755, Products A and D achieved log reductions of 2.34 and 1.70, respectively, after 1 application, and of 4.37 and 1.28, respectively, after 11 applications. Log reductions for Product A were statistically superior to those for Product D.

Conclusions
Because QBHR failed to meet Health Canada efficacy requirements and were statistically inferior to ABHR, QBHR should only be used on a limited basis if at all.

METHODS

Test Products

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Active Ingredient</th>
<th>Product Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product A</td>
<td>70% ethanol</td>
<td>gel</td>
</tr>
<tr>
<td>Product B</td>
<td>0.13% benzalkonium chloride</td>
<td>foam</td>
</tr>
<tr>
<td>Product C</td>
<td>0.20% benzalkonium chloride</td>
<td>gel</td>
</tr>
<tr>
<td>Product D</td>
<td>0.13% benzalkonium chloride</td>
<td>foam</td>
</tr>
</tbody>
</table>

Figure 1. Steps for E 1174

1. Contaminate hands with 109 cfu Serratia marcescens
2. Sample hands to obtain “baseline” level
3. Contaminate hands again and apply test product
4. Perform a total of 9 additional contamination and product application cycles
5. Sample hands after final (10th) product application

Products A, B, and C tested at a volume of 2 ml, rubbed in until dry

Figure 2. Steps for E 2755

1. Grow S. marcescens at 35 C with vigorous shaking (~10^10 cfu/ml)
2. Centrifuge culture at 7000 G for 10 minutes and resuspend in 1:10 volume of fresh broth
3. Dispense 0.2 ml of S. marcescens into the subjects’ cupped hands
4. Rub contamination into all surfaces of hands for 30 seconds

Products A and D tested at a volume of 1.5 ml, rubbed in until dry
**SUMMARY & CONCLUSIONS**

- The 70% ethanol ABHR, Product A, was the only product to meet Health Canada requirements for antiseptic drugs used in healthcare.

- The ABHR was statistically superior to all 3 quaternary ammonium based hand rubs tested after both a single use and multiple uses, using 2 different test methods.

- These results help support PIDAC recommendations to only use 70-90% ABHR in hospital settings and to not use quaternary ammonium compounds in healthcare settings.

- If you choose to use a quaternary ammonium compound based hand rub in your facility you should do so cautiously as the antimicrobial efficacy of the product may not be sufficient.

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