INTRODUCTION

- The WHO and CDC recommend alcohol-based hand sanitizers as the standard of care for routine hand hygiene.\(^7\)\(^,\)\(^17\)
- Alcohol-based sanitizers cannot be used on the ISS due to the risk of contamination to the water supply.
- There is conflicting data on sanitizer efficacy on Earth and it is unknown whether sanitization practices are effective against pathogens in space.

METHODS

- A systematic review of cohort studies was done searching Google Scholar and PUBMED through February 2017.
- Studies were included if they compared alcohol-free sanitizers to alcohol-based sanitizers, soap and water, or no intervention.
- 13 studies were identified: 5 reported on incidence of illness, 8 evaluated hand colonization rates.

RESULTS

Alcohol-free sanitizers decrease pathogens on the surface of hands

- Alcohol-free sanitizers appear non-inferior in reducing colonization with Serratia, Ecoli, Staphylococcus, and Enterobacter; study power may be lacking.\(^5\)\(^,\)\(^19\)\(^,\)\(^21\)
- Repeated washes with alcohol-based sanitizers may reduce their efficacy.\(^5\)\(^,\)\(^20\)
- Spores, fungi, and non-enveloped viruses may be best removed by physical force or alcohol rubs.\(^17\)\(^,\)\(^20\)

![Fig 1. Benzalkonium chloride vs alcohol-based sanitizers in the log reduction of S. marcescens](chart1)

**Fig 1. Benzalkonium chloride vs alcohol-based sanitizers in the log reduction of S. marcescens**

<table>
<thead>
<tr>
<th>Reduction Factor</th>
<th>Ethanol</th>
<th>Benzalkonium Chloride</th>
<th>Soap/Water</th>
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<td>3.44</td>
<td>1.93</td>
<td>2.05</td>
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*FDA standard is >2 reduction factors after 1 wash and >3 after 10 washes.

Alcohol-free sanitizer use is associated with reduced illness incidence

- School students have significantly fewer illness-related absences when using alcohol-free sanitizers vs soap and water.\(^5\)\(^,\)\(^11\)\(^,\)\(^23\)
- However, teaching and monitoring were provided to the study groups but not control groups.\(^5\)\(^,\)\(^11\)\(^,\)\(^12\)\(^,\)\(^23\)

![Fig 2. Percent risk reduction in school absences with alcohol-free sanitizers](chart2)

**Fig 2. Percent risk reduction in school absences with alcohol-free sanitizers**

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*p-value < 0.00001*

DISCUSSION

- Current sanitization practices on the ISS are based on expert opinion and design constraints.\(^6\)\(^,\)\(^13\)
- Alcohol-free sanitizers appear to correlate with a decreased incidence of illness, but there are no studies which directly compare outcomes to alcohol-based sanitizers.
- There are no in-vitro studies on the sanitizer utilized on the ISS.
- Future areas of study may include:
  - Alternative methods for sanitizer application
  - Pathogen mutations after prolonged sanitizer exposure in microgravity

REFERENCES