Evaluating the Efficacy of UV-C Technology in Acute Care

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ABSTRACT

The performance of a UV-C device was evaluated in two hospitals in tandem with manual surface disinfection methods. A variety of surface types were sampled following manual surface disinfection, and again following treatment with a UV-C device. Surfaces tested included vertical and horizontal surfaces, as well as surfaces that are sensitive to manual cleaning methods. UV-C treatment resulted in statistically significant reduction in mean plate counts for all sites tested. This simple and effective sampling method can be used to help hospital facilities assess the effectiveness of UV-C technology.

INTRODUCTION

Environmental surface cleaning is essential for controlling hospital-acquired infections, but manual disinfection alone is not always sufficient to reduce microorganism presence. Automated ultraviolet-C (UV-C) devices can be used to supplement manual disinfection, and have been shown to be effective in a clinical setting. The objective of this study was to evaluate the performance of a UV-C device in combination with manual disinfection in two U.S. hospitals using a simple and effective sampling method.

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Surface Viability</th>
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<tbody>
<tr>
<td>MRSA</td>
<td>Days to Weeks</td>
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<tr>
<td>C. difficile</td>
<td>Several Months</td>
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<tr>
<td>Carbapenem-Resistant</td>
<td>Days to Months</td>
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<tr>
<td>Klebsiella pneumoniae</td>
<td></td>
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<tr>
<td>(CRKP)</td>
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<tr>
<td>Vancomycin-Resistant</td>
<td>Days to Weeks</td>
</tr>
<tr>
<td>Enterococci (VRE)</td>
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- Only ~50% of surfaces in hospital operating or patient rooms are effectively disinfected using manual cleaning methods alone
- Pathogens can survive on surfaces up to months
- Rooms occupied by infected patients result in higher probabilities of subsequent patient infection

MATERIALS AND METHODS

- Rooms were cleaned with EPA-registered bleach or quaternary ammonium product, followed by UV-C
- Surfaces were sampled using contact plates following manual cleaning, then again following UV-C treatment
- Surfaces sampled included bed rails, over the bed tables, door handles, procedure lamps and tables, and sink fixtures, among others
- UV-C treatment consisted of three 5-minute cycles

RESULTS

Figure 1. Example sampling locations from Hospital 1. Yellow spots indicate sites tested prior to UV-C treatment but following manual cleaning, and green dots indicate sample sites tested following UV-C treatment.

Figure 2. Mean plate counts (CFU). “A” indicates plate counts following manual cleaning but prior to UV-C treatment, and “B” indicates plate counts following UV-C treatment.

- UV-C was effective on all surface types tested, including vertical, horizontal, and sensitive electronic surfaces
- The difference between mean plate counts before and after treatment with germicidal UV-C was statistically significant at a 95% confidence level for all but two of the rooms examined
- Treatment, room, item, and replicate were included in the general linear model; only replicate was not significant
- The treatment effect (before versus after UV-C treatment) was the greatest explanatory variable, accounting for >90% of the mean square error (MSE) for each hospital (p-values < 0.001)

CONCLUSIONS

- This study demonstrates a simple and effective method for evaluating UV-C devices in a clinical setting
- The use of contact plates allows for quick sampling without the need for swabbing
- UV-C was effective on both vertical and horizontal surfaces
- Results reinforce the need for a comprehensive cleaning solution (EPA-registered surface disinfectants + UV-C)

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REFERENCES


DISCLOSURES

Nothing to disclose.