



Efficacy of a Far-UV Pathogen Reduction Box for Disinfection of Hospital Equipment



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Abstract

Background: Contaminated environmental surfaces play an important role in the transmission of healthcare-associated pathogens including methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE), and *Clostridium difficile*. There is a need for automated methods for disinfection of equipment that are easy to use and non-corrosive to surfaces.

Methods: The Pathogen Reduction Box (PRB) is designed to use far ultraviolet (Far-UV and Far-UV+) lamps within a contained box to disinfect small pieces of hospital equipment such as call buttons, remote control units, and stethoscopes. In the laboratory, we examined log reductions in recovery of MRSA, VRE, and *C. difficile* from surfaces after varying lengths of exposure (5 to 120 seconds) and in the presence or absence of organic material. To assess disinfection of equipment, aerobic colony counts were measured on 50 patient call buttons before and after use of the Pathogen Reduction Box; the top and bottom surfaces were sampled separately to assess the effects of the Far-UV and Far-UV+ lamps.

Results: In the laboratory, the Far-UV and Far-UV+ lamps reduced recovery of MRSA and VRE by >3 logs within 20 seconds and >4 logs within 30 seconds. The Far-UV+ lamp was significantly more effective than the Far-UV lamp for killing of *C. difficile* (3 versus 1.5 log reductions at 30 seconds; $P < 0.001$). Organic material reduced the effectiveness of both Far-UV and Far-UV+ radiation, but >4 log reductions in MRSA and VRE could still be achieved in the PRB when the exposure time was increased to 120. The mean colony-forming units recovered from call buttons was significantly reduced by the PRB (102-111 versus 1.5-1.9 colony-forming units; $P < 0.001$).

Conclusion: Our results suggest that the Far-UV disinfecting unit is a promising new technology for rapid, automated disinfection of hospital equipment

Background

❖ Contaminated environmental surfaces play an important role in the transmission of healthcare-associated pathogens including methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE), and *Clostridium difficile*

❖ There is a need for automated methods for disinfection of equipment that are easy to use and non-corrosive to surfaces

Objective

To evaluate the efficacy and practicality of using the Pathogen Reduction Box for disinfection of small items in a hospital setting.

Figure 1. Optimal Kill Curve (*C. difficile*)

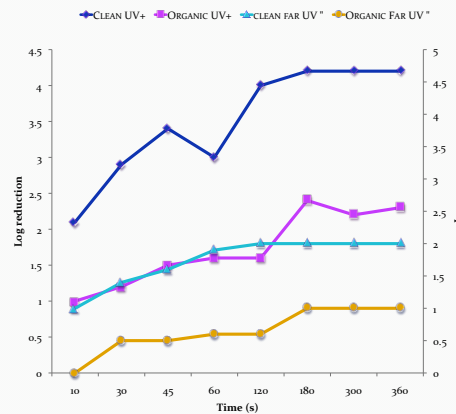


Figure 1 shows the reduction of clean *C. difficile* spores and *C. difficile* spores suspended in 5% organic load over exposure duration

Figure 2. Average CFU's total bacteria recovered from patient remote controls

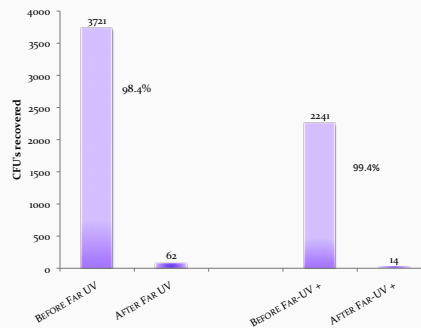


Figure 2 shows the reduction of total aerobic bacteria recovered from patient remote controls following exposure to Far-UV and Far-UV+

Methods

❖ The Pathogen Reduction Box (PRB) is designed to use far ultraviolet (Far-UV and Far-UV+) lamps which are at unique wavelengths other than UVC (254nm). The PRB contains both wavelengths to disinfect all surfaces of small pieces of hospital equipment such as call buttons, remote control units, and stethoscopes

❖ In the laboratory, we examined log reductions in recovery of MRSA, VRE, and *C. difficile* from surfaces after varying lengths of exposure (5 to 120 seconds) and in the presence or absence of organic material

❖ To assess disinfection of equipment, aerobic colony counts were measured on 50 patient call buttons before and after use of the Pathogen Reduction Box; the top and bottom surfaces were sampled separately to assess the effects of the Far-UV and Far-UV+ lamps

Results

❖ In the laboratory, the Far-UV and Far-UV+ lamps reduced recovery of MRSA and VRE by >3 logs within 20 seconds and >4 logs within 30 seconds

❖ The Far-UV+ lamp was significantly more effective than the Far-UV lamp for killing of *C. difficile* (3 versus 1.5 log reductions at 30 seconds; $P < 0.001$)

❖ Organic material reduced the effectiveness of both Far-UV and Far-UV+ radiation, but >4 log reductions in MRSA and VRE could still be achieved in the PRB when the exposure time was increased to 120 seconds

❖ The mean colony-forming units recovered from call buttons was significantly reduced by the Pathogen Reduction Box (102-111 versus 1.5-1.9 colony-forming units; $P < 0.001$)

Conclusion

The Far-UV disinfecting unit is a promising new technology for rapid, automated disinfection of hospital equipment