Background

- Healthcare room environmental surfaces can be frequently and continuously contaminated with multidrug-resistant organisms (MDROs) that can persist in the environment for a prolonged time.
- Multiple studies have shown that hospital surfaces are poorly cleaned and disinfected, demonstrating that adherence to standard cleaning/disinfection practices is challenging in healthcare facilities.
- There is a need to develop methods of continuous disinfection as well as enhanced methods of terminal room disinfection (e.g., hydrogen peroxide systems or ultraviolet light devices).
- Dilute hydrogen peroxide (DHP) technology catalytically generates hydrogen peroxide molecules from ambient humidity and oxygen in air, and the released DHP can decontaminate ambient humidity and oxygen in air, and hydrogen peroxide molecules from technology catalytically generates DHP units.
- We tested three test organisms; methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant Enterococcus (VRE), and MDR-Acinetobacter baumannii.
- An estimated 100-500 CFU for each test organism was inoculated and spread separately on each Formica sheet then exposed to DHP gas released into the room air.
- Triplicate samples were collected at times 0, 1, 3, 5, 6, 7, 24, and 48 hours.
- Following incubation, the colony forming units (CFU) of the test organisms on each Rodac plate were counted.
- Two separate experimental trials were performed for all time points.
- Statistical significance between intervention and control groups at each time point was determined by the Wilcoxon test, and p<0.05 was considered significant.

Methods

- DHP units were installed in ceilings of a model room and the hallway in front of the room per manufacturer's installation specifications, and the door was closed.
- We tested three test organisms; methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant Enterococcus (VRE), and MDR-Acinetobacter baumannii.
- An estimated 100-500 CFU for each test organism was inoculated and spread separately on each Formica sheet then exposed to DHP gas released into the room air.
- Triplicate samples were collected at times 0, 1, 3, 5, 6, 7, 24, and 48 hours.
- Following incubation, the colony forming units (CFU) of the test organisms on each Rodac plate were counted.
- Two separate experimental trials were performed for all time points.
- Statistical significance between intervention and control groups at each time point was determined by the Wilcoxon test, and p<0.05 was considered significant.

Results

- Although data in earlier hours tended to have lower microbial loads, the survival curves between both groups for each organism intersected at around 24 hours.
- There were no statistical differences in survival between DHP intervention and control groups except data at very few time points for each organism (i.e., for MRSA in Figure 1, p=0.0063 at 24 hours; for VRE in Figure 2, p=0.0163 at 1 hour, p=0.0163 at 3 hours; for MDR-Acinetobacter in Figure 3, p=0.0369 at 24 hours).
- The DHP units maintained a germicidal concentration (<0.1 ppm for all runs) that was inadequate, despite attempts to control factors that could interfere with the hydrogen peroxide gas concentration.

Conclusions

- Our preliminary study using DHP demonstrated not consistent microbial activity against MDROs on room surfaces, likely because we were unable to generate a sufficient germicidal level under our test conditions with the particular DHP units studied.
- Additional technologic modifications will be required to maintain stable and effective DHP level for continuous room decontamination in patient rooms.