**Panel V: Beyond UV-C – Reflective Surfaces and Coatings**

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Ultraviolent light (UV) light is now widely used for terminal room decontamination of hospital rooms. Most devices use UV-C irradiation with a wavelength of 254nm. Advantages of UV devices for terminal room disinfection include the following: 1) reliable biocidal activity against a wide range of pathogens; 2) surfaces and equipment decontaminated; 3) demonstrated effectiveness to reduce healthcare associated infections (HAIs) in before-after studies and randomized clinical trial; and, 4) residual free and does not give rise to health and safety concerns. Limitations for using UV for terminal room disinfection include: 1) can only be done for terminal disinfection; 2) all patients and staff must be removed from room; 3) requires 5-15 min for killing of vegetative bacteria and 10-45 min for inactivation of spores (e.g., *C. difficile*); 4) requires direct or indirect line of sight for microbial inactivation; 5) substantial capital equipment costs; and 6) does not remove dust and stains which are important to patients/visitors.

A number of factors affect the effectiveness of UV room disinfection devices including: 1) intensity of UV delivered (i.e., energy); 2) wavelength(s) of UV; 3) distance (energy delivered falls off as a square of distance); 4) duration of exposure; 5) orientation of the surface being disinfected to the UV light source (for non-shadowed surfaces, direct line of sight to UV source; for shadowed surfaces, UV reflectivity of walls/surfaces); 6) intrinsic susceptibility of microbes (e.g., spore formers such as *C. difficile* more difficult to inactivate than vegetative bacteria such as MRSA and VRE). Study variables: 1) microbial strain (there may be strain variability to UV); 2) spreading the inoculum over a greater surface area enhances killing; 3) organic load (e.g., 10% fetal calf serum) significantly decreases killing; 4) test surface does not affect killing (e.g., Formica, glass, steel); 5) humidity.

In order to improve the effectiveness of UV room disinfection devices, a reflective paint has been developed using nanotechnology. This reflective paint/wall coating has been evaluated in several studies conducted in unoccupied patient rooms (control was a similar room without reflective coating) using test surfaces contaminated with healthcare-associated pathogens. These studies have demonstrated the following: 1) UV-C reflective wall coatings significantly improve UV intensity delivered directly and indirectly to room surfaces – improvement more significant for indirect exposures; 2) UV-C reflective wall coatings significantly improve microbial inactivation with reduced exposure time to achieve similar log10 inactivation levels; 3) coating ceilings and/or floors does NOT improved microbial killing when walls are coated; and 4) reflective paint demonstrated to improve UV intensity with multiple UV room devices. Future research needs include: 1) assessing the impact and costs of coating in actual hospital units (e.g., an intensive care unit); 2) cost effective analysis demonstrating benefit of use of reflective wall coatings (parameters: cost of UV-C reflective coating vs standard paint, timing for reapplication vs standard paint, number of rooms needed to be covered)

References

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