

Considerations When Choosing An Enhanced Disinfection System

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Abstract

This article examines Ultraviolet light and Hydrogen Peroxide Vapor disinfection technologies.

Main Article

The hard surface environment has been linked to transmission of pathogens to patients. The risk of acquiring an infection while staying in a healthcare facility increases significantly if the previous room occupant harbored an infection (1–5). In addition to standard room cleaning and disinfection by environmental services staff, enhanced automated room disinfection is gradually becoming the standard of care in many hospitals and other healthcare facilities. At the Association for Professionals in Infection Control (APIC) 2016 meeting in Charlotte, NC June 11-13th, leading infection prevention researcher Dr. William Rutala stated in his plenary lecture, “This technology (Ultraviolet light (UV) or Hydrogen Peroxide Vapor (HPV)) should be used for terminal room disinfection.” As with any new technology, evaluating these devices can be a difficult task.

Currently there are two main types of automated enhanced disinfection technologies. The first uses some form of vaporized HPV and the second uses UV-C light. The HPV devices fill the space to be disinfected with a set concentration of vaporized hydrogen peroxide. This level is maintained for a period of time and then filtered out of the air by the machine. UV-C light disinfection utilizes a UV energy emitter to deliver the energy to the space. This energy disrupts the genetic material of microorganisms like bacteria and viruses, preventing them from causing an infection. Both technologies have been shown to kill bacteria in both the laboratory and healthcare facility setting and have been linked to reductions in hospital acquired infections (6-11). As with most new technologies there are limitations to their use.

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The main limitations to the use of HPV are time and labor. Specialized labor is required to set up each room. Room setup includes blocking all ventilation, sealing all doors, and preventing the vapor from leaving the treatment space. The HPV is then released into the room until a specific dose is delivered. These systems are very effective and have

shown very high log reductions in laboratory settings. However, it takes several hours to completely set up the room and expose the area. If time and labor are not an issue, then these systems work very well. Often throughput is a concern for major medical centers where there are more patients than beds available. In these instances, UV-C systems may be the better option.

UV-C systems have also demonstrated very high log reductions of bacteria and viruses in both the laboratory and healthcare settings, although slightly lower than that of HPV. The main benefit over HPV is time; these systems can accomplish whole room disinfection in minutes vs hours. There are still other things to consider when selecting and utilizing a UV-C disinfection system. This technology uses UV-C energy to target the DNA or genetic material of microorganisms. This "light" energy has the greatest efficacy in a direct line of sight from the UV-C light emitter (12). A second limitation to UV-C disinfection is that as the distance between the UV-C source and the surface being disinfected increases the total delivered energy decreases (12). Light energy like that of UV-C follows the physical inverse square law, whereby as the distance between the UV-C emitter and the surface doubles, the delivered energy is cut by one quarter. These two properties of UV-C are true for all UV devices and require some consideration when selecting a system.

The first generation UV-C devices that are still in the marketplace utilize a single emitter which limits the objects that are in the direct line of sight and within close proximity to the UV emitter. These devices therefore require more labor and must be repositioned within a single space several times to allow all of the objects in the space to receive an adequate UV-C energy dose. Newer second generation systems have incorporated multiple emitters which minimizes the labor required and just a single setup is necessary to accomplish whole room disinfection. Another important consideration is validation; some system manufacturers simply recommend a specified time for all spaces and advertise around this number such as 4, 5 or 10 minutes. Thinking about the limitations discussed above this advertised time may make sense when disinfecting a small bathroom but what about a large operating room or a room with a lot of objects; validation is key. A few devices on the market measure some of the UV-C dose in particular areas or by identifying the reflected UV-C energy. Because UV-C is reflected very poorly this method of measurement is limited and incorporates assumptions about the surfaces in the room. Accurately determining the size of the space and identifying objects within that space provides a comprehensive room map and greater efficacy while eliminating guesswork by the operator. This measurement system, incorporated into multiple emitter second generation systems automatically adjusts the cycle based on emitter placement in each space.

In Most Institutions Minimizing The Labor Requirement Is Essential

Possibly the most overlooked consideration when selecting an automated enhanced disinfection system is labor. Although these systems are automated they still require time to set up and move the systems from room to room. In most institutions minimizing the labor requirement is essential. HPV systems require only a single room setup, however specialized training is required and sealing of the room is a necessity. First generation single emitter UV systems require an operator to stand by the system and move it two to three times to disinfect a single space. Second generation UV-C disinfection systems with multiple emitters require just a single setup and provide a time to the operator whereby that person can be productive elsewhere during the disinfection cycle. Again note that these systems are only to be used as an enhancement to traditional cleaning not a replacement, thus standard cleaning procedures should remain the same.

Two other things to consider when purchasing an enhanced disinfection system are flexibility and training. Most disinfection systems are able to only disinfect entire rooms. Newer second generation systems are able to be used together as a multiple emitter system or decoupled and used individually for smaller spaces like bathrooms. They can

also target the energy to specific areas which can be useful for disinfecting things like workstations on wheels, wheelchairs, IV poles, cell phones, and other equipment in less time than a whole room cycle. Lastly, training is essential, all new procedures and practices require training. Comprehensive training should not just be on the use of the system and how to turn it on and off but also on proper room setup and utilization. Ensure that whatever disinfection modality or system you choose that the manufacturer provides extensive on-site and continuing education to your staff. Proper utilization is essential to a successful enhanced disinfection campaign.

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