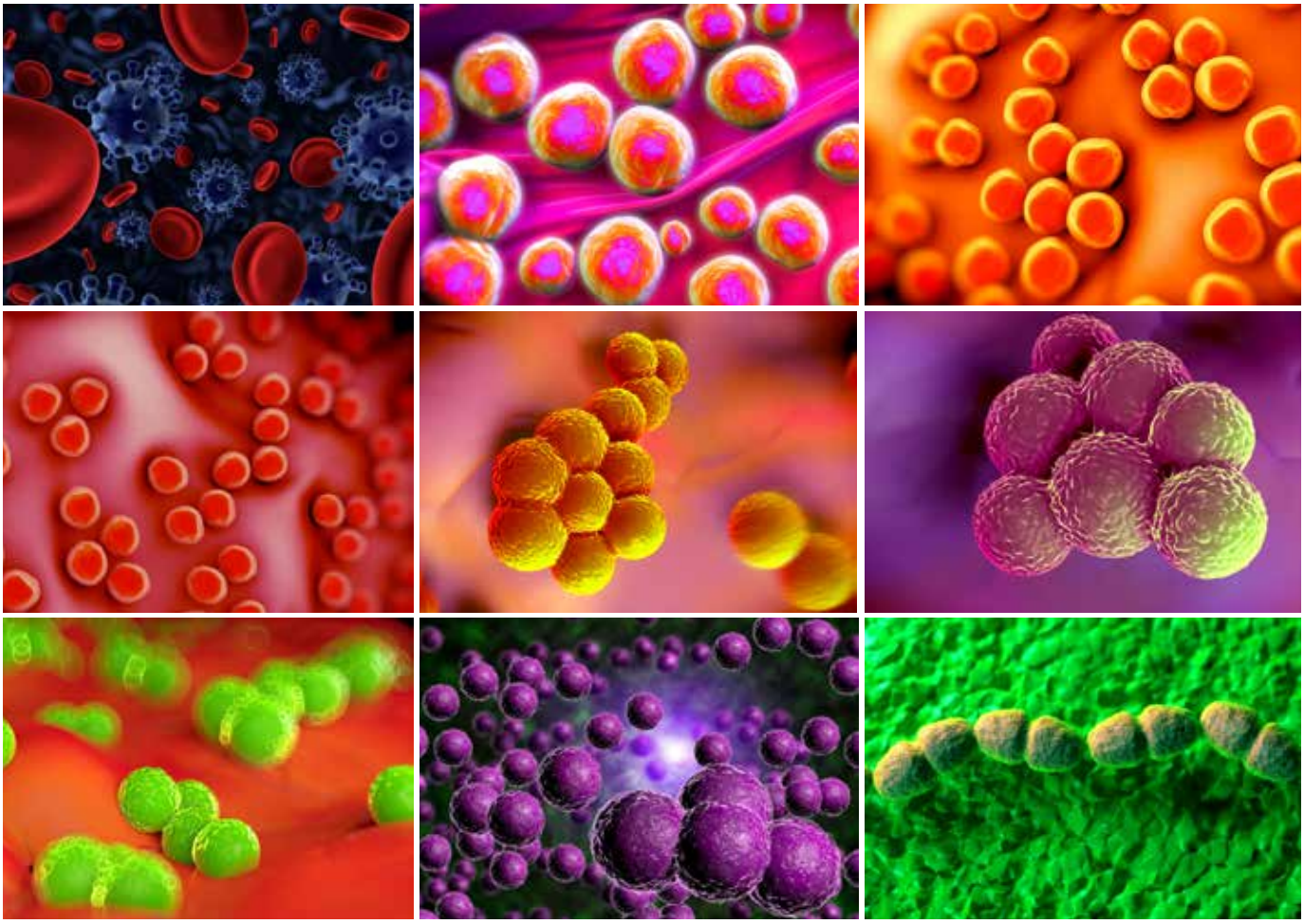

SEEING THE LIGHT

UVC light engineer's weapon in battle against superbugs

By Barry Hunt

The science is in. The long debated and previously underappreciated link between the physical environment and healthcare acquired infections (HAIs) has been established. When pathogenic bacteria and viruses are shed in close proximity to susceptible patients, HAIs occur. Eliminating the reservoir reduces transmission. Reducing bioburden in the right place at the right time can best be done through design, technology and automation.

BODY OF EVIDENCE

Beginning in 2011, studies showed a significant reduction in bioburden when patient rooms were disinfected with mobile ultraviolet C (UVC) light devices operated by environmental services at terminal discharge. By 2013, studies indicated significant reductions of HAIs, some up to 50 per cent or more.

Earlier this year, the Association for Professionals in Infection Control and Epidemiology (APIC) recognized Dr. Deverick Anderson of Duke University with its Distinguished Scientist Award for his contribution to infection prevention science. This includes the first study undertaken to prove that transmission of multi-drug resistant organisms (MDRO) occurs from the hospital environment and enhanced cleaning can reduce the risk of that transmission. Adding UVC to quaternary cleaning compounds (quats) or bleach

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reduces a patient's risk of acquiring a HAI by 32 to 37 per cent, when the prior occupant has had a MDRO, such as MRSA, VRE or C. difficile.

ILLUSTRIOUS ENERGY

UVC penetrates the cell membranes of viruses and bacteria and attacks their DNA, terminating their ability to spread. Unlike chemical disinfectants, bacteria and viruses have not been shown to systematically develop further resistance to the UVC light.

UVC disinfection constants have been published for most organisms, allowing easy calculation of time and distance required for deactivation. In general, bacteria and viruses have little protection from UVC and may be deactivated in seconds; however, deactivation of bacteria in a spore state takes much longer than when in a vegetative state. For example, C. difficile spores require 15 times more UVC energy than Klebsiella pneumonia.

UVC disinfection time varies depending on the light intensity and distance between the light source and target. It takes 400 millijoules per square centimetre (mj/cm2) of 254 nanometre (nm) UVC energy to eliminate 99.9999 per cent (or 6 log) of C. difficile spores. The time to disinfect a room depends on the size of the room, number of devices (one or two), amount of energy each device produces and distance of each device to the furthest target surface.

THE ROOM BEYOND

Disinfecting patient rooms with UVC once a week prior to each new occupant makes sense and appears to be effective in reducing risk to patients.

But does this approach go far enough?

After all, patient rooms are cleaned every day. And they may not be the only areas that would benefit from daily UVC disinfection.

C. difficile and VRE are intestinal bacteria associated with explosive diarrhea. A 2012 study published in the American Journal for Infection Control showed flushing releases infectious toilet aerosols that float for up to 90 minutes, contaminating the air and settling on nearby surfaces. C. difficile can also be cultured 30-centimetres above the bowl with every flush. Armed with this information, Canadian researchers are looking at whether bathrooms could benefit from UVC disinfection with every use.

Last year, a study at St. Mary's General Hospital in Kitchener, Ont., examined the usability and effectiveness of an automated UVC disinfection device. Findings included: UVC significantly reduced bioburden; equipment and utility rooms may be accessed as much as 100 times per day, providing a nexus for cross-contamination; and each room has a unique biological fingerprint.

That is, culture plates taken daily from the same surfaces without UVC disinfection grow the same organisms day after day. As well, culture plates are virtually clean when UVC is switched on; however, they return to normal appearance 24 hours after UVC disinfection is switched off.

The study also found that despite signage, staff and patients don't always close bathroom and utility room doors after use. On average, doors were closed 32 per cent of the time during the study period. This led to an average bioburden reduction of 65 per cent. While this reduction in contamination is significant, compliance and effectiveness could be increased further with the use of automatic door closers for spaces with automatic UVC disinfection devices.

In a second study, Lion's Gate Hospital evaluated the effectiveness of an automated UVC disinfection device in reducing bioburden in a bathroom, where the door was closed 100 per cent of the time after use. Researchers found that use of this device resulted in a 97 and 95 per cent reduction in contamination of the toilet and sink, respectively. The contamination in the air was also reduced by 65 per cent.

The in-patient tower at Lion's Gate Hospital in North Vancouver features floors that include up to three wards of four patients each who share a single bathroom. Following the bioburden study, the hospital installed 10 automatic UVC disinfection devices into the shared bathrooms as part of an overall strategy to reduce persistent C. difficile rates as high as 13 to 15 cases per month. Other mitigation strategies employed included leadership, training, mindfulness, decluttering and improved cleaning processes. Since the introduction of the devices in April, the hospital's C. difficile rates have dropped to just one case per month. ■

Barry Hunt is president and CEO of Class 1 Inc., a leading provider of medical equipment and systems, including UVC room disinfection. He is also chair of the Coalition for Healthcare Acquired Infection Reduction (CHAIR) Canada.