

Ultraviolet and HVAC: Keys to HAI Reduction

The use of ultraviolet light systems is becoming more widely used in healthcare facilities for disinfecting patient and operating rooms. Yet, ultraviolet lights systems are misunderstood in spite of significant research and use in other industries. So let's unravel this mystery.

Ultraviolet (UV) light in nature is electromagnetic radiation produced by the sun. The most common forms are UV-A which is a long wave light and not absorbed by the ozone layer (also called black light), UV-B which is a medium wave and mostly absorbed by the ozone layer and finally UV-C which is a short wave light and completely absorbed by the ozone layer. Modern science has been able to create UV-C lighting that are able to penetrate the cell wall of microorganisms, and alter the DNA structure such that the microorganism becomes non-viable; unable to reproduce or infect a patient.

Did you know UV-B induces production of vitamin D in the skin, sunburn happens at wavelengths near the boundary of the UV-A and UV-B bands, overexposure to UV-B radiation not only can cause sunburn but also some forms of skin cancer skin, disinfection using UV-C radiation is commonly used in wastewater treatment applications and is finding an increased usage in municipal drinking water treatment. UV-C is also used in night time cleaning of laboratories and meat packing facilities. Another term used for UV-C disinfection is Ultraviolet Germicidal Irradiation (UVGI).

Healthcare Acquired Infections (HAI's) are the 4th leading cause of death in healthcare facilities in Canada. Besides the traditional prevention and control strategies of hand hygiene, environmental cleaning and infection control surveillance, the built environment can significantly contribute to the reduction of HAI's.

One of the most popular forms of disinfection is the use of portable UV-C systems. A Canadian company Sanuvox manufactures a twin unit which can be placed in the patient room with one unit on either side of the bed to cover off the shadow effect and of course with no patient in the room and the corridor door closed. The lights can be activated remotely via WiFi applications to smart phones plus infrared mechanisms on the units turn off the UV-C lights if there is the slightest movement in the room. Disinfection results are measured in terms of distance from the light to bed, wall, etc. and the intensity of the bulbs themselves and described in the chart below.

Bacteria	Distance	5 ft.	6 ft.	7 ft.	8 ft.	9 ft.	10 ft.
	nW/cm2	1314	999	778	620	504	417
K pneumonia	Seconds	18	24	30	42	48	60
VRE	Seconds	30	36	42	54	66	78
MRSA	Minutes	1.2	1.6	2.1	2.6	3.2	3.8
C diff	Minutes	4.6	6.0	7.7	9.7	11.9	14.4

Therefore, even the stubborn C. diff bacteria are eliminated in less than 15 minutes to Log 5 in the patient room. Because the bathroom is even smaller, placing one of these units in the bathroom would require a clean time of less than 5 minutes. And yes, environmental services

staff still have to clean the patient room in their usual manner and we still have to always wash our hands!



Sanuvox Aseptix twin units disinfecting patient room

Let's go one step further and place another Sanuvox UV-C product in the Heating Ventilation and Air Conditioning (HVAC) system to disinfect the air of both bacteria and viruses. Units can either be placed in the ducts or inside the main HVAC unit. Other stand-alone units can be placed inside the bathrooms of patients above the door to clean on a cycle basis. Think of the patient with C diff. and their diarrhea episodes resulting in the fecal cloud depositing the bacteria back onto the bathroom surfaces. The bathroom UV-C light cycles on when the door is closed and the patient not in the room...and the room is free of bacteria and viruses in 5 minutes. Another great application of UV-C cleaning would be between cases in the operating room.

Another company York Air Conditioning is manufacturing a HVAC unit with UV-C lights built inside the unit. A typical configuration for high risk health-care application places the UV-C lights downstream from the cooling coil to deal with the spore size micro-organisms and upstream of a high efficiency HEPA (High Efficient Particle Arrestance) filter to eliminate airborne bacterial and viral contaminants. The York Solution UV-C system has been developed with their partners Johnson Controls and UltraViolet Devices, Inc.

The following table shows the effectiveness of the York Solution UV-C system.

Application	Lamp Quantity	Air Changes Per Hour	Kill Rate Efficiency
Good	4	Single pass	50%
Good	4	6	99.98%
Better	8	Single pass	75%
Better	8	3	99.98%
Best	20	Single pass	90% (+)
Best	20	3	99.999%

And finally, here are a couple of real life examples. An Invitro Fertilization Laboratory in the United States installed UV-C cleaning in their HVAC system and increased the clinical pregnancy rates from 38.9% to 62.3%. The Women's & Children's Hospital of Buffalo, NY reported the following. "eUVGI eradicated microbes in HVACs and was associated with a decrease in NICU environmental pathogens and tracheal colonization. Significant reductions in VAP and antibiotic use in NICU high-risk patients were associated with eUVGI in this limited study".

In mid-October, TRU-D Smart UVC has deployed two superbug-slaying machines at JFK Hospital and ELWA Hospital in Monrovia, Republic of Liberia. They are helping to disinfect healthcare environments where Ebola patients are being treated. In an effort to eliminate Ebola at the source, the use of innovative disinfection technology, such as TRU-D, is critical to creating and maintaining a pathogen-free environment for patients and healthcare staff.

UV-C disinfect cleaning is real and works!!! Use these systems and reduce HAI's.

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