USING ULTRAVIOLET LIGHT FOR SURFACE DISINFECTION

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DISCLOSURE
Research Biomerieux, Teck
OBJECTIVES

1. Describe how UVC light works
2. Discuss UVC strategies to reduce HAIs
3. Review the evidence that support use of UVC to reduce HAIs
• Risk of an ARO increases with prior occupancy by a patient with an ARO
• Manual cleaning is imperfect
• UVC may be an effective adjunct
The Power of Light
UV SURFACE DISINFECTION
used in laboratories for years
new literature demonstrates value as an adjunct to cleaning
reduces CD spores, MRSA, VRE in hospital rooms
evaluation must include ability to integrate technology into workflow
COMMON QUESTIONS

IS IT SAFE?
Yes, sensors and barriers prevent accidental human exposure
UVC does not penetrate glass

DOES IT WORK?
Yes, both in laboratory and clinical setting
Types of UVC Technology Available

**Continuous UVC**

- Low pressure mercury 254 nm
- Cycle time: 5 to >60 min
- Machines as to how they determine the length of a cycle
- One study suggests more effective than pulsed xenon
- Purchase prices vary significantly

**Pulsed Xenon**

- Pulsed light from 200 to 320 nm
- Cycle time 5-7 min
- As per continuous UVC
Effect of Variation in Test Methods on Performance of Ultraviolet-C Radiation Room Decontamination

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OBJECTIVE. To determine the effect of variation in test methods on performance of an ultraviolet-C (UV-C) room decontamination device.

DESIGN. Laboratory evaluation.

METHODS. We compared the efficacy of 2 UV-C room decontamination devices with low pressure mercury gas bulbs. For 1 of the devices, we evaluated the effect of variation in spreading of the inoculum, carrier orientation relative to the device, type of organic load, type of carrier, height of carrier, and uninterrupted versus interrupted exposures on measured UV-C killing of methicillin-resistant Staphylococcus aureus and Clostridium difficile spores.

RESULTS. The 2 UV-C room decontamination devices achieved similar log_{10} colony-forming unit reductions in the pathogens with exposure times ranging from 5 to 40 minutes. On steel carriers, spreading of the inoculum over a larger surface area significantly enhanced killing of both pathogens, such that a 10-minute exposure on a 22-mm² disk resulted in greater than 2 log reduction in C. difficile spores. Orientation of carriers in parallel rather than perpendicular with the UV-C lamps significantly enhanced killing of both pathogens. Different types of organic load also significantly affected measured organism reductions, whereas type of carrier, variation in carrier height, and interrupted exposure cycles did not.

CONCLUSIONS. Variation in test methods can significantly impact measured reductions in pathogens by UV-C devices during experimental testing. Our findings highlight the need for standardized laboratory methods for testing the efficacy of UV-C devices and for evaluations of the efficacy of short UV-C exposure times in real-world settings.

Infect Control Hosp Epidemiol 2016;37:555–560
Does UVC Work Clinically?

Many studies show decrease in bioburden
Limited studies on impact on HAI reduction

Vianna PG AJIC 2016:44:299-303
Napolitano NA AJIC 2015;43:1342-6
Please note that the decluttering and VRE risk management approach began with Wave 1 in September 2012.
Use of a nonexistent operator
Decline in UVC use with shift to new HK team
### The advantages of software for process monitoring

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And now of course, there’s Angus to help!
PURCHASE CONSIDERATIONS

Canadian facilities work at 100% capacity. No ability to extend “down time” for rooms.

Most UVC machines are microbiologically effective.

Functionality, integration into workflow, operator considerations become the primary determinants for purchase. Cycle time may become paramount.

Consider how your facilities operates when selecting UVC machines.
PERMANENT UVC INSTALLATION IN BATHROOMS

J Cooper, G Astrakianskis, K Bartlet, E Bryce

The Problem: Common shared hallway bathrooms with limited sink access

The background: Toilets generate aerosols of bacteria and viruses that follow air currents for long distances or land on surfaces.

The question: Is permanently installed UVC light effective in decreasing microorganisms in the air and on surfaces?
THE STUDY DESIGN

J Cooper, G Astrakianskis, K Bartlet, E Bryce

Shared hallway washrooms of similar design and size with either UVC (with 5 minute run time)

150 litre air samples were collected 5 minutes and 30 seconds after patient use and cultured

Surface samples from toilet and counter cultured
Washroom Layout and Sampling Locations

- Location of air samples
- Location of surface samples
<table>
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Automated, permanent UVC lights can decrease exposure to potential pathogens

Again, careful consideration of where these devices are placed – AND WHY – is required.
REDEFINE SANITIZATION OF MOBILE HAND HELD DEVICES

UVC FOR MOBILE EQUIPMENT

Li, Wong, Rose, Wickham, Bryce Am J Infect Control 2016

hand-held equipment can be fomites for microbe transmission

Aluvis machine is effective at disinfecting hand-held devices, but requires some human factors optimization
Ambient LED and White Light

Ultra Violet (UV)  
Visible Light Safety Zone  
Infrared (IR)

400nm  500nm  600nm  700nm

405 nanometers: Peak germicidal activity via photoexcitation of porphyrin molecules
CONCLUSION

We are entering into an exciting new world of technology

Need to balance cost with efficacy

And consider human factors into the equation
THANK YOU
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References


2. Spencer M, Vignari M, Bryce E et al. A model for choosing an automated ultraviolet-C disinfection system and building a case for the C-suite. Two case reports. AJIC 2017;45:227-292


5. Weber DJ, Rutala WA, Anderson DJ, Chen LF, Sickbert-Bennett EE, Boyce J. Effectiveness of ultraviolet devices and hydrogen peroxide systems for terminal room decontamination: focus on clinical trials. AJIC 2016;44:e77-e84


