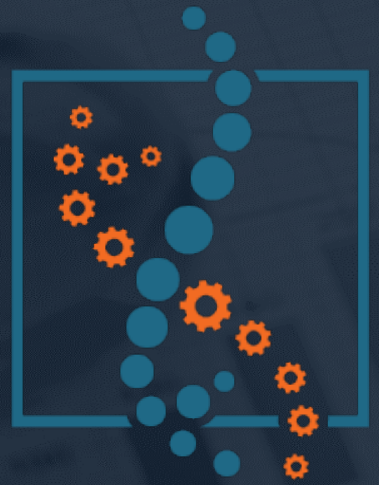

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Dosimeter technology background

- Been around since 1800s

- Different types:
  - Radiometer
  - Chemical indicators
  - Biological indicators
  - Etc.

- Used in research, industry, healthcare,
- etc.

Why use a chemical colour changing dosimeter with UV in healthcare?

- Colour changing dosimeters already being used in healthcare:
  - Autoclaves
  - Steam
  - Heat
  - Etc.

US market research (110 hospitals):
> 73% says they would use a dosimeter (some hospitals did not use UV and/or does not plan to use it)

Machine specific for largest actors in industry – on average 80% said they would use the indicators
With 2 of the top 5 companies – 100% of the hospitals said they would use a dosimeter

Colour changing colour indicator most popular way to continuesly measure UVC for every cycle

What part does a colour changing dosimeter have in a standard for UVC disinfection ?

- Reference to other standards:
  - Colour changing dosimeter already used in healthcare
  - Recommended by CDC and FDA

- Easy way to monitor UVC exposure for every UVC cycle

- Colour changing dosimeter wont replace radiometer, microbiology testing

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Colour changing chemical indicators development - UVC

- Start with what the market wants (Ips, EVS, etc):
  - Reliable
  - Easy to use

- Photochromic ink
  - Chemical reaction leading to colour change

- Major development points:
  - Wavelength specificity – visible light
  - Stability
  - Repeatability
  - Angles – vertical vs horizontal
  - Temperature, humidity
  - Safety

How can a colour changing indicators help?

- Increase understanding for UVC
- Help to identify shadowed areas
  - 30-50% of surfaces in shadowed areas during cycle*
- Areas further away
- Decrease disinfection time with up to 75%
- **Potential to increase disinfection levels**

*John M. Boyce, MD;1,2 Patricia A. Farrel, MT et.al, "Impact of Room Location on UV-C Irradiance and UV-C Dosage and Antimicrobial Effect Delivered by a Mobile UV-C Light Device", infection control & hospital epidemiology june 2016, vol. 37, no. 6
Marie Lindblad, Fredrik Huss, MD et.al, "Ultraviolet-C decontamination of a hospital room: Amount of UV light needed", JBUR 5947 No. of Pages 8

Does it work?

Ultraviolet-C (UV-C) monitoring made ridiculously simple: UV-C dose indicators for convenient measurement of UV-C dosing

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Case Western Reserve University EST. 1826 think beyond the possible

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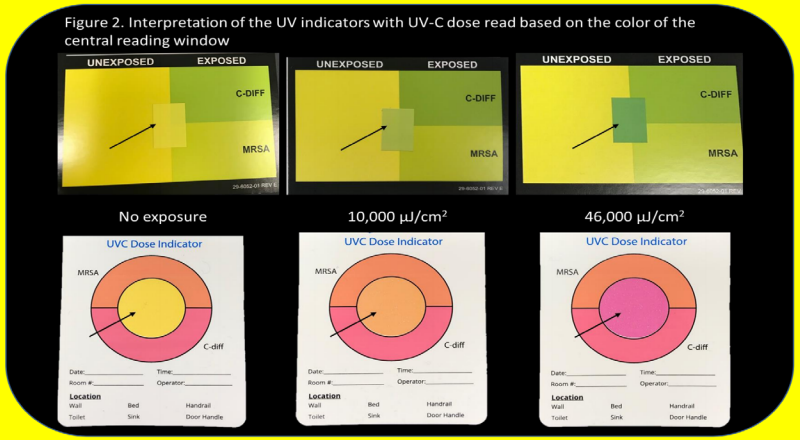
Poster #1215

Background

- Ultraviolet-C (UV-C) light is increasingly used as an adjunct to standard cleaning in healthcare facilities
- Most facilities do not have a means to measure UV-C to determine if effective doses are being delivered
- We tested the efficacy of 2 easy-to-use colorimetric indicators for monitoring UV-C dosing in comparison to log reductions in pathogens

Figure 2. Interpretation of the UV indicators with UV-C dose read based on the color of the central reading window

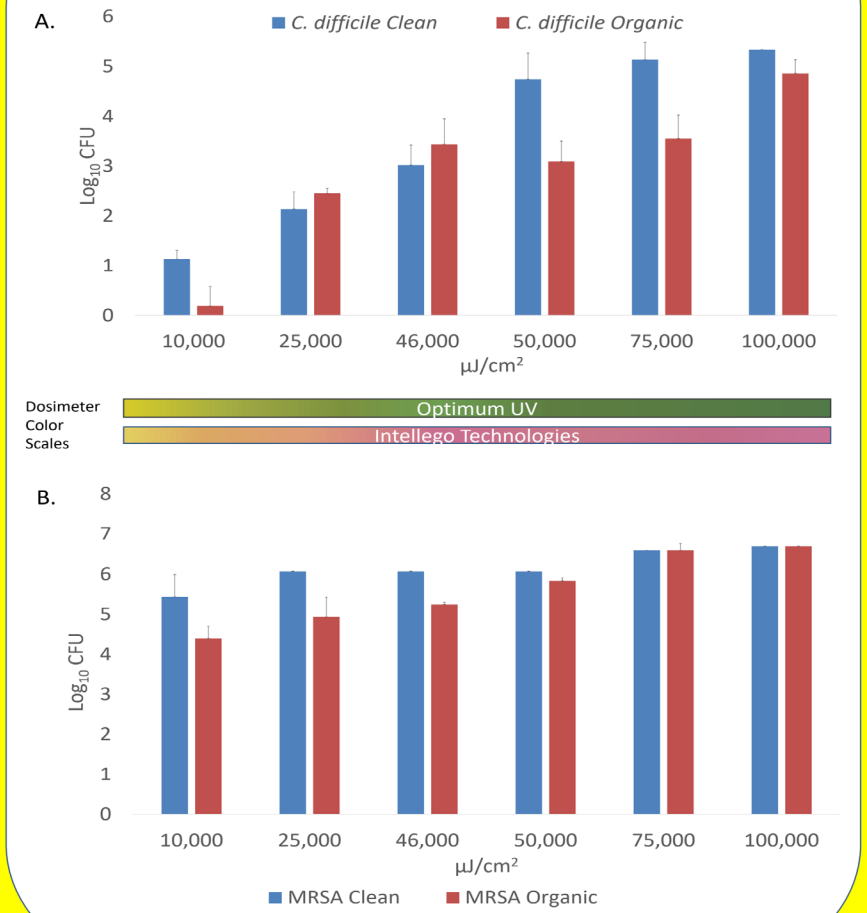


Methods

- In a laboratory setting, we exposed methicillin-resistant Staphylococcus aureus (MRSA) and *Clostridioides difficile* spores on steel disk carriers to UV-C for varying fluence exposures ranging from 10,000 to 100,000 µJ/cm2
- The UV-C indicators were placed adjacent to the carriers
- Change in color of the indicators was correlated with dose and $\log_{10}$ CFU reductions

Results

Figure 1: Reduction of *C. difficile (A) and MRSA (B)* with varying fluence exposures



Results

- The UV-C doses required to achieve a 3-log reduction in MRSA and C. difficile were 10,000 and 46,000 µJ/cm², respectively
- For both indicators, there was a visible color change from baseline at 10,000 µJ/cm2 and a definite final color change by 46,000 µJ/cm2 (Figure 1&2)
- Organic load had only a modest impact on UV-C efficacy
- The indicators required only a few seconds to place and were easy to read (Figure 2)

Conclusions

- UV-C doses of 10,000 µJ/cm² and 46,000 µJ/cm² were required to achieve 3 log reductions of MRSA and *C. difficile* spores, respectively.
- The colorimetric indicators provide an easy means to monitor UV-C dosing.
- Additional studies are needed to evaluate use of the indicators in patient rooms including in shaded areas

Acknowledgement

- We thank The Clorox Company and Intellego Technologies for providing devices for testing
- Providing companies did not have any role in planning or design of the study and no funding was received

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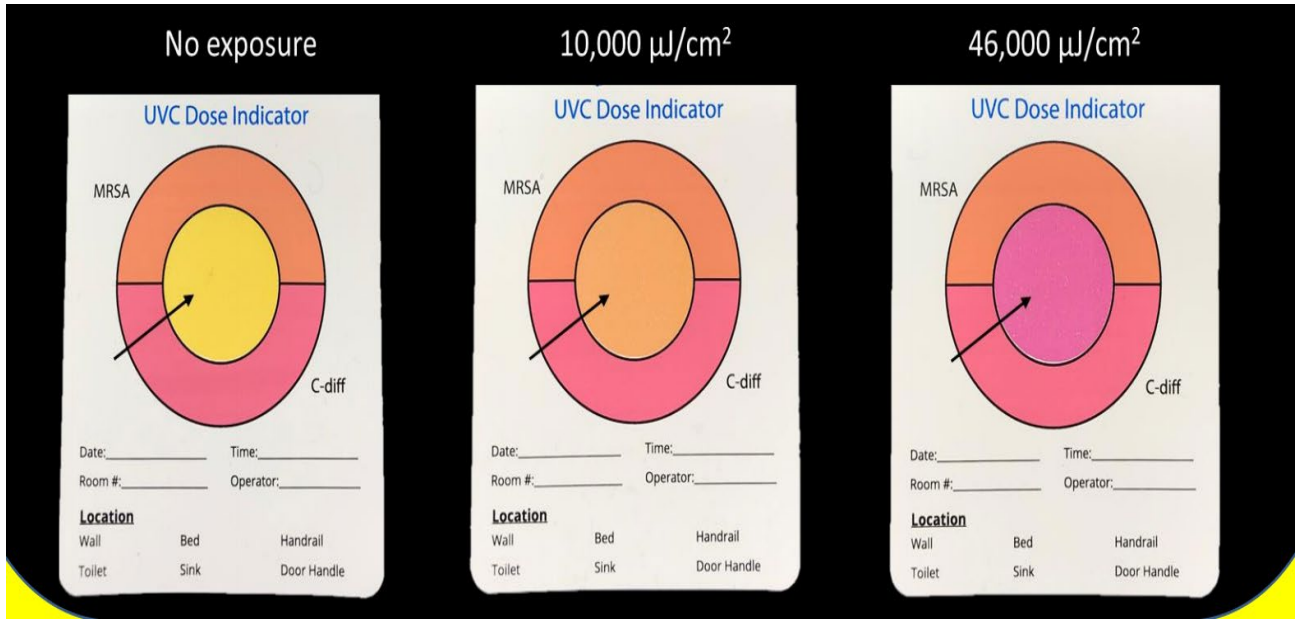

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Additional hospital studies

- Dr Donskey study presentation – IUVA workshop 14th of January
- ”*Ultraviolet-C decontamination of hospital room: Amount of UV light needed*”
- Hopsitals already using dosimeters today
- More to come...

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Ultraviolet-C decontamination of a hospital room: Amount of UV light needed

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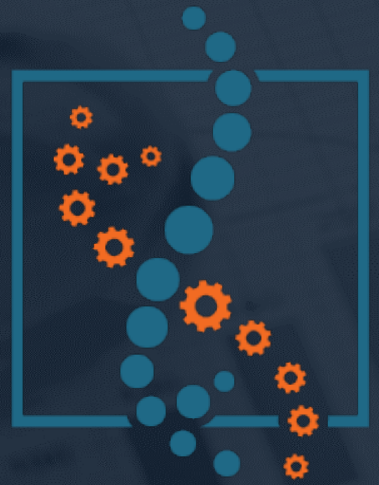

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