UVDI™

Clinical and Laboratory Evidence



UVDI-360
Room Sanitizer
Equipped with
UV Smart Connect™

UVDI™
EST. 1992

Committed to Helping Through Evidence and Science

UVDI was founded in 1992 with a Mission to provide a cleaner, safer, and healthier world with advanced UV-C solutions that disinfect the air and surfaces in the environments we live, work, and play in.

We serve this Mission with proven UV-C disinfection technology supported by independent scientific evidence, transparent data and rigorous product testing.

For No-Touch UV hospital disinfection, we believe all Healthcare professionals deserve the following:

- Independently proven, broad spectrum efficacy at real-world times and distances
- Peer-reviewed, published studies demonstrating the highest-levels of effectiveness in clinical settings
- Surface coverage confirmation technology verifying a sufficient UV-C dose has reached any targeted surface

The following pages detail the independent evidence generated by leading healthcare systems, researchers and laboratories utilizing the UVDI-360 Room Sanitizer.

We are committed to helping you provide enhanced patient-and-staff protection using evidence-based UV-C disinfection technology.

Sincerely,

Peter Veloz
CEO, UVDI

uvdi.com • uv@uvdi.com • 1-844-777-UVDI

Table of Contents

Independent Laboratory Microefficacy Testing: 99.99% inactivation of 37 microorganisms 4-5

SARS-CoV-2, BSL-3 Laboratory | Innovative Bioanalysis, January 2021 6

***C. difficile* | Infection Control & Hospital Epidemiology, January 2017**
University of Pennsylvania – David Pegues, MD 7

***C. difficile* & MRSA | Infection Control & Hospital Epidemiology, August 2014**
UNC Health Care – William Rutala, MS, MPH, PhD 8

***C. difficile* & MRSA | Antimicrobial Resistance and Infection Control, February 2018**
University of Iowa – Vincent Masse, MD 9

***C. difficile* & MRSA | SHEA 2016**
Cleveland Clinic – Abhishek Deshpande, MD 10

***C. difficile* & MRSA | Infection Control & Epidemiology, May 2016**
Louis Stokes Cleveland VA Medical Center – Curtis Donskey, MD 11

MRSA | Frontiers in Microbiology, December 2020
Hospital Infantil de México Federico Gómez – Daniela De la Rosa-Zamboni, MS, MD 12-13

MRSA & *Klebsiella Pneumoniae* | Infection Control & Hospital Epidemiology, August 2016
UNC Health Care – William Rutala, MS, MPH, MD 14

CRE | Journal of Hospital Infection, March 2022
Wits Donald Gordon Medical Centre – Warren Lowman, Clinical Microbiologist 15

CRE | Infection Control & Hospital Epidemiology, August 2016
Johns Hopkins Hospital – Lisa Maragakis, MD, MPH 16

***Pseudomonas aeruginosa* | APIC 2015**
Women's Hospital, Deaconess Health System in Indiana – Sonya Mauzey, RN, BS, CIC 17

MDROs | Independent Lab Testing, January 2017
Cardiff University – Jean Yves Maillard, MD 18

***C. difficile*, MS-2, MRSA | APIC 2015**
University of Arizona, Charles Gerba, PhD 19

Microbial Burden | European Journal of Public Health, September 2020
Rugani Hospital – Gabriele Messina MD, PhD, MSc 20

Microbial Burden | APIC 2015
Oasis Hospital – Maurice Croteau, Director of Healthcare Services 21

***Candida auris* | Independent Lab Testing, January 2019**
University of Siena - Gabriele Messina MD, PhD, MSc. 22

***Candida auris* | Mycoses, May 2019**
Canisius-Wilhelmina Hospital – Andrea Voss, MD 22

***Candida auris* | Infection Control & Hospital Epidemiology, January 2018**
Louis Stokes Cleveland VA Medical Center - Curtis Donskey, MD 23

Viruses | American Journal of Infection Control, March 2018
St. Mary's Hospital for Children – Marianne Pavia, MS 24

UV-C Dose Confirmation | Open Forum Infectious Diseases, October 2019
Louis Stokes Cleveland VA Medical Center – Curtis Donskey, MD 25

Health Care Worker Perceptions of UV-C Technology Use 2018 | American Journal of Infection Control, March 2018
Johns Hopkins Hospital - Lisa Maragakis, MD, MPH 26

Index | Additional UVDI-360 Studies 27

Independently proven 99.99% inactivation of 37 microorganisms at real-world times and distances

- **Independently proven** *99.99% inactivation of 35 high-risk microorganisms in 5 minutes at 8 feet distance - and SARS-CoV-2 at 12 feet distance.*
- **99.99% inactivation** *of Candida auris in 20 minutes at 8 feet distance.*

	≥ 4.0 Log Reduction	≥ 5.0 Log Reduction	≥ 6.0 Log Reduction
Fungi	• *Candida auris*†	• *Candida albicans*	
Bacterial Spores	• *Clostridioides difficile*		
Viruses	• Adenovirus • Hepatitis A Virus • Hepatitis C Virus†† • Herpes Simplex Virus 2 • Human Coronavirus • Measles Virus • Respiratory Syncytial Virus • Rhinovirus • Rotavirus • Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2)	• Ebola • Enterovirus 68 • Herpes Simplex Virus 1 • Influenza A Virus (H1N1) • Middle East Respiratory Syndrome Coronavirus (MERS-CoV) • Norovirus††† • Poliovirus	
Bacteria		• *Acinetobacter baumannii* • *Bordetella pertussis* • *Escherichia coli* • *Escherichia coli* (carbapenem-resistant; CRE) • *Enterococcus faecium* (vancomycin-resistant; VRE) • *Listeria monocytogenes* • Methicillin-resistant *Staphylococcus aureus* (MRSA) • *Mycobacterium bovis* (TB surrogate) • *Pseudomonas aeruginosa* • *Salmonella enterica* • *Staphylococcus aureus* • *Staphylococcus epidermis* (coagulase-negative; CoNS)	• *Enterobacter aerogenes* • *Enterococcus faecalis* • *Klebsiella pneumoniae* • *Proteus mirabilis* • *Serratia marcescens*

†Between 3-and-4-log reduction achieved at 20 minutes †† Via bovine viral diarrhea virus surrogate ††† Via feline calicivirus surrogate



"...the UVDI-360 Room Sanitizer...was effective in 5-10 minutes in eliminating >5-log MRSA and Carbapenem-Resistant *Klebsiella pneumoniae* when the surfaces were in direct line of sight and >4-log when the surfaces were in indirect line of sight."

- William Rutala, MS, MPH, PhD, Director of Hospital Epidemiology, et. al., UNC School of Medicine, *Infection Control and Hospital Epidemiology* 2016

Rutala, W.A. et. al. Patient Room Decontamination against Carbapenem- Resistant Enterobacteriaceae and Methicillin-Resistant Staphylococcus aureus Using a Fixed Cycle-Time Ultraviolet-C Device and Two Different Radiation Designs. Infect. Control Hosp. Epidemiol. 2016, 1- 3.

99.99% inactivation of SARS-CoV-2 in 5 minutes at 12 feet

Efficacy of the UVDI-360 Device Against Surface SARS-CoV-2

Testing Site:

Testing on the coronavirus strain that causes the COVID-19 disease was conducted by Innovative Bioanalysis, a CAP, CLIA, and BEI-recognized BSL-3 certified laboratory (CA, USA).

Purpose:

To examine the effectiveness of the UVDI-360 Room Sanitizer against SARS-CoV-2, the viral strain the causes COVID-19.

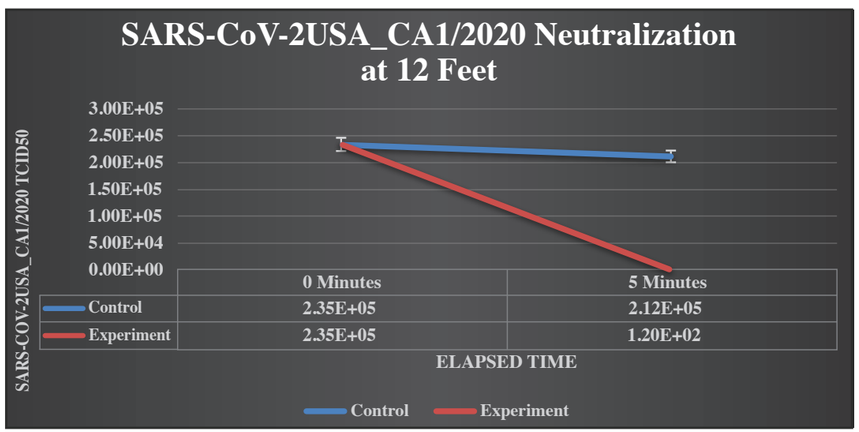
Methods:

Two separate testing distances were used in two separate tests.

- Test A was set up with samples 8 feet away from the centerline of the UV system.
- Test B was set up with samples 12 feet away from the centerline of the UV system.
- UVDI-360 Room Sanitizer was then run for 5 minute cycles from both distances.

Results:

Proven 99.99% reduction of SARS-CoV-2 (4 log) in 5 minutes at a distance of 12 feet was verified in testing parameters indicative of rapid whole room disinfection.



References:
Innovative Bioanalysis, January 2021.

The UVDI-360 Room Sanitizer reduced *C. difficile* in Hematology/Oncology units

Impact of Ultraviolet Germicidal Irradiation for No-Touch Terminal Room Disinfection on Clostridium difficile

Infection Control & Hospital Epidemiology, January 2017

Principal Investigator:

David Pegues, MD, Professor of Medicine, Hospital of the University of Pennsylvania

Purpose:

To examine the impact of UVDI-360 Room Sanitizer deployment combined with manual surface disinfection with bleach on *C. difficile* in Hematology/Oncology units over a 12-month evaluation period.

Methods:

The UVDI-360 Room Sanitizer was deployed for a 12-month intervention period, in combination with standard manual surface disinfection with bleach. Following routine terminal cleaning of room surfaces with a bleach disinfectant. The UVDI-360 was deployed for two 8-minute cycles on either side of the foot of the patient bed. UVDI UV Dose Verify™ cards placed throughout the patient room were used to verify the cycle time and adequate exposure of the bathroom to ultraviolet UV-C light.

Results:

Targeted deployment of UVGI to rooms of high-risk patients at discharge resulted in a 25% reduction of *C. difficile* without adversely impacting room turnaround. The intervention generated estimated annual direct costs averted of $348,528 to $1,537,000.

References:
Pegues DA, Han J, Gilmar C, McDonnell B, Gaynes S. Impact of Ultraviolet Germicidal Irradiation for No-Touch Terminal Room Disinfection on *Clostridium difficile* Infection Incidence Among Hematology-Oncology Patients. *Infect Control Hosp Epidemiol.* 2017 Jan;38(1):39-44.

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Effectiveness against methicillin-resistant *Staphylococcus aureus* (MRSA) and *C. difficile* – on direct and indirect surfaces - in patient rooms

Room Decontamination Using an Ultraviolet-C Device with Short Ultraviolet Exposure Time

Infection Control & Hospital Epidemiology, August 2014

Principal Investigator:

William Rutala, MS, MPH, PhD, Director of Hospital Epidemiology, UNC School of Medicine

Purpose:

To examine UVDI-360 Room Sanitizer efficacy against methicillin-resistant *Staphylococcus aureus* (MRSA) and *C. difficile* spores plated on Formica®.

Methods:

UV-C was applied to MRSA and *C. difficile* spores plated on Formica® laminate placed at various locations in a single patient room. The UV device was run for a single 5-minute cycle for MRSA and a single 10-minute cycle for *C. difficile* spores.

Results:

The UVDI-360 Room Sanitizer achieved a 3.56 log reduction against methicillin-resistant *Staphylococcus aureus* (MRSA) in 5 minutes, and a 2.78 log reduction against *C. difficile* spores in 10 minutes

Microorganism	MRSA (5 minutes)	*C. difficile* spores (10 minutes)
Surface Type	**(Log_{10} Reduction)**	
Direct Surfaces	4.10	3.35
Indirect Surfaces	2.74	1.80
Overall	3.56	2.78

References:
Rutala, W.A.; Gergen, M.F.; Tande, B.M.; Weber, D.J. Room Decontamination Using an Ultraviolet-C Device with Short Ultraviolet Exposure Time. *Infect. Control Hosp. Epidemiol.* 2014, 35, 1070-1072.

Click or Scan QR Code to Read Study

Inactivation of *C. difficile* and MRSA with shorter cycle times than alternative UV-C room disinfection devices

Comparing and Optimizing Ultraviolet Germicidal Irradiation Systems for Patient Room Terminal Disinfection

Antimicrobial Resistance & Infection Control, February 2018

Principal Investigator:

Vincent Masse, MD, University of Iowa Carver College of Medicine and University of Iowa Hospitals and Clinics

Purpose:

To compare the performance of several UV surface disinfection devices, including the UVDI-360 Room Sanitizer and Tru-D.

Methods:

UV-C system output was compared using a radiometer, at a set of fixed times and distances. Output in a patient room was also compared using a radiometer and UV Dose Verify™ cards to detect dose delivery to surfaces when following the directions for use recommended by each manufacturer (i.e., single placement in a room for Tru-D, and multiple placements for the UVDI-360 Room Sanitizer).

Results:

The authors reported that both the UVDI-360 Room Sanitizer and Tru-D devices delivered more than enough UV-C to surfaces 5, 8, and 10 feet away from the device to kill *C. difficile* and MRSA within a 5-minute cycle time. The authors also demonstrated that multiple device placements with shorter cycle times, which UVDI recommends, are preferred over the single placement with longer cycle times that Tru-D recommends, based on dose delivered to a variety of hospital room surfaces. They noted that an additional cycle in the bathroom, which UVDI recommends, is required for adequate UV-C delivery in bathrooms and other adjoining rooms. Tru-D's single placement in the main room failed to deliver sufficient UV-C to adjoining bathrooms to kill *C. difficile* or MRSA.

References:
Masse, V.; Hartley, M. J.; Edmond, M. B.; Diekema, D. J. Comparing and Optimizing Ultraviolet Germicidal Irradiation Systems Use for Patient Room Terminal Disinfection: An Exploratory Study Using Radiometry and Commercial Test Cards. 2018, 7 (1), 29

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Effective reduction of multidrug-resistant organisms (MDROs), including *C. difficile* and methicillin-resistant *Staphylococcus aureus* (MRSA) in patient rooms

Effectiveness of An Ultraviolet Light Decontamination Device in Reducing Hospital Room Contamination

SHEA, 2016

Principal Investigator:

Abhishek Deshpande, MD, PhD, Assistant Professor of Medicine, Cleveland Clinic Lerner College of Medicine at Case Western Reserve University

Purpose:

To examine UVDI-360 Room Sanitizer effectiveness against nosocomial microorganisms in hospital rooms, including *C. difficile* and methicillin-resistant *Staphylococcus aureus* (MRSA).

Methods:

The UVDI-360 Room Sanitizer was run in isolation rooms on two units in an acute-tertiary care hospital for 6 months. Each patient room was treated for two 5-minute cycles, and the patient bathroom for one 5-minute cycle, for a total of 15 minutes per room. Cultures were collected before and after UV-C treatment to determine the levels of contamination of *C. difficile*, MRSA, Vancomycin-Resistant *Enterococcus* (VRE), and multidrug-resistant gram-negative organisms.

Results:

The UVDI-360 Room Sanitizer achieved 76% reduction in recovery of MRSA and *C. difficile* after UV disinfection compared to chemical cleaning alone.

References:
Deshpande, A.; Hartley, J.; Cadnum, J.; Jencson, A.; Sankar, T. Effectiveness of an Ultraviolet Light Decontamination Device in Reducing Hospital Room Contamination. *SHEA (poster presentation);* 2016.

The UVDI-360 Room Sanitizer effectively inactivates *C. difficile* and methicillin-resistant *Staphylococcus aureus* (MRSA)

Effect of Variation in Test Methods on Performance of Ultraviolet-C Radiation Room Decontamination

Infection Control & Hospital Epidemiology, May 2016

Principal Investigator:

Curtis Donskey, MD, Professor of Medicine, Case Western Reserve University and Staff Physician, Infectious Diseases Section, Louis Stokes Cleveland VA Medical Center

Purpose:

To determine the impact of variation in UV-C efficacy test methods on log reduction results.

Methods:

Two UV-C devices, including the UVDI-360 Room Sanitizer, were compared using a single test method for efficacy against MRSA and *C. difficile*. The UVDI-360 was then subjected to further testing whereby one variable at a time was altered to assess the impact on the results, including carrier distance from the lamps, height of the carriers relative to the floor, carrier type, inoculum spread, carrier angle relative to the device and organic load.

Results:

A >3 log reduction was achieved within 5 minutes for MRSA for both UV devices tested. As expected, log reductions for MRSA and *C. difficile* changed, depending on the variables tested, including inoculum dispersal, organic load, carrier orientation and carrier height. This study demonstrates the need for industrywide standards for evaluating UV-C device efficacy.

References:
Cadnum, J.L.; Tomas, M.E.; Sankar, T.; Jencson, A.; Mathew, J.I.; Kundrapu, S.; Donskey, C.J. Effect of Variation in Test Methods on Performance of Ultraviolet-C Radiation Room Decontamination. *Infect. Control Hosp. Epidemiol.* 2016, 1–6.

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Effectiveness against methicillin-resistant *Staphylococcus aureus* (MRSA) in operating rooms

Control of Methicillin-Resistant Staphylococcus aureus Strains Associated with a Hospital Outbreak Involving Contamination from Anesthesia Equipment Using UV-C

Frontiers in Microbiology, December 2020

Principal Investigator:

Dra. Daniela De la Rosa-Zamboni MS, MD, Department of Hospital Epidemiology; Hospital Infantil de México Federico Gómez

Purpose:

A key objective of the intervention was to eliminate the outbreak and to determine if enhanced UV-C room disinfection was effective in helping to do so.

Methods:

- Only 3 minutes are needed to reduce the log of MRSA counts by >5.69 and 5 minutes for other bacteria in a space with a diameter of 15.7 feet.
- The equipment was operated in five to seven positions, according to the OR size.
- After disinfection with a manual disinfectant did not halt the outbreak, UV-C disinfection was started regularly in all ORs from Monday to Friday, with a coverage of approximately 70%.

Results:

In our study, the control of MRSA was achieved by UV-C disinfection of all ORs, where the cleaning and sanitizing of anesthesiology equipment were reinforced according to the CDC guidelines.

References:
De la Rosa-Zamboni D., Xicohtencatl-Cortes J. et al. Control of Methicillin-Resistant *Staphylococcus aureus* Strains Associated With a Hospital Outbreak Involving Contamination From Anesthesia Equipment Using UV-C. *Front Microbiol.* 2020 Dec 14;11:600093.

Click or Scan QR Code to Read Study



> "Control of MRSA was achieved by UV-C disinfection of all ORs..."

Hospital Infantil de México Federico Gómez (HIMFG), Mexico City, Mexico.
Frontiers in Microbiology, December 2020

De la Rosa-Zamboni D et. al. Control of Methicillin-Resistant Staphylococcus aureus Strains Associated with a Hospital Outbreak Involving Contamination From Anesthesia Equipment Using UV-C. Frontiers in Microbiology 2020 Dec 14;11:600093;pg 8

Effectiveness against Carbapenem-resistant *Klebsiella pneumoniae* and methicillin-resistant *Staphylococcus aureus* (MRSA) in patient room

Patient Room Decontamination Against Carbapenem-resistant Enterobacteriaceae and Methicillin-resistant Staphylococcus aureus Using a Fixed Cycle-Time Ultraviolet-C Device

Infection Control & Hospital Epidemology, August 2016

Principal Investigator:

Willliam Rutala, MS, MPH, PhD, Director of Hospital Epidemiology, UNC School of Medicine

Purpose:

To examine UVDI-360 Room Sanitizer efficacy against methicillin-resistant *Staphylococcus aureus* (MRSA) and carbapenem-resistant *Klebsiella pneumoniae* (CRKP) plated on Formica®, using two different device placement methods.

Methods:

UV-C was applied to clinical isolates of MRSA and carbapenem-resistant *Klebsiella pneumoniae* (CRKP) plated on Formica® laminate placed at various locations in a patient room. Two separate experiments were run using two different UV device placement setups to compare the log reductions obtained with each setup. In setup A, the device was placed in the center of the room and run for a single 5-minute cycle, and in setup B, the device was run for two 5-minute cycles with the device placed on either side of the patient bed.

Results:

The UVDI-360 Room Sanitizer achieved a >5 log reduction for directly exposed sites and a >4 log reduction for indirectly exposed sites against MRSA and CRKP in 5-10 minutes.

Microorganism	MRSA		CRKP	
Device Setup	Setup A (one cycle)	Setup B (two cycles)	Setup A (one cycle)	Setup B (two cycles)
Surface Type	**(Log_{10} Reduction)**		**(Log_{10} Reduction)**	
Direct Surfaces	5.27	5.82	5.74	6.61
Indirect Surfaces	4.17	4.55	4.53	5.39
Overall	4.61	5.06	5.01	5.87

References:
Kanamori, H.; Rutala, W.A.; Gergen, M.F.; Weber, D.J. Patient Room Decontamination against Carbapenem-Resistant Enterobacteriaceae and Methicillin-Resistant *Staphylococcus aureus* Using a Fixed Cycle-Time Ultraviolet-C Device and Two Different Radiation Designs. *Infect. Control Hosp. Epidemiol.* 2016, 1-3.

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Effective against CRE in high-risk areas including critical care, oncology, transplant and gastrointestinal surgery units

The Novel Application and Effect of an Ultraviolet Light Decontamination Strategy on Carbapenem-Resistant Enterobacterales in a Hospital Setting

Journal of Hospital Infection, March 2022

Principal Investigator:

Dr. Warren Lowman, Clinical Microbiologist and IPC Specialist. Wits University Donald Gordon Medical Centre, Johannesburg, South Africa

Purpose:

To evaluate the impact of continuous ultraviolet light (UV-C) on Carbapenem-resistant *Enterobacterales* (CRE) in five high-risk units: critical care, oncology, transplant and gastrointestinal surgery units.

Methods:

Introduction of UV-C followed a 12-month baseline period, with a 2-month wash-in period. Implementation included terminal decontamination at discharge and a novel in-use protocol, whereby rooms occupied for 48 hours and longer were decontaminated during the course of the patients in-hospital stay.

Results:

In-use UV-C protocol demonstrated a significant negative association with the incidence density rate of CRE when adjusting for CRE admission rate (p = 0.0069). CRE decreased by 23% during the intervention period (P = 0.042). UV-C is potentially an important component of an enhanced decontamination protocol for the control of CRE in a hospital setting.

References:
Lowman W, Etheredge HR, Gaylard P, Fabian J. The novel application and effect of an ultraviolet light decontamination strategy on the healthcare acquisition of carbapenem-resistant Enterobacterales in a hospital setting. *J Hosp Infect.* 2022 Mar;121:57-64

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>5 log reduction against carbapenem-resistant *Enterobacteriaceae* (CRE; *K. pneumoniae, E. coli,* and *E. cloacae*) in patient rooms

UV-C Light Disinfection of Carbapenem-Resistant Enterobacteriaceae from High-Touch Surfaces in a Patient Room and Bathroom

Infection Control & Hospital Epidemiology, August 2016

Principal Investigator:

Lisa Maragakis, MD, MPH, Senior Director of Infection Prevention and Associate Professor of Medicine, The Johns Hopkins Health System

Purpose:

To examine UVDI-360 Room Sanitizer efficacy against carbapenem-resistant *Enterobacteriaceae* (CRE; *K. pneumoniae, E. coli* and *E. cloacae*) plated on Formica®. This study is part of a cluster, randomized, two period crossover trial focused on evaluating MDRO transmission that includes daily patient room cleaning with UV-C in addition to terminal cleaning in Oncology and Solid Organ Transplant units.

Methods:

UV-C was applied to carbapenem-resistant *Enterobacteriaceae* plated on Formica® placed on more than 17 high-touch surfaces in a patient room and bathroom.

Results:

The UVDI-360 Room Sanitizer achieved a >5 log reduction against all three CRE microorganisms tested. No CRE microorganisms grew on 131 out of 133 plates tested following three 5-minute cycles of exposure to UV-C.

References:
Rock, C.; Curless, M.S.; Nowakowski, E.; Ross, T.; Carson, K.A.; Trexler, P.; Carroll, K.; Maragakis, L.L. UV-C Light Disinfection of Carbapenem-Resistant *Enterobacteriaceae* from High-Touch Surfaces in a Patient Room and Bathroom. *Infect. Control Hosp. Epidemiol.* 2016, 1-2

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Reduction of *Pseudomonas aeruginosa* in a neonatal intensive care unit

Coming to the Light: Impact of Ultraviolet Technology on Incidence of Pseudomonas in a Neonatal Intensive Care Unit

APIC, 2015

Principal Investigator:

Sonya Mauzey, RN, BS, CIC, Infection Preventionist, The Women's Hospital – Deaconess Health System

Purpose:

To examine the impact of UVDI-360 Room Sanitizer on *Pseudomonas aeruginosa* in a neonatal intensive care unit.

Methods:

A retrospective review of positive *Pseudomonas aeruginosa* culture incidence was conducted on patients in a neonatal intensive care unit for a period of 3 years. Manual surface disinfection alone was used in the first half of the study (1.5 years), and the UVDI-360 Room Sanitizer was used as an adjunct to manual surface disinfection during the second half of the study.

Results:

Only one positive *Pseudomonas aeruginosa* culture was found among neonatal intensive care unit patients in the 1.5-year period when the UVDI-360 Room Sanitizer was used, as compared to 32 positive cultures found in the 1.5-year baseline period when manual surface disinfection alone was used.

References:
Mauzey, S. Coming to the Light: Impact of Ultraviolet Technology on Incidence of Pseudomonas in a Neonatal Intensive Care Unit. *APIC (poster presentation);* 2015 American Journal of Infection Control 43 (2015) S18-S73

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Bactericidal and sporicidal efficacy against a wide range of MDROs

Demonstrating the Microbial Efficacy of the UVDI-360 Room Sanitizer

Independent Lab Testing, January 2017

Principal Investigator:

Jean Yves Maillard, MD, Professor of Pharmaceutical Microbiology, Cardiff School of Pharmacy and Pharmaceutical Sciences, Cardiff University, Cardiff, United Kingdom

Purpose:

Test the bactericidal and sporicidal efficacy of the UVDI-360 Room Sanitizer against a wide range of MDR isolates in both clean and dirty conditions.

Methods:

Ten different types of bacteria and spores were dried on a stainless steel coupon in both clean and dirty conditions. Coupons were placed in the room in horizontal and vertical orientation, direct and shadowed locations at three distances. The UV device was run for a 15-minute cycle and surviving organisms were recovered and enumerated according to standard operating procedures.

Results:

In all instances, the UVDI-360 Room Sanitizer produced >4 log reduction (in some instances >5 log reduction) in viable bacterial efficacy after 15 minutes of uninterrupted exposure. The bactericidal/sporicidal efficacy of the UVDI-360 Room Sanitizer was not affected by the clean versus dirty coupon conditions. Placement of the coupon horizontally or vertically to the source did not affect microbicidal efficacy.

References:
Maillard, JY, Testing the Microbicidal Efficacy of the UVDI-360 Room Sanitizer, Cardiff School of Pharmacy and Pharmaceutical Sciences, Cardiff University; January 2017.

Effective inactivation of *C. difficile* spores, MS-2 virus and MRSA on long-term care fomites

UltraViolet Light Efficacy in the Absence of Cleaning

APIC, 2015

Principal Investigator:

Charles Gerba, PhD, Professor, Microbiology & Environmental Sciences, University of Arizona

Purpose:

To examine the effectiveness of the UVDI-360 Room Sanitizer combined with an accelerated Hydrogen Peroxide disinfectant against *C. difficile* spores, MS-2 virus and MRSA.

Methods:

C. difficile spores, MS-2 virus and MRSA were plated on stainless steel, and MRSA was additionally plated on Formica® and 100% polyester. Then each plate was treated with accelerated Hydrogen Peroxide, followed by 10 minutes of exposure to the UVDI-360 Room Sanitizer.

Results:

UV in conjunction with Hydrogen Peroxide resulted in a ≥4 log reduction against MRSA, *C. difficile* spores and MS-2 virus. This treatment effectively removed >6 log of MRSA from the soft surface. polyester.

Microorganism	**MRSA (10 minutes)**	***C. difficile* spores (10 minutes)**	**MS-2 virus (10 minutes)**
Surface Type	**(Log_{10} Reduction)**		
Stainless Steel	4.14	>4	8.2
Formica®	>5.3	—	—
Polyester	>6.0	—	—

References:
Sifuentes, L.Y.; Peterson, A.; Pivo, T.; Gerba, C.P. Ultra Violet Light Efficacy in the Absence of Cleaning. In *APIC (poster presentation);* 2015.

Effective bioburden reduction by the UVDI-360 Room Sanitizer in Operating Rooms in three usage scenarios

Six Ultraviolet Minutes for Cleaner Operating Theatres

European Journal of Public Health, September 2020

Principal Investigator:

Dr. Gabriele Messina, Professor of Public Health, University of Siena, Siena, Italy

Purpose:

Aim was assessing the difference of contamination: i) between different levels of disinfection; ii) before and after the use of the UVDI-360 Room Sanitizer.

Methods:

Between December 2019/February 2020 a cross sectional study was conducted in OT in a real clinical context. 94 Petri dishes (PD) were used in 3 OT. Three different sanitation levels (SL1-3) were compared pre- and post-use of UVC-D: i) No cleaning after surgery (SL1); ii) after in-between cleaning (SL2); iii) after terminal cleaning (SL3). The UVDI-360 Room Sanitizer was employed for 6 minutes, 3 minutes per bed side.

Results:

The UVDI-360 improved environmental contamination in any of the three sanitation levels. Furthermore, the use of the UVDI-360 alone was better than in-between and terminal cleaning.

References:
R Bosco, S Gambelli, V Urbano, G Cevenini, G Messina, Six ultraviolet minutes for cleaner operating theatres, *European Journal of Public Health*, Volume 30, Issue Supplement_5, September 2020

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Effective microbial load reduction by the UVDI-360 Room Sanitizer when tested on vertical, horizontal and chemical-sensitive surfaces

Evaluating the Efficacy of UV-C Technology in Acute Care

APIC, 2015

Principal Investigator:

Maurice Croteau, Director of Healthcare Services, Western Paper Distributors

Purpose:

To demonstrate the effectiveness of a simple test method to evaluate microbial load reduction in hospital rooms following treatment with UV-C.

Methods:

High-touch surfaces were sampled before and after UV-C treatment using RODAC™ contact plates. More than 30 surface types were tested in operating rooms, burn units, intensive care units and a special procedures unit in two hospitals.

Results:

A simple, easy-to-use microbial test showed that the UVDI-360 Room Sanitizer significantly reduced microbial presence on a variety of surfaces in two hospitals following standard manual surface disinfection. UV-C was effective on all surface types tested, including vertical, horizontal and sensitive electronic surfaces.

References:
Croteau, M.E.; Grover, T.M. Evaluating the Efficacy of UV-C Technology in Acute Care. In *APIC (poster presentation);* 2015

99% Inactivation against *Candida auris* in 10 minutes at 8 feet distance; 99.99% inactivation in 20 minutes at 8 feet distance

Test on Candida auris Using the UVDI-360 Room Sanitizer

Independent Lab Testing, January 2019

Principal Investigator:

Dr. Gabriele Messina, Professor of Public Health, University of Siena, Siena, Italy

Objectives:

To assess the effectiveness of the UVDI-360 Room Sanitizer in inactivating select isolates of *Candida auris* at fixed distance and time period.

Methods:

Stainless steel carriers were inoculated with 10ml of test culture. Carriers were placed in the room as followed:

1) Treated sample: 2 vertical supports facing at half height one side of the device at 8 feet

2) Positive control; 2 vertical supports (1 per strain) out of the device range.

Results:

The UVDI-360 Room Sanitizer achieved a 99.99% inactivation of *Candida auris* in 20 minutes - and greater than 99% inactivation in 10 minutes - from 8 feet.

Killing of Candida auris by UV-C: Importance of Exposure Time and Distance

Mycoses, May 2019

Principal Investigator:

Andreas Voss, MD, Canisius-Wilhelmina Hospital

Objectives:

Our aim was to investigate the effect of different UV-C exposure times and distance in killing *C auris*, using strains from different countries.

Methods:

Candida auris was seeded on glass slides and exposed to UV-C for 5, 10, 20 and 30 minutes at 6.5 feet and 13 feet

Results:

A maximal effect of *C auris* killing was found after 30 minutes of UV-C exposure at 6.5 ft.

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Relative Resistance of the Emerging Fungus Candida auris and Other Candida Species to Killing by Ultraviolet Light

Infection Control & Hospital Epidemiology, January 2018

Principal Investigator:

Curtis Donskey, MD, Professor of Medicine, Case Western Reserve University and Staff Physician, Infectious Diseases Section, Louis Stokes Cleveland VA Medical Center

Objectives:

Our aim was to investigate the effect of different UV-C exposure times and distance in killing *Candida auris*, using strains from different countries.

Methods:

The carriers were placed perpendicular to the vertical lamps 5 feet from the device at a height of 4 feet and were exposed to a UV-C cycle of 10, 20 and 30 minutes.

Results:

The UVDI-360 Room Sanitizer achieved a greater than 99.99% inactivation of *Candida auris* in 20 minutes.

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References:

Messina, G., Test on Candida auris Using the UVDI-360 Room Sanitizer. University of Siena. November 17, 2019

de Groot T, Chowdhary A, Meis JF, Voss A. Killing of Candida auris by UV-C: Importance of exposure time and distance. Mycoses. 2019 May;62(5):408-412.

Cadnum, J., Shaikh, A., Piedrahita, C., Jencson, A., Larkin, E., Ghannoum, M., & Donskey, C. (2018). Relative Resistance of the Emerging Fungal Pathogen Candida auris and Other Candida Species to Killing by Ultraviolet Light. *Infection Control & Hospital Epidemiology*, 39(1), 94-96.

Effective viral reduction in a long-term care facility

The Effect of Ultraviolet-C Technology on Viral Incidence in a Pediatric Long-term Care Facility

American Journal of Infection Control, March 2018

Principal Investigator:

Marianne Pavia MS, BS, CIC, FAPIC, Director of Infection Prevention – St. Mary's Hospital for Children

Purpose:

To examine the impact of the UVDI-360 Room Sanitizer on viruses in a pediatric long-term care facility.

Methods:

UV-C technology was deployed at St. Mary's during an approximately 12-month period. A single UV-C device was deployed in 5 of the 12 toddler unit rooms. The other 7 toddler rooms were cleaned using standard manual disinfection protocols only and were not treated with UV-C during the study period. Patient rooms were treated with UV-C on a rotating schedule to ensure even coverage of each room.

Results:

Ultraviolet-C (UV-C) technology implementation was associated with a 44% reduction in viruses in a long-term care facility.

References:
Marianne Pavia, MS, BS, CIC, FAPIC, Edwin Simpser, MD, Melissa Becker, MS, W. Keith Mainquist, PhD, Katherine A. Velez, PhD. The effect of ultraviolet-C technology on viral infection incidence in a pediatric long-term care facility. *American Journal of Infection Control* 46 (2018) 720 -722

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UVDI UV Dose Verify™ technology effectively confirms the UV-C dose required to inactivate *C. difficile* spores and MRSA

Ultraviolet-C (UV-C) Monitoring Made Ridiculously Simple: UV-C Dose Indicators for Convenient Measurement of UV-C Dosing

Open Forum Infectious Diseases, October 2019

Principal Investigator:

Curtis Donskey, MD, Professor of Medicine, Case Western Reserve University and Staff Physician, Infectious Diseases Section, Louis Stokes Cleveland VA Medical Center

Background:

Ultraviolet-C (UV-C) light is increasingly used as an adjunct to standard cleaning in healthcare facilities. However, most facilities do not have a means to measure UV-C to determine whether 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 microorganisms.

Methods:

In a laboratory setting, we exposed methicillin-resistant *Staphylococcus aureus* (MRSA) and *Clostridium difficile* spores on steel disk carriers with or without an organic load (5% fetal calf serum) to UV-C for varying times resulting in fluence exposures ranging from 10,000 to 100,000 μJ/cm2. The UV-C indicators were placed adjacent to the carriers. Log reductions were calculated in comparison to untreated controls and the change in color of the indicators was correlated with dose and log reductions.

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). 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). The colorimetric indicators provide an easy means to monitor UV-C dosing.

References:
Jennifer Cadnum, BS, Annette Jencson, MT, CIC, Sarah Redmond, MD, Thriveen Sankar Chittoor Mana, MBA, Curtis Donskey, MD, 1215. Ultraviolet-C (UV-C) Monitoring Made Ridiculously Simple: UV-C Dose Indicators for Convenient Measurement of UV-C Dosing, Open Forum Infectious Diseases, Volume 6, Issue Supplement_2, October 2019, Page S437

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Patients and health care workers perceive the UVDI-360 positively as an effort to protect them

Patient and Health Care Worker Perceptions of Daily Use of Ultraviolet-C Technology as an Adjunct to Daily Cleaning in an Academic Hospital

American Journal of Infection Control, March 2018

Principal Investigator:

Lisa Maragakis, MD, MPH, Senior Director of Infection Prevention and Associate Professor of Medicine, The Johns Hopkins Health System

Purpose:

A cluster randomized crossover trial using several UVDI-360 devices was conducted by Dr Lisa Maragakis clinical research group at John Hopkins School of Medicine, a premier academic school of health in Baltimore Maryland, to investigate the impact of daily ultraviolet (UV)-C light disinfection (in patient rooms and bathrooms) on the acquisition of vancomycin-resistant *enterococci*, *Clostridium difficile*, and other health care associated microorganisms. In conjunction with the trial, a first-of-its-kind patient and healthcare worker satisfaction survey was conducted to assess the acceptance of UV technology for daily cleaning of the patient rooms.

Methods:

100 patients and 81 healthcare workers were randomly surveyed in hematological malignancy and bone marrow transplant units on their perceptions of daily use of the UVDI-360 devices for whole room disinfection. The surveys were conducted during August 2016, 8 months after initiation of the Ultraviolet-C Light Evaluation as an Adjunct to Removing Multi-Drug Resistant Organisms trial.

Results:

Most patients and healthcare workers perceived the UV-C light as an effort to protect them from infections. The results of this survey show that daily use of UV-C light is feasible and well accepted by patients and HCWs and may enhance the overall patient experience.

References:

Rock, C.; Curless, M.S.; Nowakowski, E.; Ross, T.; Carson, K.A.; Scheeler, V.; Maragakis, L.L. Patient and health care worker perceptions of daily use of ultraviolet-C technology as an adjunct to daily cleaning in an academic hospital: Secondary study of Ultra Violet-C Light Evaluation as an Adjunct to Removing Multi-Drug Resistant Organisms. *American Journal of Infection Control* 46 (2018) 348-9

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Additional UVDI-360 Room Sanitizer Studies

R Bosco, S Gambelli, V Urbano, G Cevenini, G Messina, Analytical approach for a better control of environmental contamination, *European Journal of Public Health*, Volume 30, Issue Supplement_5, September 2020

Deshpande, A.; Hartley, J.; Einloth, C.; Fatica, C.; Donskey, C.; Fraser, T. Perceptions of Healthcare Workers and Environmental Services Staff Regarding Ultraviolet Room Decontamination Devices. In *APIC (poster presentation);* 2016; p. 251.

Cadnum JL, Tomas ME, Sankar T, Jencson A, Mathew JI, Kundrapu S, Donskey CJ. Effect of Variation in Test Methods on Performance of Ultraviolet-C Radiation Room Decontamination. *Infect Control Hosp Epidemiol.* 2016

Index

Principal Investigator(s) — **Pages**

Croteau, Maurice 21
De la Rosa, Daniela 12
Deshpande, Abhishek 10
Donskey, Curtis 11, 23, 25
Gerba, Charles 19
Lowman, Warren 15
Maillard, Jean Yves 18
Maragakis, Lisa 16, 26
Masse, Vincent 9
Mauzey, Sonya 17
Messina, Gabriele 20, 22, 27
Pavia, Marianne 24
Pegues, David 7
Rutala, William 5, 8, 14
Voss, Andreas 22

Facility, by Name — **Pages**

Canisius-Wilhelmina Hospital 22
Cardiff University 18
Cleveland Clinic 10
Hospital Infantil de México Federico Gómez 12, 13
Johns Hopkins Hospital 16, 26
Louis Stokes Cleveland VA Medical Center 11, 23, 25
Oasis Hospital 21
Rugani Hospital 20
St. Mary's Hospital for Children 24
The Women's Hospital 17
University of Arizona 19
University of Iowa 9
UNC Health Care 8, 14
University of Pennsylvania 7
University of Siena 22
Wits Donald Gordon Medical Centre 15

Microorganisms in Studies — **Pages**

Candida auris 22, 23
CR Enterobacterales 15, 16
C. difficile Spores 7, 8, 9, 10, 11, 19, 25,
E. cloacae 16
E. coli 16
Klebsiella pneumoniae 5, 14
MRSA 9, 10, 11, 12, 14, 19, 25
MS-2 Bacteriophage 19
Microbial Bioburden 18, 20, 21
Pseudomonas aeruginosa 17
SARS-CoV-2 6
Vancomycin-Resistant Enterococcus (VRE) 10

Location in Facility — **Pages**

Burn Units 21
Critical Care 15
Gastrointestinal Surgery Units 15
Hematology 7
Lab Setting 6, 11, 18, 19, 22, 25
ICU/NICU 17, 21
Oncology 7, 15, 16
Operating Room 12, 20, 21
Patient Room 7, 8, 9, 10, 14, 16, 22, 23, 24, 26
Transplant 15, 16, 26

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