



VIOLET

by **clinell**[®]

Room Sanitiser



Clinical & Laboratory Evidence

powered by **UVDI** technology



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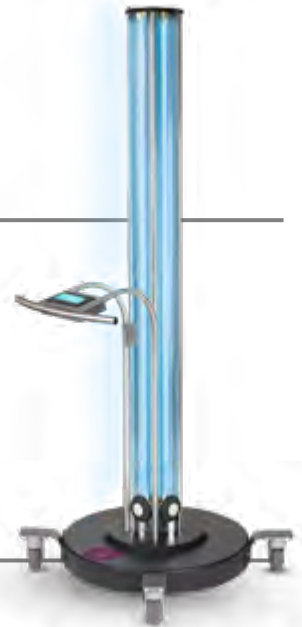
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HOW ULTRAVIOLET LIGHT WORKS

Violet by Clinell Room Sanitiser uses germicidal wavelength ultraviolet radiation (UV-C) to kill microorganisms.



How it works

The sun emits three types of UV radiation:

UV-A (315nm-400nm):

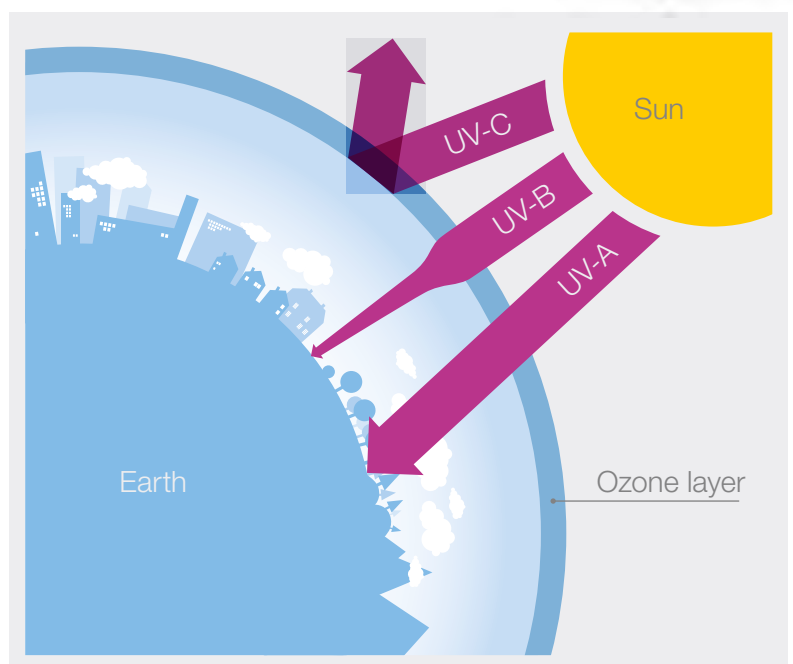
Black light used for tanning lamps, can be harmful to eyes.

UV-B (280nm-315nm):

Can cause sunburn and skin cancer.

UV-C (200nm-280nm):

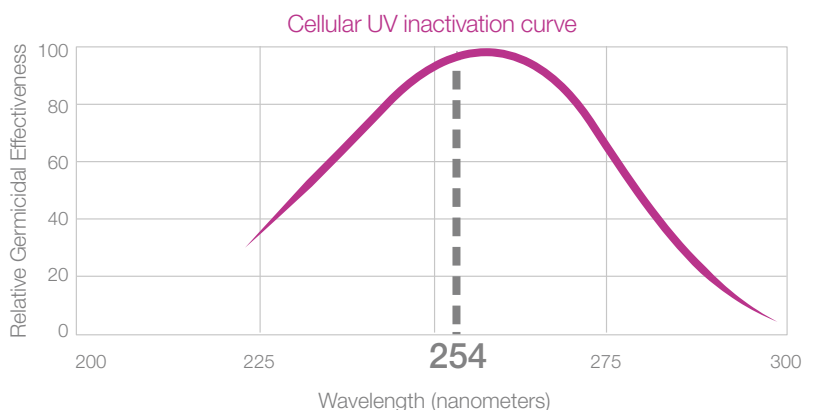
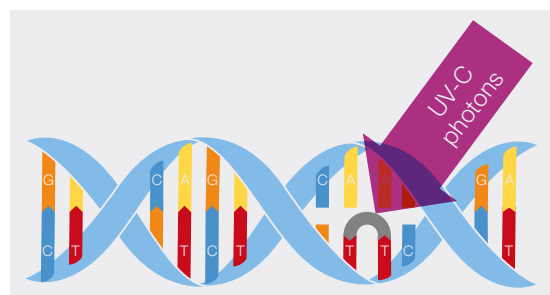
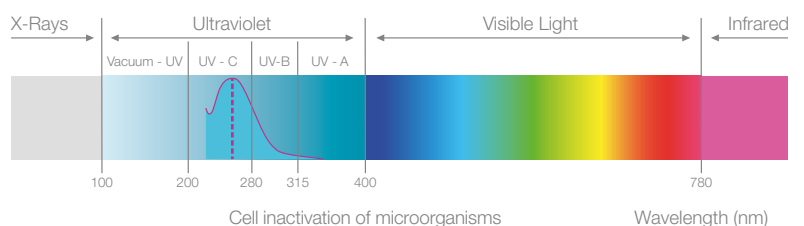
Kills microorganisms via short-wavelength ultraviolet radiation. This radiation is normally stopped by the Earth's ozone layer.



The power of UV-C

The Violet by Clinell Room Sanitiser generates artificial UV-C energy by ionizing low pressure mercury vapour in germicidal ultraviolet lamps.

Ionized mercury emits a predominantly discrete wavelength of 254nm - in the UV-C band which is an ideal wavelength for destroying the DNA of single cell organisms.



Room decontamination units (such as ultraviolet-C and hydrogen peroxide systems) aid in reducing environmental contamination after terminal room cleaning and disinfection².

Third-party testing results for the Violet by Clinell Room Sanitiser against *C. difficile* spores and MRSA

Microorganism	Distance (feet)	Time (mins)	% Reduction compared to control	Log reduction compared to control
<i>Clostridium difficile</i> (endospores)	3	4	>99.995	>4.32
	8	5	>99.992	>4.09
	12	8	>99.995	>4.32
Methicillin Resistant <i>Staphylococcus aureus</i> (MRSA)	3	1	>99.999	>5.69
	8	2	>99.999	>5.69
	12	3	>99.999	>5.69

Results verified by third-party laboratory.

Safe and effective way to reduce or eliminate microorganisms³

Studies have shown that UV-C technology can reduce the microbial burden and the risk of HCAs.

After using a UV-C device for one year, "Rates of *C. difficile* infection (CDI) declined 25% on the study units and increased 16% on non-study units. There was a significant association between UV device usage and decline in CDI incidence"⁴.

"After implementation of UVD, a dramatic decrease in the incidence of *Pseudomonas* was noted, potentially avoiding numerous infants from becoming colonised or infected"⁵.

Advantages over other no-touch room decontamination technologies

1. Rapid room decontamination.
2. Can be used in high turnaround areas or rooms.
3. Ventilation system does not need to be disabled.
4. Smoke alarm does not need to be disabled.
5. UV-C radiation leaves no residual contamination or by-products which may cause health and safety concerns.
6. No consumable products. This ensures operating costs are low.
7. Can be used as part of a daily disinfection routine.
8. Safe for staff and patients. Ordinary glass and plastic windows will block any UV-C radiation and there is no need to seal room.
9. Room can be used immediately on completion.

Greater than
99.99%
kill of microorganisms
and is effective
from 1 minute.

PERFORMANCE VALIDATED BY THIRD-PARTY LABORATORY MICRO-EFFICACY TESTING

Kills more than 30 HCAI-causing pathogens in 5 minutes at 8 feet.

- 4 log reduction of *Clostridium difficile* spores
- Greater than 5 log reduction of over 20 pathogens including MRSA, VRE and CRE.

Testing Distance and Time: 8 feet, 5 minutes

	4 Log Reduction	5 Log Reduction	6 Log Reduction
Fungi		<ul style="list-style-type: none"> • <i>Candida albicans</i> 	
Bacterial Spores	<ul style="list-style-type: none"> • <i>Clostridium difficile</i> 		
Viruses	<ul style="list-style-type: none"> • Adenovirus • Hepatitis A Virus • Hepatitis C Virus[†] • Herpes Simplex Virus 2 • Human Coronavirus • Respiratory Syncytial Virus • Rhinovirus • Rotavirus 	<ul style="list-style-type: none"> • Enterovirus 68 • Herpes Simplex Virus 1 • Influenza A Virus (H1N1) • Norovirus[‡] • Poliovirus 	
Bacteria		<ul style="list-style-type: none"> • <i>Acinetobacter baumannii</i> • <i>Bordetella pertussis</i> • <i>Escherichia coli</i> • <i>Escherichia coli</i> (carbapenem-resistant; CRE) • <i>Enterococcus faecium</i> (vancomycin-resistant; VRE) • <i>Listeria monocytogenes</i> • Methicillin-resistant <i>Staphylococcus aureus</i> (MRSA) • <i>Mycobacterium bovis</i> (TB surrogate) • <i>Pseudomonas aeruginosa</i> • <i>Salmonella enterica</i> • <i>Staphylococcus aureus</i> • <i>Staphylococcus epidermis</i> (coagulase-negative; CoNS) 	<ul style="list-style-type: none"> • <i>Enterobacter aerogenes</i> • <i>Enterococcus faecalis</i> • <i>Klebsiella pneumoniae</i> • <i>Proteus mirabilis</i> • <i>Serratia marcescens</i>

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Test reports available upon request.

[†] Via bovine viral diarrhea virus surrogate

[‡] Via feline calicivirus surrogate

The Violet by Clinell Room Sanitiser produces a >4 log reduction against a range of multi-drug resistant bacteria and spores, in both clean and dirty conditions.

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 Violet by Clinell Room Sanitiser against laboratory strains and clinical isolates of a range of MDROs in both clean and dirty conditions. These include *C. difficile*, MRSA, VRE, *Klebsiella sp.* and *Acinetobacter baumannii*.

Methods:

Bacteria and spores were dried on a stainless steel coupon in both clean and dirty conditions. Coupons were placed in the room in both horizontal and vertical orientations, 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 Violet by Clinell Room Sanitiser produced >4 log reduction (in some instances >5 log reduction) for all vegetative bacteria and >2 log reduction for *C. difficile* spores after 15 minutes of uninterrupted exposure. The bactericidal/sporicidal efficacy of the Violet by Clinell Room Sanitiser was not affected by the clean vs dirty coupon conditions. There was no difference in efficacy when considering distance from the Violet by Clinell Room Sanitiser. Placement of the coupon horizontally or vertically to the source did not affect microbicidal efficacy.

Organism Strain	Log Reduction in Dirty Conditions		
	Direct Exposure 1m Distance	Under Workbench 1m Distance	Under Workbench, Floor Corner 1.5m Distance
S. aureus	5.67	5.57	5.31
MRSA	4.93	4.93	4.93
A. baumannii	4.74	4.87	5.20
E. faecalis (VRE)	4.95	4.95	4.95
K. pneumoniae (NDM)	4.38	4.38	4.38
K. pneumoniae (ESBL)	4.97	4.97	4.97
C. difficile	3.87	2.79	2.95

References:

Maillard, JY, Testing the Microbicidal Efficacy of the Violet UV Room Sanitiser, Cardiff School of Pharmacy and Pharmaceutical Sciences, Cardiff University; January, 2017.

ST. MARY'S HOSPITAL FOR CHILDREN

Violet by Clinell Room Sanitiser reduced viral infection incidence by 44% among pediatric patients in a long-term care facility when used as an adjunct to standard cleaning protocols.

Principal Investigator:

Marianne Pavia, MS, BS, CIC, FAPIC, St. Mary's Hospital for Children, Bayside, NY.

Purpose:

To examine the effect of the Violet by Clinell Room Sanitiser efficacy on viral pathogen infection incidence among pediatric patients at St. Mary's Children's Hospital, Bayside, NY.

Methods:

The Violet by Clinell Room Sanitiser was deployed for a 12-month period – a single device was placed in 5 toddler unit rooms, the remaining 7 rooms were cleaned with only standard manual disinfection protocols. Prior to UV-C treatment rooms and common areas were disinfected with quaternary ammonium disinfectants. Patient rooms were treated with Violet on a rotating schedule (receiving 2 or 3 treatments per week). Common areas received 3 treatments per week.

Results:

Comparing the 12-month UV-C deployment period with the prior 12-month period where UV-C was not deployed, a 44% unadjusted reduction in overall viral infection incidence was found. Cumulative infection incidence found UV-C had a potentially compounding benefit when used over time – suggesting each month's UV-C use builds on the benefit of use in the previous month.

References:

Pavia, M. Simpson, E. Becker, M. Mainquist, WK. Velez, KA. The effect of ultraviolet-C technology on viral infection incidence in a pediatric long-term care facility. Am J Infect Control 2018; In Press.

The Violet by Clinell Room Sanitiser reduced *C. difficile* infection (CDI) rates by 25% and averted an estimated \$348,528–\$1,537,000 in annual direct medical costs in Hematology/Oncology units.

Principal Investigator:

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

Purpose:

To examine the impact of Violet by Clinell Room Sanitiser deployment combined with manual surface disinfection with bleach on *C. difficile* infection rates in Hematology/Oncology units over a 12-month evaluation period.

Methods:

The Violet by Clinell Room Sanitiser was deployed for a 12-month intervention period, in combination with standard manual surface disinfection with bleach. CDI rates were compared pre and post-intervention using a mixed effects Poisson regression model.

Results:

Deployment of the Violet by Clinell Room Sanitiser resulted in a 25% decrease in CDI rates on the study units, as compared to the baseline period. An estimated \$348,528–\$1,537,000 in annual direct medical costs were averted by preventing up to 16.6 cases of CDI per 10,000 patient days on the study units.

	Baseline (Jan. 2013–Dec. 2013)	Intervention (Feb. 2014–Jan. 2015)
CDI Rate*	30.34	22.85

*CDI rate is per 10,000 patient days

References:

Pegues, D.A.; 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

Pegues, D.; Gilmar, C.; Denno, M.; Gaynes, S. Reducing *Clostridium difficile* Infection among Hematology-Oncology Patients Using Ultraviolet Germicidal Irradiation for Terminal Room Disinfection. In IDWeek (poster presentation); 2015.

The Violet by Clinell Room Sanitiser achieved a >5 log reduction against carbapenem-resistant *Enterobacteriaceae* (CRE; *K. pneumoniae*, *E. coli*, and *E. cloacae*) in patient rooms.

Principal Investigator:

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

Purpose:

To examine Violet by Clinell Room Sanitiser efficacy against carbapenem-resistant *Enterobacteriaceae* (CRE; *K. pneumoniae*, *E. coli* and *E. cloacae*) plated on Formica®. This study is part of a cluster, randomised, 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 Violet by Clinell Room Sanitiser 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.

Rock, C.; Curless, M.; Nowakowski, E.; Ross, T.; Carson, K.; Trexler, P.; Carroll, K.; Maragakis, L. UV Light Decontamination of Carbapenem-Resistant *Enterobacteriaceae* from High Touch Surfaces in a Patient Room and Bathroom. In SHEA (poster presentation); 2016.

The Violet by Clinell Room Sanitiser effectively reduced the presence of multidrug-resistant organisms (MDROs), including *C. difficile* and methicillin-resistant *Staphylococcus aureus* (MRSA) in patient rooms.

Principal Investigators:

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

Purpose:

To examine Violet by Clinell Room Sanitiser effectiveness against nosocomial pathogens in hospital rooms, including *C. difficile* and methicillin-resistant *Staphylococcus aureus* (MRSA). This study is part of a randomised ward-level crossover study on four medical surgical wards during an 8-month period, focused on evaluating *C. difficile* infection (CDI) rates. This study also included an evaluation of healthcare worker and environmental services staff perceptions.

Methods:

The Violet by Clinell Room Sanitiser was run in isolation rooms on two units in an acute-tertiary care hospital for 6 months. Each patient room was treated with 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 *Enterococci* (VRE), and multidrug-resistant gram-negative organisms.

Results:

The Violet by Clinell Room Sanitiser achieved significant reduction in recovery of MRSA and *C. difficile* during the intervention period, as compared to the preintervention period. MRSA and *C. difficile* recovery was reduced by 76% ($p=0.03$) during the intervention, as compared to the preintervention period.

References:

Deshpande, A.; Hartley, J.; Cadnum, J.; Jencson, A.; Sankar, T. Effectiveness of an Ultraviolet Light Decontamination Device in Reducing Hospital Room Contamination. In SHEA (poster presentation); 2016; p. 549.

LOUIS STOKES CLEVELAND VA MEDICAL CENTRE

The Violet by Clinell Room Sanitiser effectively kills *C. difficile* and methicillin-resistant *Staphylococcus aureus* (MRSA); standardised UV-C device efficacy testing is needed so that different devices can be compared.

Principal Investigators:

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

Purpose:

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

Methods:

Two UV-C devices, including the Violet by Clinell Room Sanitiser, were compared using a single test method for efficacy against MRSA and *C. difficile*. Violet by Clinell Room Sanitiser 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.

Cadnum, J.L.; Mana, T.S.C.; Jencson, A.L.; Deshpande, A.; Donskey, C.J. Not All Efficacy Testing Is Created Equal: Effect of Variation in Test Methods on Performance of an Ultraviolet Radiation Room Disinfection Device. In SHEA (poster presentation); 2015.

UNC HEALTH CARE

The Violet by Clinell Room Sanitiser is effective against carbapenem-resistant Enterobacteriaceae (CRE) and methicillin-resistant *Staphylococcus aureus* (MRSA) plated on Formica® laminate in patient rooms

Principal Investigator:

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

Purpose:

To examine the Violet by Clinell Room Sanitiser 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 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 centre 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 Violet by Clinell Room Sanitiser achieved a >5 log reduction for directly exposed sites and a >4 log reduction for indirectly exposed sites against MRSA and CRKP in 10 minutes. Setup A was comparable to Setup B, with a statistically significant improvement in log reduction found for Setup B. This difference may not be clinically relevant, however, as a >2 log reduction is proposed to be clinically effective by the study authors.

Pathogen	MRSA		CRKP	
	Setup A (one cycle)	Setup B (two cycles)	Setup A (one cycle)	Setup B (two cycles)
Surface Type	(Log 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.

The Violet by Clinell Room Sanitiser is effective against methicillin-resistant *Staphylococcus aureus* (MRSA) and *C. difficile* plated in patient rooms at a shorter cycle time than competing UV-C devices.

Principal Investigator:

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

Purpose:

To examine efficacy of the Violet by Clinell Room Sanitiser and Tru-D Smart UV-C Room Sanitisers 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 two patient rooms. The UV devices were run for cycle times determined by manufacturers guidelines according to size and configuration of patient rooms..

Results:

The Violet by Clinell Room Sanitiser achieved a 3.56 log reduction against MRSA in 5 minutes, and a 2.78 log reduction against *C. difficile* spores in 10 minutes. The Tru-D Smart UV-C achieved a 4.53 log reduction against MRSA in 25 minutes, and a 2.78 log reduction against *C. difficile* in 43 minutes.

The authors indicate that the difference in log reduction of MRSA between devices is likely to be clinically negligible, with the Tru-D device taking 5 times as long as the Violet by Clinell Room Sanitiser. The mean log reduction of *C. difficile* spores was identical (though the Tru-D device had a greater 95% confidence interval spread), with the Tru-D device taking more than 4 times as long as the Violet by Clinell Room Sanitiser to complete its cycle.

Device	Organism	Cycle Time	Total Decontamination Log Reduction
Clinell Violet UV Room Sanitiser	MRSA	5m 0s	3.56
	<i>C. difficile</i> spores	10m 0s	2.78
Tru-D Smart UVC	MRSA	25m 13s	4.53
	<i>C. difficile</i> spores	43m 42s	2.78

References:

Rutala WA, Gergen MF, Tande BM, Weber DJ. Room decontamination using an ultraviolet-C device with short ultraviolet exposure time. *Infection Control & Hospital Epidemiology*. 2014 Aug.
Rutala WA, Gergen MF, Tande BM, Weber DJ. Rapid hospital room decontamination using ultraviolet (UV) light with a nanostructured UV-reflective wall coating. *Infection Control & Hospital Epidemiology*. 2013 May.

UNIVERSITY OF ARIZONA

The Violet by Clinell Room Sanitiser effectively inactivates *C. difficile* spores, MS-2 virus and MRSA on long-term care fomites when used in conjunction with Hydrogen Peroxide.

Principal Investigator:

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

Purpose:

To examine the effectiveness of the Violet by Clinell Room Sanitiser combined with Clorox Healthcare Hydrogen Peroxide 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. Each plate was then treated with Hydrogen Peroxide, followed by 10 minutes of exposure to the Violet by Clinell Room Sanitiser

Results:

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

Pathogen	MRSA (5 minutes)	<i>C. difficile</i> spores (10 minutes)	MS-2 virus (10 minutes)
Surface Type	(Log 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.

OASIS HOSPITAL

A simple test demonstrates effective microbial load reduction by the Violet by Clinell Room Sanitiser in an acute care setting when tested on vertical, horizontal and chemical-sensitive surfaces.

Principal Investigators:

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 Violet by Clinell Room Sanitiser 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.

Reference:

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

WOMEN'S HOSPITAL – DEACONESS HEALTH SYSTEM

The Violet by Clinell Room Sanitiser reduces *Pseudomonas aeruginosa* infection incidence among patients in a neonatal intensive care unit.

Principal Investigators:

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

Purpose:

To examine the impact of the Violet by Clinell Room Sanitiser on *Pseudomonas aeruginosa* infection incidence in a neonatal intensive care unit.

Methods:

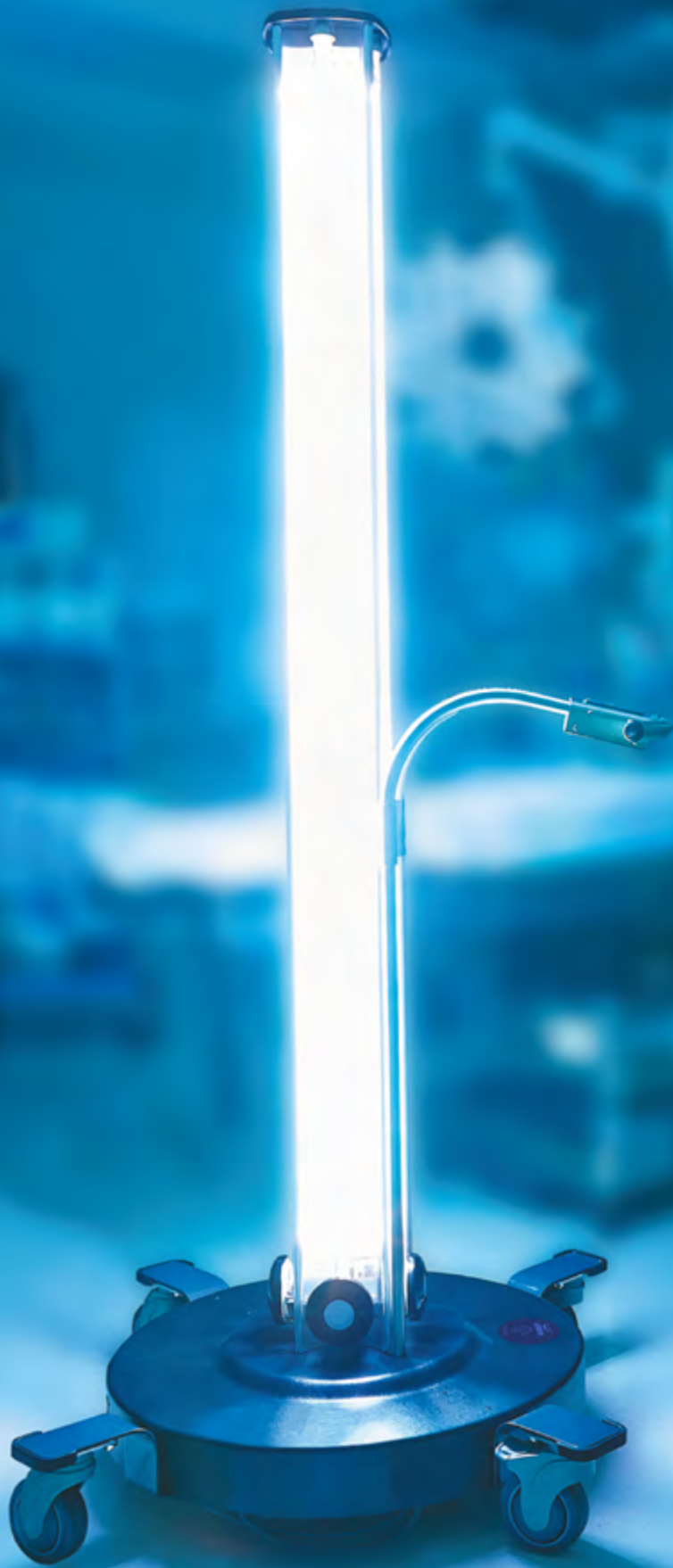
A retrospective review of positive *Pseudomonas aeruginosa* culture incidence was conducted on patients in a neonatal intensive care unit for a period of 3 years. Manual surface disinfection alone was used in the first half of the study (1.5 years), and the Violet by Clinell Room Sanitiser was used as 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 Violet by Clinell Room Sanitiser was used, as compared to 32 positive cultures found in the 1.5 year baseline period when manual surface disinfection alone was used.

Reference:

Mauzey, S. Coming to the Light: Impact of Ultraviolet Technology on Incidence of *Pseudomonas* in a Neonatal Intensive Care Unit. In APIC (poster presentation); 2015.





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