INSELGRUPPE

UV-C Raumdesinfektion Pro/Con Debatte:
Contra

21.01.2025 HIPOP

Philipp Jent, Leiter Infektionsprävention und –kontrolle, Inselspital Bern / Insel Gruppe


XENEX
Tru-D
HERO2i
JKS

Hintergrund

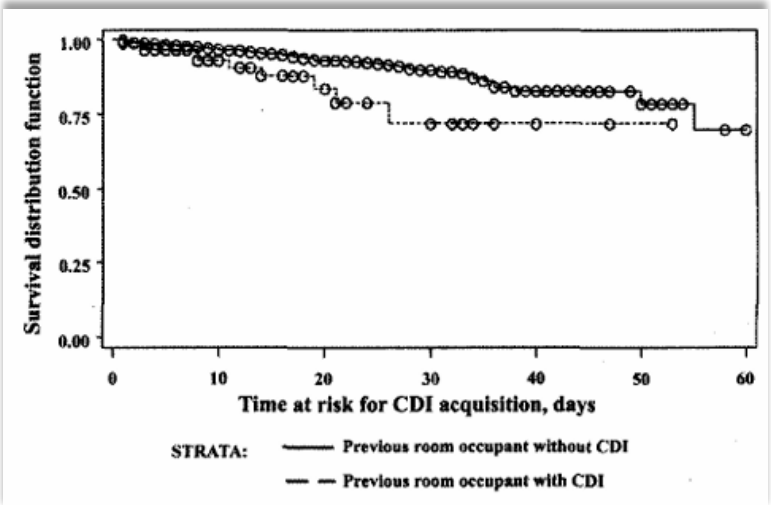
Umweltlast trägt zu Übertragung bei

INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY MARCH 2011, VOL. 32, NO. 3

ORIGINAL ARTICLE

Evaluation of Hospital Room Assignment and Acquisition of *Clostridium difficile* Infection

Megan K. Shaughnessy, MD;[1] Renee L. Micielli, MD;[1] Daryl D. DePestel, PharmD;[2] Jennifer Arndt, MS;[3] Cathy L. Strachan, MSRN;[4] Kathy B. Welch, MS;[3] Carol E. Chenoweth, MD[1,3]



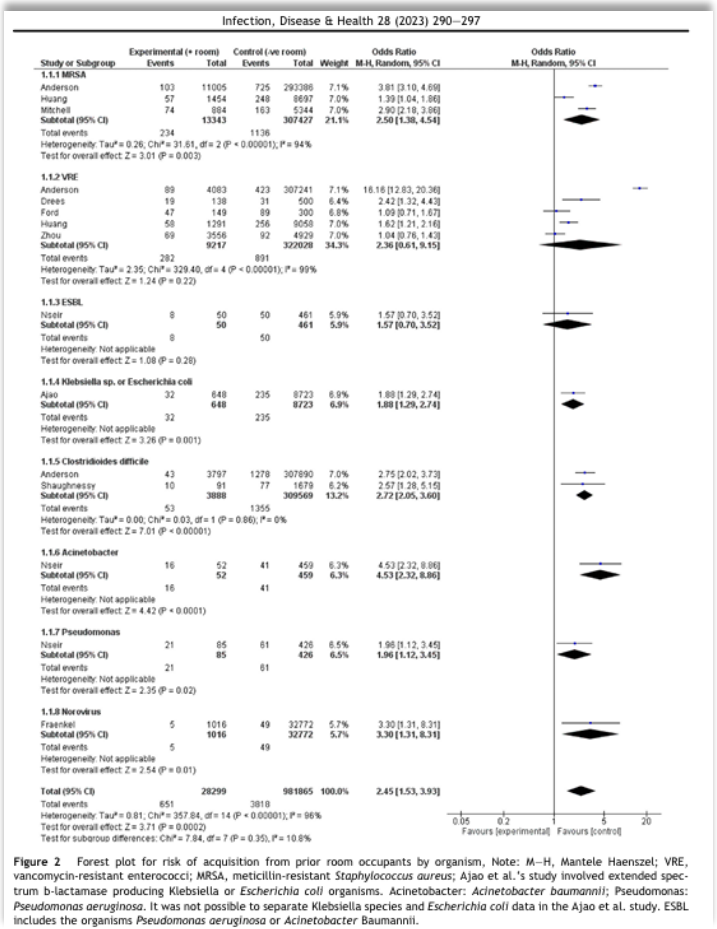


Figure 2 Forest plot for risk of acquisition from prior room occupants by organism, Note: *M*–H, Mantele Haenszel; VRE, vancomycin-resistant enterococci; MRSA, meticillin-resistant *Staphylococcus aureus*; Ajao et al.'s study involved extended spectrum b-lactamase producing Klebsiella or *Escherichia coli* organisms. Acinetobacter: *Acinetobacter baumannii*; Pseudomonas: *Pseudomonas aeruginosa*. It was not possible to separate Klebsiella species and *Escherichia coli* data in the Ajao et al. study. ESBL includes the organisms *Pseudomonas aeruginosa* or *Acinetobacter* Baumannii.

Hintergrund

Mechanische und chemische Oberflächenreinigung und Desinfektion (Touch-Methoden) reduziert MDRO Nachweise und auch *C. difficile* Nachweise in Studien – *aber unvollständig*

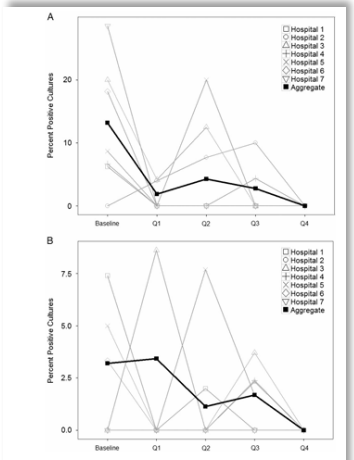


FIGURE 2. Effect of the cleaning intervention on percentage of rooms with positive cultures for *Clostridium difficile* from high-touch surfaces after cleaning following patient discharge from *C. difficile* infection (CDI) (*A*) and non-CDI (*B*) rooms in the 7 intervention hospitals. Abbreviation: Q, quarter of the study year.

tps://doi.org/10.1017/ice.2017.76 Published online by Cambridge University Press

Investigating the effect of enhanced cleaning and disinfection of shared medical equipment on health-care-associated infections in Australia (CLEEN): a stepped-wedge, cluster randomised, controlled trial

Katrina Browne, Nicole M White, Philip L Russo, Allen C Cheng, Andrew J Stewardson, Georgia Matterson, Peta E Tehan, Kirsty Graham, Maham Amin, Maria Northcote, Martin Kiernan, Jennie King, David Brain, Brett G Mitchell

Summary

Background There is a paucity of high-quality evidence based on clinical endpoints for routine cleaning of shared medical equipment. We assessed the effect of enhanced cleaning and disinfection of shared medical equipment on health-care-associated infections (HAIs) in hospitalised patients.

Lancet Infect Dis 2024; 24: 1347–56
Published Online August 13, 2024

Interventionen um Verbesserungen zu erreichen hier wirksam!

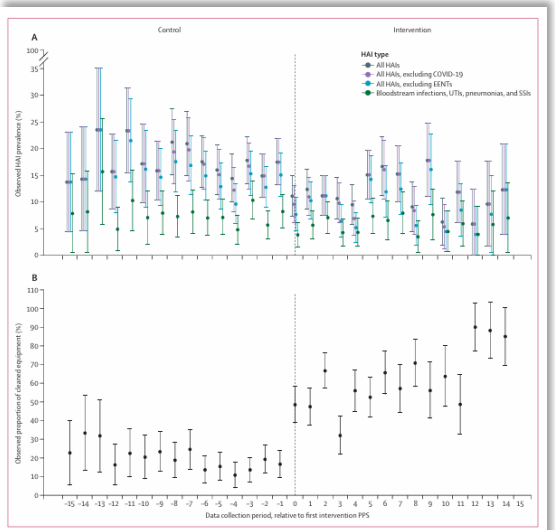
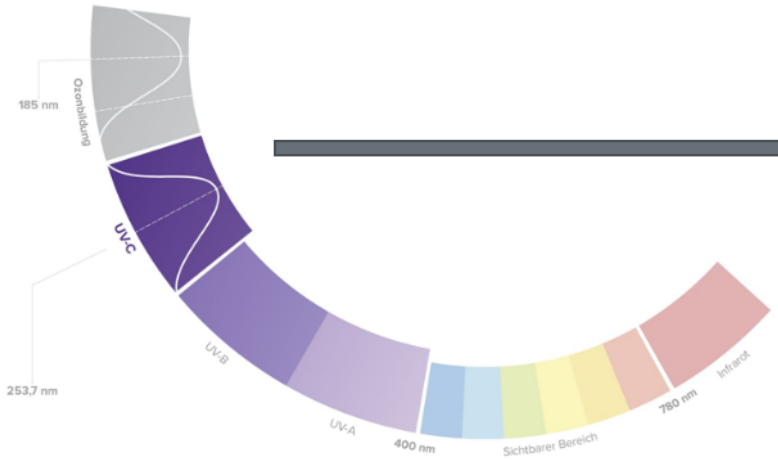
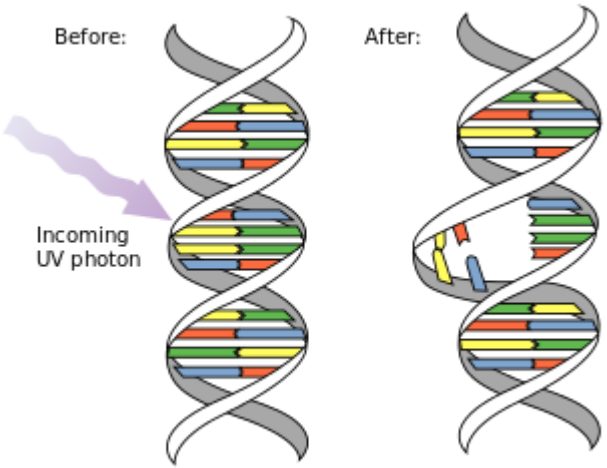


Figure 3: **Summary of outcomes relative to the first intervention PPS**
HAI prevalence (A) and proportion of cleaned equipment (B) in the control phase and intervention phase by HAI subtype. Each data collection period represents a 2-week period. EENT=ear, eye, nose, and throat infection. HAI=health-care-associated infection. PPS=point prevalence survey. SSI=surgical site infection. UTI=urinary tract infection.

Hintergrund

UV-A	380-315 nm "Schwarzlicht"
UV-B	315-280 nm verantwortlich für den Sonnenbrand
UV-C	280-200 nm Entkeimungswirkung
UV-C-VUV	200-100 nm Ozonbildung





Physikalische Wirksamkeit

…eher etwas für den PRO Teil: 2-5 Log10 Reduktion für MRSA, VRE, C. diff

Table II
In-vitro studies evaluating the efficacy of no-touch disinfectant systems against *Clostridium difficile* or spore-forming bacteria

Author (year)	Setting	Product	Method; inoculum	Effect
Nerandzic *et al.*[43]	Bench top	UV-C (Tru-D) (22,000 μWs/cm²)	10^5–105 *C. difficile* spores spread on 1 cm² surface	>2–4 $\log_{10}$ spore reduction. No significant difference when the spores are suspended in BSA.
	Patient rooms		Spore carrier (plastic) test with 10^5 *C. difficile* spores	2.6 $\log_{10}$ reduction in direct line of sight. 1 $\log_{10}$ reduction out of direct line of sight.
Rutala *et al.*[44]	Patient rooms	UV-C (Tru-D) (36,000 μWs/cm²)	Spore carrier (formica) test with 10^4–10^6 *C. difficile* spores	Mean $\log_{10}$ reduction of 2.79 (within 50 min). UV-C was less effective out of direct light of sight.
Boyce *et al.*[42]	Patient rooms (46–86 m²) and bathrooms	UV-C (Tru-D) (22,000 μWs/cm²)	Spore carrier (stainless steel) test with 10^5 *C. difficile* spores	~68 min cycle: 2.2 $\log_{10}$ reduction (range: 1.7–2.9). ~84 min cycle: 2.3 $\log_{10}$ reduction (range: 1.4–3.2).
Barbut *et al.*[45]	Patient rooms (33–45 m²)	HPV (Bioquell)	Spore carrier (PVC and laminate) test with 10^5–10^6 *C. difficile* spores	HPV achieved complete eradication of spores.
Havill *et al.*[47]	Patient rooms and bathrooms (46–86 m²)	HPV (Bioquell)	Spore carrier (stainless steel) test with 10^6 *C. difficile* spores	HPV achieved >6 $\log_{10}$ reduction of spore count. HPV inactivated 100% of BI with 10^4 spores and 99% of BI with 10^6 spores.
		UV-C (22,000 μWs/cm²)	BI with 10^4 and 10^6 spores of *G. stearothermophilus*	UV-C achieved a mean of 2 $\log_{10}$ reduction of spores (range: 1.7–3.0). UVC inactivated 29% of BI with 10^4 spores and 0% of BI with 10^6 spores. UVC was less effective out of direct light of sight.
Fu *et al.*[46]	Patient rooms (46–86 m²) and bathrooms	HPV (Bioquell)	Spore carrier (stainless steel) test with 10^6 *C. difficile* spores	HPV achieved <4 $\log_{10}$ reduction of spore count.
		aHP (Sterinis)	Pouched 10^4 and 10^6 spores of *G. stearothermophilus* BI	aHP achieved <4 $\log_{10}$ reduction spore count. HPV inactivated 95% of BI with 10^4 spores and 91% of BI with 10^6 spores. aHP inactivated 36.4% of BI with 10^4 spores and 6.8% of BI with 10^6 spores.
Nerandzic *et al.*[48]	Bench top	Far UV (185–230 nm (hand-held device) (100 mJ/cm², 5 s)	Droplets containing 10^6–10^8 spores inoculated on cover of a plastic Petri dish	UV-C reduced *C. difficile* spores by 4.4 $\log_{10}$ The sporicidal effect is reduced in presence of heavy organic load
	Patient rooms		10^4–10^5 spores inoculated on different surfaces (stethoscopes, keyboard)	UV-C reduced *C. difficile* spores by 3.2 $\log_{10}$

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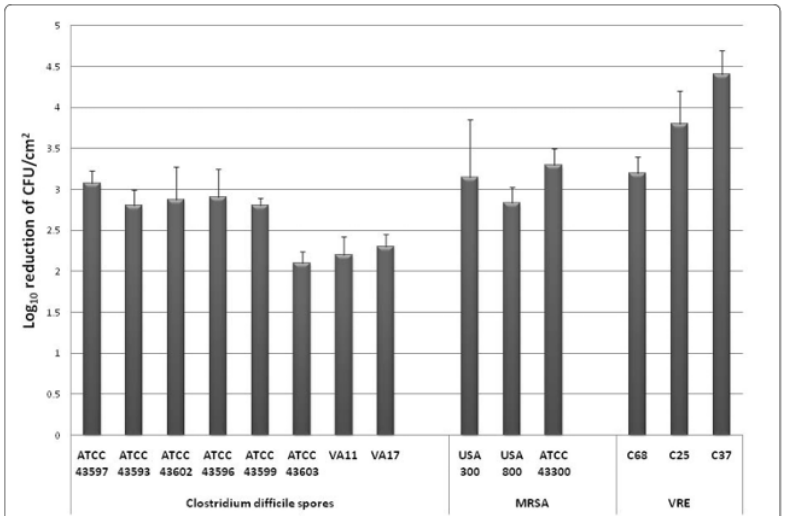

Figure 2 Mean reduction ($\log_{10}$colony-forming units [CFU]/cm²) in recovery of multiple strains of *Clostridium difficile*, methicillin-resistant *Staphylococcus aureus* (MRSA), and vancomycin-resistant *Enterococcus* (VRE) from laboratory bench top surfaces after the use of the Tru-D device. For each pathogen, the inoculum applied to the bench top was adjusted such that 10^3 to 10^5 CFU were recovered from the positive control specimens. The Tru-D device was operated at a reflected dose of 22,000 μWs/cm² for ~45 minutes.

Physikalische Wirksamkeit

Aber: Wasserstoffperoxid Verdampfer viel effektiver, ca. 6 log10 Reduktion bei Sporen (C. diff)

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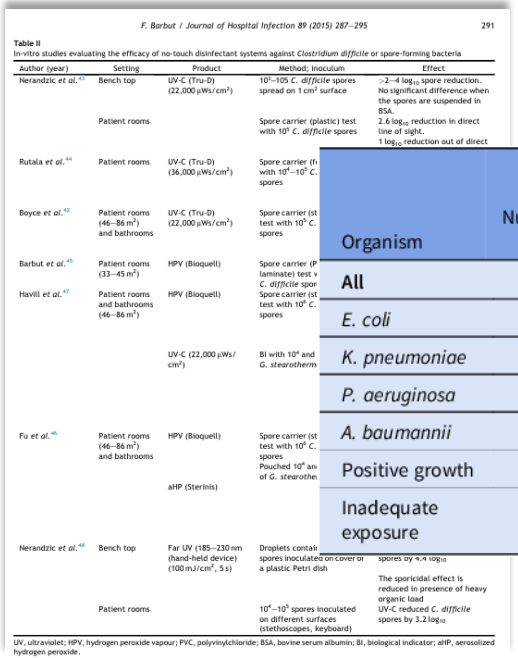
Physikalische Wirksamkeit

2-3 Log10 Reduktion auch für «pathogene» Gramnegative



F. Barbut / Journal of Hospital Infection 89 (2015) 287–295 291

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Barbut *et al.*[45]	Patient rooms (33–45 m²)	HPV (Bioquell)	Spore carrier (P laminate) test v *C. difficile* spor	
Havill *et al.*[47]	Patient rooms and bathrooms (46–86 m²)	HPV (Bioquell)	Spore carrier (st test with 10^6 *C.* spores	
		UV-C (22,000 μWs/cm²)	BI with 10^4 and *G. stearotherm*	
Fu *et al.*[46]	Patient rooms (46–86 m²) and bathrooms	HPV (Bioquell)	Spore carrier (st test with 10^6 *C.* spores Pouched 10^4 an of *G. stearothe*	
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Nerandzic *et al.*[48]	Bench top	Far UV (185–230 nm (hand-held device) (100 mJ/cm², 5 s)	Droplets contain spores inoculated on cover of a plastic Petri dish	spores by 4.4 $\log_{10}$ The sporicidal effect is reduced in presence of heavy organic load
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Nerandzic *et al. BMC Infectious Diseases* 2010, **10**:197
http://www.biomedcentral.com/1471-2334/10/197

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Organism	Number of rooms	Number of exposed plates	Number of control plates	Median distance from UV-C tower in cm (IQR)	Median UV-C machine runtime in minutes (IQR)	Mean CFUs at 48 hours post-UV-C	Mean control CFUs at 48 hours	Log reduction	Percentage reduction
All	**7**	**140**	**12**	**119.4 (85.1–147.3)**	**29 (21–33)**	**0.4**	**87.4**	**2.35**	**99.54**
E. coli	7	35	3	119.4 (83.8–151.8)	29 (21–33)	0.7	65.3	1.96	98.93
K. pneumoniae	7	35	3	119.4 (82–137.8)	29 (21–33)	0.1	69.3	3.08	99.86
P. aeruginosa	5	35	3	119.4 (95.3–148.6)	27 (21–29)	0.2	120.3	2.78	99.83
A. baumannii	5	35	3	114.3 (83.8–146.7)	32 (27–42)	0.6	94.7	2.20	99.37
Positive growth	4	10	8	161.9 (127.0–227.3)	33 (27–42)	5.5	74.8	1.13	92.65
Inadequate exposure	1	4	4	143.5 (126.4–161.9)	33	11.5	63	0.74	81.75

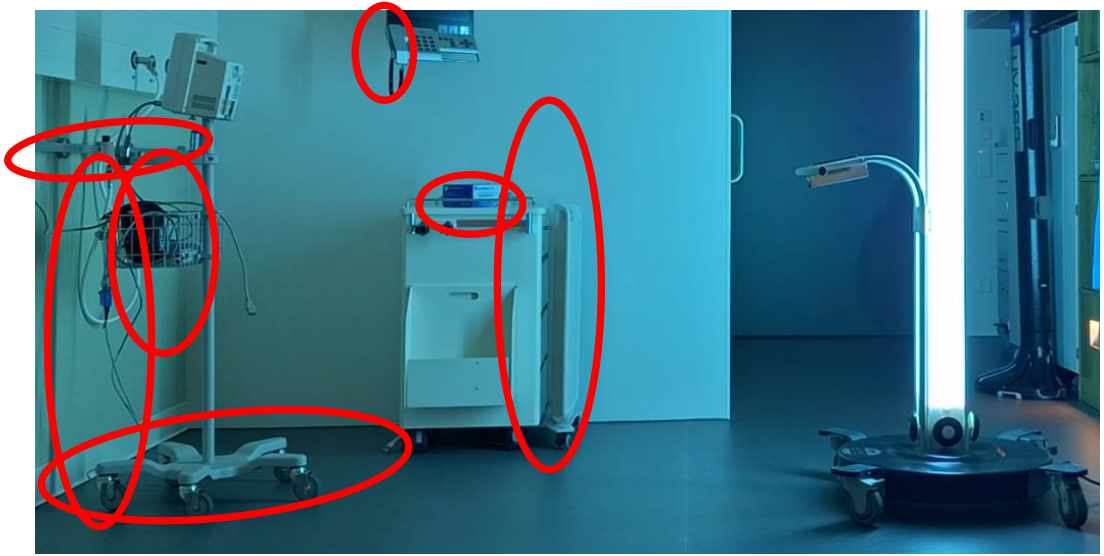
Figure 2 Mean reduction ($\log_{10}$colony-forming units [CFU]/cm²) in recovery of multiple strains of *Clostridium difficile*, methicillin-resistant *Staphylococcus aureus* (MRSA), and vancomycin-resistant *Enterococcus* (VRE) from laboratory bench top surfaces after the use of the Tru-D device. For each pathogen, the inoculum applied to the bench top was adjusted such that 10^3 to 10^5 CFU were recovered from the positive control specimens. The Tru-D device was operated at a reflected dose of 22,000 μWs/cm² for ~45 minutes.

Doi: 10.1017/ash.2023.514

Physikalische Wirksamkeit = Real-Life Wirksamkeit?

UVC = Lichtbasiert….

Kommt Strahlung am Ort des Geschehens an ???



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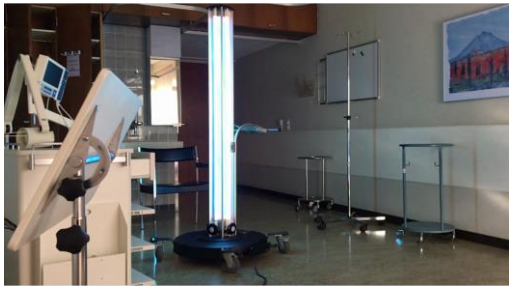


Nur zum Teil lösbar

über «multiple positioning» /

mobile Roboter

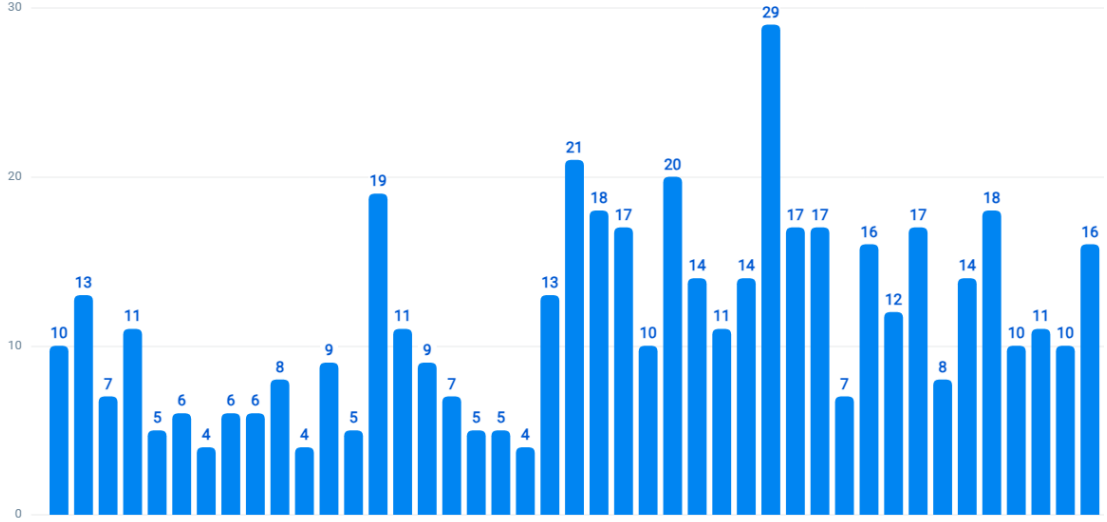
Real-Life Wirksamkeit? Organisatorische Abläufe

Austritte in Nacht

Austritte am Wochenende

Mehrbettzimmer

....



Verfügbarkeit eines UVC Gerätes heisst nicht flächendeckender Einsatz!

Real-Life Wirksamkeit? Gramnegative Bakteriämien

Clinical Infectious Diseases
MAJOR ARTICLE

Effectiveness of Ultraviolet-C Disinfection on Hospital-Onset Gram-Negative Rod Bloodstream Infection: A Nationwide Stepped-Wedge Time-Series Analysis

Michihiko Goto,[1,2,a,©] Shinya Hasegawa,[1,2,a] Erin C. Balkenende,[1,3] Gosia S. Clore,[3] Nasia Safdar,[4,5] and Eli N. Perencevich,[1,3] on behalf of VA-CDC Practice-Based Research Network[b]

[1]Center for Access and Delivery Research and Evaluation, Iowa City Veterans Affairs Health Care System, Iowa City, Iowa, USA; [2]Division of Infectious Diseases, Department of Internal Medicine, University of Iowa, Iowa City, Iowa, USA; [3]Division of General Internal Medicine, Department of Internal Medicine, University of Iowa, Iowa City, Iowa, USA; [4]Primary and Specialty Medicine Service Line, William S. Middleton Memorial VA Medical Center, Madison, Wisconsin, USA; and [5]Department of Medicine, Division of Infectious Diseases, University of Wisconsin School of Public Health and Medicine, Madison, Wisconsin, USA

Table 2. Association Between Automated Ultraviolet-C Disinfection Use and Monthly Incidence Rates of each Measurement

Outcome	Incidence Rate Ratio (95% CI)	*P* value
Primary outcome		
HO-GNR BSI	0.813 [.656–.969]	.009
Secondary outcomes		
Escherichia coli BSI	0.885 [.737–1.062]	.19
Klebsiella spp. BSI	0.892 [.751–1.061]	.20
Non-fermenting GNR BSI	0.665 [.534–.830]	<.001

Abbreviations: BSI, bloodstream infection; CI, confidence interval; HO-GNR, hospital-onset gram-negative rod.

Endpunkt der richtige?

129 Spitäler, 9 Jahre (USA, Veterans Health Administration)

Wirksam, aber kein «Gamechanger»

Real-Life Wirksamkeit? C. difficile

from the 129 hospitals during the study period. There were declining baseline trends nationwide (mean, −0.6% per month) for HO-CDI. The use of UV-C had no statistically significant association with incidence rates of HO-CDI (incidence rate ratio [IRR], 1.032; 95% CI, 0.963–1.106; *P* = .65) or incidence rates of healthcare-associated positive *C. difficile* test results (HO-Lab). **Conclusions:** In this large quasi-experimental analysis within the VHA System, the enhanced terminal room cleaning with UVC disinfection was not associated with the change in incidence rates of clinically confirmed hospital-onset CDI or positive test results with recent healthcare exposure. Further research is needed to understand reasons for lack of effectiveness, such as understanding barriers to utilization.

129 Spitäler, 9 Jahre (USA, Veterans Health Administration)

Kein Effekt bezüglich C. diff Nachweis und HA-CDI

Real-Life Wirksamkeit? MDRO Kolonisation/Infektion, C. diff

Enhanced terminal room disinfection and acquisition and infection caused by multidrug-resistant organisms and *Clostridium difficile* (the Benefits of Enhanced Terminal Room Disinfection study): a cluster-randomised, multicentre, crossover study

Deverick J Anderson, Luke F Chen, David J Weber, Rebekah W Moehring, Sarah S Lewis, Patricia F Triplett, Michael Blocker, Paul Becherer, J Conrad Schwab, Lauren P Knelson, Yuliya Lokhnygina, William A Rutala, Hajime Kanamori, Maria F Gergen, Daniel J Sexton; for the CDC Prevention Epicenters Program

Lancet 2017; 389: 805–14

	Reference	UV group	Bleach group	Bleach and UV group
All target organisms				
Exposed patients	4916	5178	5438	5863
Incident cases (%)	115 (2·3%)	76 (1·5%)	101 (1·9%)	131 (2·2%)
Exposure days	22 426	22 389	24 261	28 757
Rate (per 10 000 exposure-days)	51·3	33·9	41·6	45·6
Risk reduction (95% CI)	Reference	17·4 (5·8 to 28·9)	9·7 (−2·7 to 22·0)	5·7 (−6·2 to 17·7)
RR (95% CI); p value	Reference	0·70 (0·50 to 0·98); 0·036	0·85 (0·69 to 1·04); 0·116	0·91 (0·76 to 1·09); 0·303
Clostridium difficile*				
Exposed patients	..	..	2499	2678
Incident cases (%)	..	..	36 (1·4%)	38 (1·4%)
Exposure days	..	..	11 385	12 509
Rate (per 10 000 exposure-days)	..	..	31·6	30·4
Risk reduction (95% CI)	..	..	Reference	1·2 (−12·7 to 15·2)
RR (95% CI); p value	..	..	Reference	1·0 (0·57 to 1·75); 0·997

Cluster RCT in 9 US Spitälern

Kein «Gamechanger»…

Kein Effekt bei C. diff

Real-Life Wirksamkeit? MDRO Kolonisation/Infektion, C. diff

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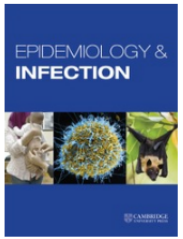
Exposure days	..	..	11 385	12 509
Rate (per 10 000 exposure-days)	..	..	31·6	30·4
Risk reduction (95% CI)	..	..	Reference	1·2 (−12·7 to 15·2)
RR (95% CI); p value	..	..	Reference	1·0 (0·57 to 1·75); 0·997

Cluster RCT in 9 US Spitälern

Kein «Gamechanger»…

Kein Effekt bei C. diff

Real-Life Wirksamkeit? Metaanalyse



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C. diff

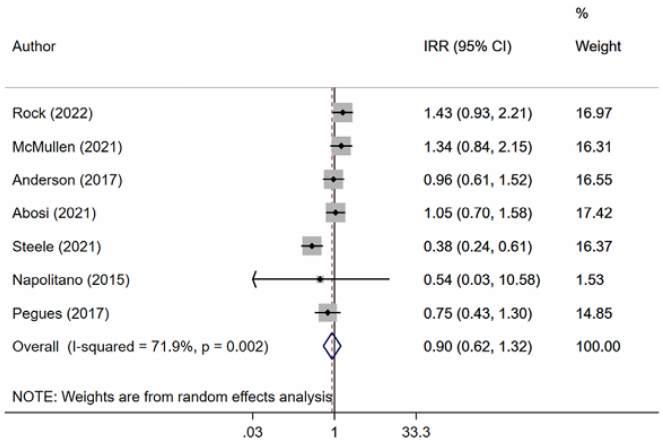
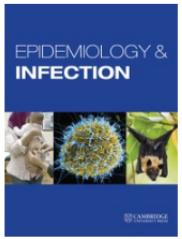


Figure 2. Forest plot of IRRs of *Clostridioides difficile* (CD) infection for UV-C versus control.

Real-Life Wirksamkeit? Metaanalyse



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VRE

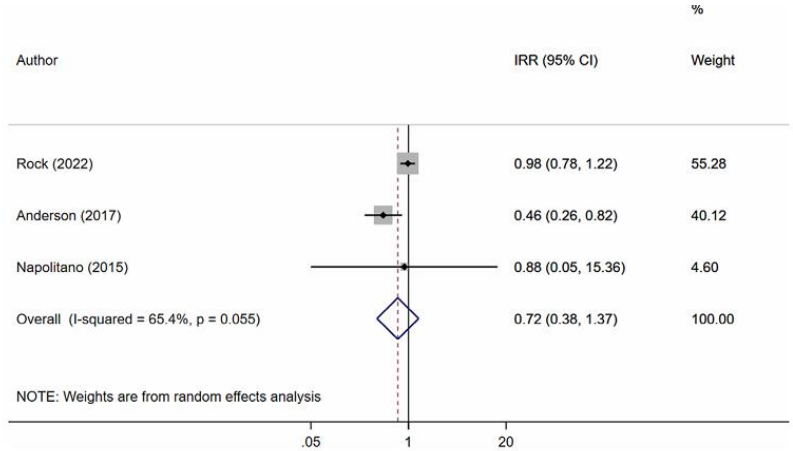

Figure 3. Forest plot of IRRs of vancomycin-resistant enterococcal infection (VRE) for UV-C versus control.

GNR

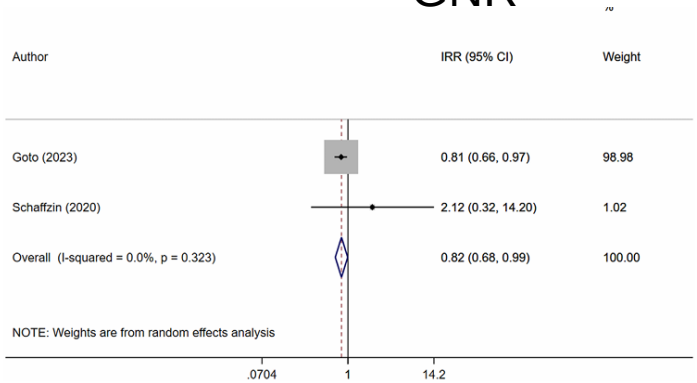

Figure 4. Forest plot of IRRs of Gram-negative rod infection for UV-C versus control.

Real-Life Wirksamkeit? Cluster RCT zu eiHAI

Clinical Infectious Diseases
MAJOR ARTICLE

Lowering the Acquisition of Multidrug-Resistant Organisms (MDROs) With Pulsed-xenon (LAMP) Study: A Cluster-Randomized, Controlled, Double-Blinded, Interventional Crossover Trial

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Crossover cluster RCT auf 15 Stationen

Pulsed UV

Endpunkt?

Table 3. Rates of Pathogens and Device Infections in the Sham and Intervention (PX-UV) Group

	Sham Arm			Intervention (PX-UV) Arm				
	No. of Cases	No. of Patient-Days	Infection Rate (per 1000 Patient-Days)	No. of Cases	No. of Patient-Days	Infection Rate (per 1000 Patient-Days)	Relative Risk (95% CI)	*P*
eiHAIs								
Overall	298	94 153.5	3.17	303	86 800.4	3.49	1.10 (.94, 1.29)	.23
Acinetobacter baumannii	53	94 153.5	0.56	55	86 800.4	0.63	1.13 (.77, 1.64)	.54
Clostridiodes difficile	57	94 153.5	0.61	59	86 800.4	0.68	1.12 (.78, 1.62)	.53
ESBL *Escherichia coli*	25	94 153.5	0.27	20	86 800.4	0.23	.87 (.48, 1.56)	.64
ESBL KP	34	94 153.5	0.36	31	86 800.4	0.36	0.99 (.61, 1.61)	.96
MRSA	116	94 153.5	1.23	122	86 800.4	1.41	1.14 (.88, 1.47)	.31
VRE	13	94 153.5	0.14	16	86 800.4	0.18	1.34 (.64, 2.78)	.44

UVC - Contra

Physikalisch wirksame Methode mit aufwändiger **Implementierung** im Alltag

- Schattenwurf
- Abdeckung Randzeiten
- …

Real-world «**Effectiveness**»

- GNR/VRE: fraglich, kein Gamechanger
- C.diff: nicht nachweisbar…

Meine persönliche Meinung könnte von diesem Vortrag abweichen ☺

INSELGRUPPE

Fragen?