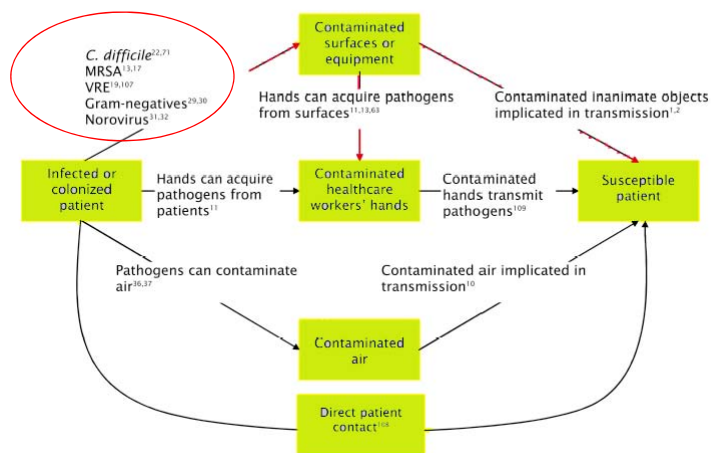


UVc und H₂O₂: Gadget oder höhere Sicherheit?

Andreas F. Widmer, Basel



Übertragung von Erregern von Oberflächen auf Patienten



Otter JA. *Infect Control Hosp Epidemiol* 2011;32(7):687-699

Ansichten der «Oldies»

“We conclude that organisms in the inanimate hospital environment contribute negligibly to endemic nosocomial infection and that routine microbiologic surveillance of the inanimate environment is not cost effective”

Maki DG et al.
N Engl J Med 1982;307:1562-1566.



«There is no evidence that environmental cleaning/disinfection has an impact on the incidence of nosocomial infection»



Wing-Hong Seto ICCAC 2007.

Environmental Surface Disinfection?

- ***1 – 2 hours after floor disinfection identical number of bacteria as prior to disinfection***

[Ayliffe GAJ et al. BMJ 1966; 2: 442]

- ***“There is no difference in hospital-acquired infection rates when floors are cleaned with detergent vs. disinfectant”***

[Rutala WA et al: J Hosp Infect 2001; 48 Suppl. A: 66]

Cross-over Aldehyd vs Glucoprotamin disinfection of Bone Marrow Transplant Unit. Recontamination after disinfection

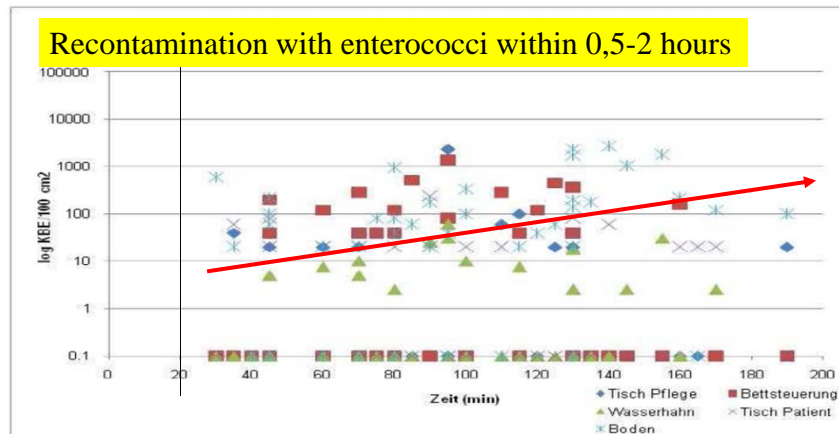


Abb. 1a: Verteilung der Datenpunkte Gesamtkeimzahl bei DECONEX® 50FF Probennahme 0-240 min

Meinke R. & Widmer AF. [Infect Control Hosp Epidemiol](#). 2012 Nov;33(11):1077-80

Transfer of Pathogens and Surrogate Markers from Surfaces to Hands

Reference	Setting, location	Organism(s)	Method	No.	No. (%) contaminated	Comment
Rusin et al ¹ (2002)	Laboratory, USA	Bacteria and phage	Fomites were experimentally contaminated with a mixture of bacteria and phage and touched by volunteers	10-20	...	Transfer efficiency was higher for non-porous fomites (28%-66%); gram-positive bacteria had the highest transfer efficiency (41%)
Jiang et al ² (1998)	Child care center, USA	Virus surrogate	DNA was dried onto toys, which were passed to researchers to hold	5	5 (100)	Subsequent transfer of DNA to clean toys occurred on 3 of 5 occasions
Rheinbaben et al ³ (2000)	Laboratory, Germany	Phage	Volunteers contacted an experimentally contaminated door handle	14	14 (100)	30%-66% of the inoculated virus was recovered from the hands of volunteers
Boyce et al ⁴ (1997)	Ward side rooms, USA	MRSA	Hand cultures were performed after routine patient care without direct patient contact	12	5 (42)	All 12 HCWs wore gloves
Ray et al ⁵ (2002)	Wards side rooms, USA	VRE	Hand cultures were performed after 5-second contact with bed rail and bedside table in rooms of VRE patients	13	6 (46)	5 of 6 hand cultures were indistinguishable from environmental cultures by PFGE
Barker et al ⁶ (2004)	Laboratory, UK	Norovirus	Clean fingertips touched contaminated surfaces and then other objects	30	12 (40)	4 of 10 door handles, 5 of 10 telephones, and 3 of 10 taps became contaminated
Bhalla et al ⁷ (2004)	8 wards, USA	Pathogens	Hand cultures were performed after 5-second contact with bed rail and bedside table	64	34 (53)	Positive hand culture results were obtained for 24% of 25 rooms that had been cleaned after patient discharge
Hayden et al ⁸ (2008)	ICU, USA	VRE	Hand cultures were performed for 44 HCWs who had negative hand culture results at study entry and touched only environmental surfaces during routine patient care	44	23 (52)	Each contact with patient or environmental surface represented a 10% risk of acquiring VRE

NOTE. HCW, healthcare worker; ICU, intensive care unit; MRSA, methicillin-resistant *Staphylococcus aureus*; PFGE, pulsed-field gel electrophoresis; VRE, vancomycin-resistant enterococci.

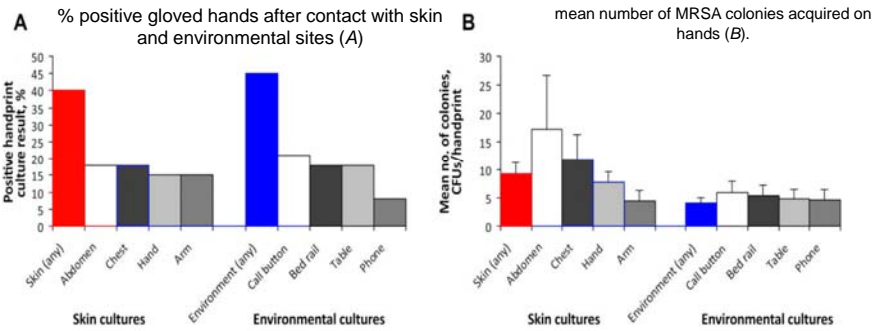
Otter JA *Infect Control Hosp Epidemiol* 2011;32(7):687-9

FREQUENCY OF ACQUISITION OF MRSA ON GLOVED HANDS AFTER CONTACT WITH SKIN AND ENVIRONMENTAL SITES

40 patients, MRSA carriers

hand contamination was equally likely after contact with commonly examined skin sites and commonly touched environmental surfaces in patient rooms (40% vs 45%)

No significant difference on contamination rates of gloved hands after contact with skin or environmental surfaces (40% vs 45%; $p=0.59$)



Stiefel U, et al. ICHE 2011;32:185-187

Korrelation Bioburden (Gesamtkeimzahl) und Anzahl Pathogene Keime auf Oberflächen

KEINE Korrelation zwischen Gesamtkeimzahl und Häufigkeit Anzahl pathogener Keimer

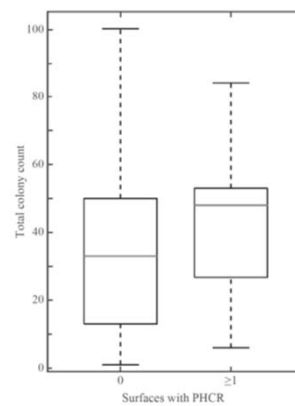
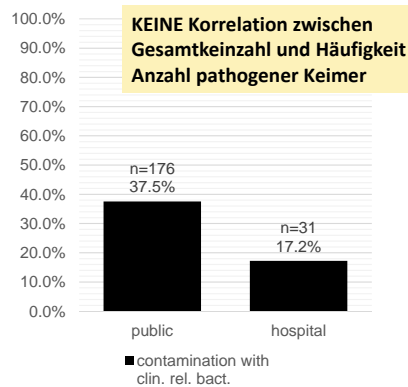
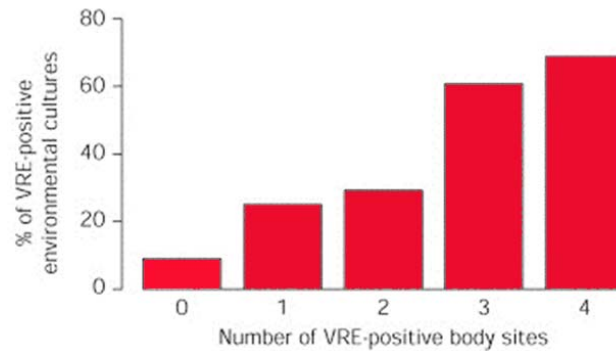


Figure 1. Total colony count (colony-forming units per plate) obtained from surfaces without the presence of pathogens of high clinical relevance (PHCR) and surfaces with at least one PHCR; no significant difference was found ($P = 0.67$).

Widmer FC. J Hosp Infect. 2019 Feb;101(2):240-244

pathogens of high clinical relevance (PHCR)

Correlation between number of body sites colonised with VRE and environmental contamination in the same room



Marc JM Bonten: The Lancet Volume 348, 1996 1615 - 1619

Studies Investigating the Role Played by Contaminated Surfaces in the Endemic Transmission of Nosocomial Pathogens

Reference	Setting, location	Organism	Study design	Key findings
Samore et al ¹⁸ (1996)	Hospital-wide, USA	<i>C. difficile</i>	6-month prospective observational study	Frequency of transmission correlated with the intensity of environmental contamination
Mayfield et al ¹⁹ (2000)	3 units, USA	<i>C. difficile</i>	18-month prospective before-after study of a switch from QAC to bleach disinfection	Significant reduction in CDI incidence in the highest-risk unit (from 8.6 to 3.3 cases per 1,000 patient-days)
Wilcox et al ²⁰ (2003)	2 units, UK	<i>C. difficile</i>	2-year prospective ward crossover study of a switch from detergent to bleach disinfection	Significant reduction in CDI incidence in one of the units (from 8.9 to 5.3 cases per 100 admissions) but not in the other
Boyce et al ²¹ (2008)	Hospital-wide, USA	<i>C. difficile</i>	20-month prospective before-after study of routine use of HPV decontamination	Significant reduction in CDI incidence in 5 high-incidence units (from 2.3 to 1.3 cases per 1,000 patient-days); lesser reduction in CDI incidence hospital-wide
Manian et al ²² (2010)	Hospital-wide, USA	<i>C. difficile</i> /VRE	24-month prospective before-after study of routine use of HPV decontamination	Significant reductions in <i>C. difficile</i> (from 1.0 to 0.5 cases per 1,000 patient-days) and VRE (from 0.3 to 0.15 cases per 1,000 patient-days); substantial but not statistically significant reductions in MRSA and <i>Acinetobacter</i> species
Bonten et al ¹⁹ (1996)	ICU, USA	VRE	2-month prospective observational study	23% of 13 patients admitted to VRE-contaminated rooms acquired VRE
Hayden et al ²³ (2006)	ICU, USA	VRE	9-month prospective before-after study of educational improvement of cleaning and hand hygiene	Frequency of environmental contamination was reduced; patient acquisition of VRE was reduced from 33 to 17 acquisitions per 1,000 patient-days during the improved cleaning phase
Passaretti et al ²⁴ (2008)	ICU, USA	VRE	12-month prospective cohort study investigating the effect of HPV decontamination	HPV was protective against VRE acquisition when the prior room occupant had VRE (IRR for patients admitted to rooms decontaminated using HPV vs standard methods, 0.22)
Hardy et al ²⁵ (2006)	ICU, UK	MRSA	14-month prospective observational study	More than 10% of acquisitions were likely to be have been directly from the environment
Mahamat et al ²⁶ (2007)	Hospital-wide, UK	MRSA	8-year prospective interrupted time-series analysis of multiple infection control interventions	Introduction of bleach disinfection, environmental sampling, alcohol gels, and admission screening all reduced the prevalence of MRSA
Dancer et al ²⁸ (2009)	2 wards, UK	MRSA	12-month prospective crossover study of the effect of 1 extra cleaner	Enhanced cleaning was associated with significant reductions in surface contamination, hygiene failures, and MRSA acquisition

NOTE. CDI, *Clostridium difficile* infection; HPV, hydrogen peroxide vapor; ICU, intensive care unit; IRR, incidence rate ratio; MRSA, methicillin-resistant *Staphylococcus aureus*; QAC, quarternary ammonium compound; VRE, vancomycin-resistant enterococci.

Otter JA Infect Control Hosp Epidemiol 2011;32(7):687-9

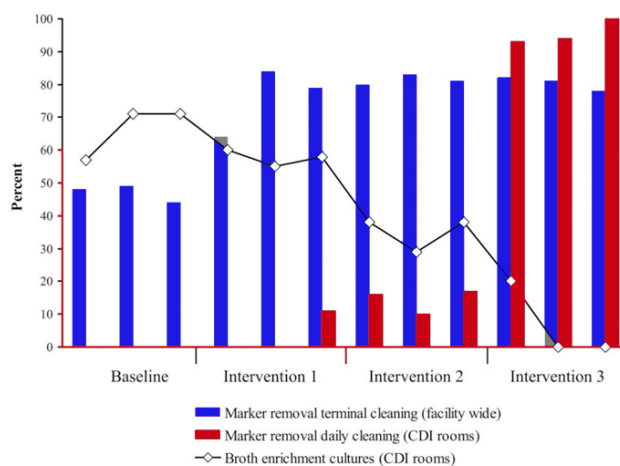
Compliance with Protocols for Cleaning Disinfection Monitoring Cleaning Practices

- 1404 objects were evaluated before the intervention
- 744 objects were evaluated after the intervention
- Proportion of objects cleaned
 - Before intervention: 47%
 - After interventions: 76 - 92%
- Technique improved in all hospitals ($p < 0.001$)
- Technique has been adopted in numerous hospitals and has led to improved cleaning practices

Carling PC et al. Clin Infect Dis 2006;42:385

Carling PC et al. Infect Control Hosp Epidemiol 2008;29:1

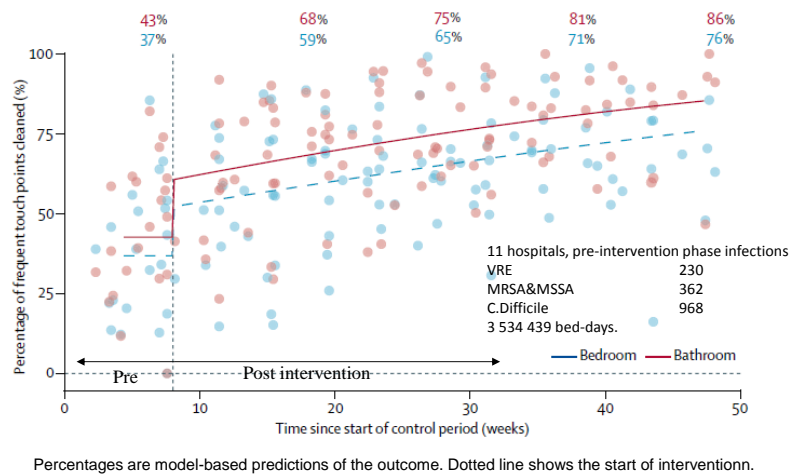
Effect of sequential environmental cleaning and disinfection interventions



Effect of sequential environmental cleaning and disinfection interventions on thoroughness of cleaning (determined on the basis of fluorescent marker removal) and on disinfection of *Clostridium difficile* infection (CDI) rooms (determined on the basis of environmental cultures for *C. difficile*). Intervention 1 (January 1, 2011, through February 28, 2012; 14 months) involved education in combination with monitoring of fluorescent marker removal from high-touch surfaces with feedback to housekeepers; intervention 2 (March 1, 2012, through June 30, 2012; 4 months) included addition of an automated ultraviolet radiation device for disinfection of CDI rooms; intervention 3 (July 1, 2012, through September 30, 2012; 3 months) included enhanced standard cleaning through formation of a 3-person dedicated daily disinfection team for high-touch surfaces in CDI rooms and implementation of a process requiring that terminally cleaned CDI rooms be "cleared" for the next patient by environmental services supervisors and/or infection control staff. Each intervention was divided into 3 time periods, which are indicated by separate bars.

Sitzlar B. Infect Control Hosp Epidemiol 2013;34(5):459-65.

Percentage of frequent touch points cleaned in patient bathrooms and bedrooms, by UV light spots



Mitchell BG et al. Lancet Infect Dis. 2019 Mar 8.

Predictors of MRSA and VRE Acquisition by patients previously occupied by MRSA or VRE

Design: retrospective cohort study, 10 ICUs, 750-bed teaching hospital
 Intervention: targeted feedback using a black-light marker, cleaning cloths saturated with disinfectant via bucket immersion, and increased education

Acquisition of MRSA and VRE was lowered from 3.0% to 1.5% for MRSA and from 3.0% to 2.2% for VRE ($P < .001$ for both).

Patients in rooms previously occupied by MRSA carriers had an increased risk of acquisition during the baseline (3.9% vs 2.9%, $P = .03$) but not the intervention (1.5% vs 1.5%, $P = .79$) period.

In contrast, patients in rooms previously occupied by VRE carriers had an increased risk of acquisition during the baseline (4.5% vs 2.8%, $P = .001$) and intervention (3.5% vs 2.0%, $P < .001$) periods.

R. Datta et al. Arch Intern Med 2011;171(6):491-94

Chart showing the increased risk associated with the prior room occupant.

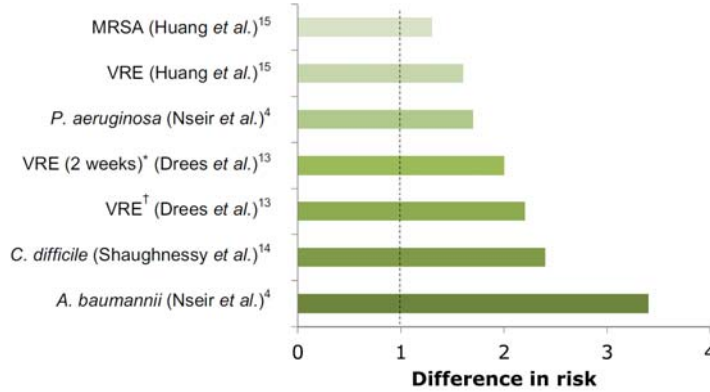


Chart showing the increased risk associated with the prior room occupant. The figures of difference in risk are unadjusted based on raw data. Several of the studies included adjusted measures of risk, but these were not included because of differences in study design. * Any patient infected or colonized with VRE in the two weeks prior to admission. † The immediate prior room occupant was known to be infected or colonized with VRE.

Otter JA Am J Infect Control 2013;41:S6-11.

Time from first positive bacterial culture from any source to documented transfer of clonally identical bacteria between patients and room surfaces.

Infection Control & Hospital Epidemiology

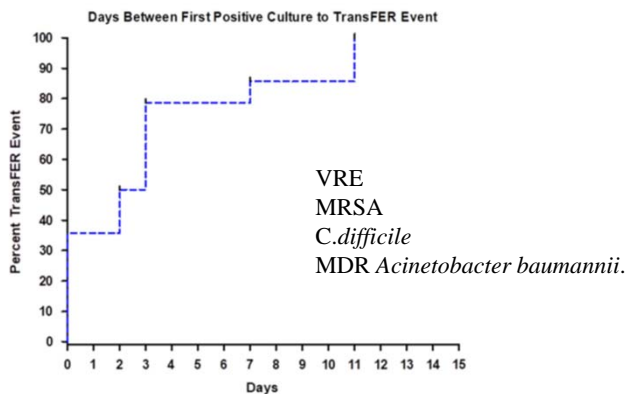


Fig. 2. Time-to-event analysis showing time from first positive bacterial culture from any source to documented transfer of clonally identical bacteria between patients and room surfaces.

Chen LF. *Infect Control Hosp Epidemiol.* 2019 Jan;40(1):47-52. doi: 10.1017/ice.2018.275

«No Touch Disinfection Systems»

Hydrogen Peroxid Vapor (HPV)



Ca CHF 30'000
Teurer Unterhalt
Gerät am USB zu verkaufen

Hydrogen Peroxide Vapor (HPV)

- Cleaning of room (25min average)
- Ventilation ducts must be taped, doors closed
- HPV injected into empty room
- Catalytic converter converts hydrogen peroxide into water vapor
- No toxic residues
- Turn-around time for a hospital room = ~ 2 hr 20 min
- Highly effective against Mtb, bacterial spores, fungi, viruses
- Has been shown to reduce acquisition of *C. difficile* and vancomycin-resistant enterococci

USB: 4-12h

French GL et al. J Hosp Infect 2004;57:31
Boyce JM et al. Infect Control Hosp Epidemiol 2008;29:723
Otter JA et al. Infect Control Hosp Epidemiol 2009;30:574
Passaretti CL. Clin Infect Dis 2013;56(1):27 – 35

Efficacy of hydrogen peroxide systems for decontamination of the hospital environment, by health care-associated pathogen

Lead author, year	HP system	Pathogen	Sites revealing contamination before HPV
French, 2004 ³⁵	HPV	MRSA	61/85-72%
Bates, 2005 ⁴³	HPV	<i>Serratia</i>	2/42-5%
Jeanes, 2005 ⁴⁴	HPV	MRSA	10/28-36%
Otter, 2007 ⁴⁶	HPV	MRSA	18/30-60%
Dryden, 2008 ⁴⁵	HPV	MRSA	8/29-28%
Boyce, 2008 ³⁹	HPV	<i>C difficile</i>	11/43-26%
Bartels, 2008 ⁴⁷	HP dry mist	MRSA	4/14-29%
Shapey, 2008 ⁴⁸	HP dry mist	<i>C difficile</i>	48/203-24%
Barbut, 2009 ⁴⁹	HP dry mist	<i>C difficile</i>	34/180-19%
Otter, 2010 ⁵⁰	HPV	GNR	10/21-48%

HPV, Hydrogen peroxide vapor.
NOTE. Modified from Falagas et al.³⁶

Lead author, year	HP system	Pathogen	Sites revealing contamination after HPV	% Reduction
French, 2004 ³⁵	HPV	MRSA	1/85-1%	98
Bates, 2005 ⁴³	HPV	<i>Serratia</i>	0/24-0%	100
Jeanes, 2005 ⁴⁴	HPV	MRSA	0/50-0%	100
Otter, 2007 ⁴⁶	HPV	MRSA	1/30-3%	95
Dryden, 2008 ⁴⁵	HPV	MRSA	1/29-3%	88
Boyce, 2008 ³⁹	HPV	<i>C difficile</i>	0/37-0%	100
Bartels, 2008 ⁴⁷	HP dry mist	MRSA	0/14-0%	100
Shapey, 2008 ⁴⁸	HP dry mist	<i>C difficile</i>	7/203-3%	88
Barbut, 2009 ⁴⁹	HP dry mist	<i>C difficile</i>	4/180-2%	88
Otter, 2010 ⁵⁰	HPV	GNR	0/63-0%	100

HPV, Hydrogen peroxide vapor.
NOTE. Modified from Falagas et al.³⁶

Rutala WA Am J Infect Control 2013;41:S36-S41.

Saving Costs through the Decontamination of the Packaging of Unused Medical Supplies Using Hydrogen Peroxide Vapor

Johns Hopkins Hospital, Baltimore

Medical supply items from 20 patient rooms colonized with MDRO

- 7/100 (7%) items contaminated with VRE (pilot study)
- 9/100 (9%) of 100 items contaminated with MDROs (follow-up study)
- 0/2000 contaminated after exposure to HPV
- Annual cost of supplies discarded: \$387,055. Cost for HPV?

TABLE 2. Microbiological Assessment of 5 Standardized Supply Items from the Rooms of 20 Patients under Precautions for a Multidrug-Resistant Organism (MDRO)

Variable	MRSA	VRE	MDR-GNR ^a	Any MDRO ^b	Other microbes
No. positive/no. sampled	3/100	3/100	4/100	9/100 ^c	98/100 ^d
Items contaminated	Large dressing, small dressing, specimen cup	Large dressing, small dressing, syringe	Syringe (2 items), large dressing, specimen cup

TABLE 3. Projected Cost Savings Associated with Hydrogen Peroxide Vapor Disinfection of Packaged Supplies

Variable	Neurosurgical ICU	Surgical ICU	Transplant unit ^a	Oncology ICU	Medical ICU	Cardiothoracic ICU	Total
No. of supply items per room	712	302	200	567	747	739	3,267
Room supplies costs per room	363.55	119.67	96.01	255.69	407.44	274.04	1,516.39
No. of patients under precautions discharged	165	189	556	259	379	150	1,698
Policy for discard of supply stock, %	100	100	80	100	100	100	...
Annual cost of discarded supplies, \$	59,985.75	22,618.39	42,703.02	66,223.06	154,419.38	41,105.55	387,055.15

Otter JA. Infect Control Hosp Epidemiol 2013;34(5):472-478

Comparison of H₂O₂ Devices

	Bioquell HPV	AHP
Solution	35% H ₂ O ₂ delivered as a vapour.	5% H ₂ O ₂ delivered by an aerosol.
Application	Heat generated vapour.	Pressure or ultrasound generated aerosol.
Efficacy	6-log reduction and elimination of pathogens. Inactivates catalase-positive bacteria.	Does not reliably achieve a 6-log reduction; reduction in contamination but not elimination of pathogens. Problems with catalase-positive bacteria (including MRSA, <i>Acinetobacter</i> and CPE).
Distribution	Homogeneous distribution.	Incomplete distribution.
Cycle time	<2 hrs for a single room (active aeration).	>2 hrs for a single room (passive aeration).
Safety	Need to seal doors and air vents.	Need to seal doors and air vents.
Repeatability and reliability	Very little variability between cycles; cycle failures rare.	Variability between cycles; cycle failures reported frequently.
Regulatory position	Rapid review panel (RRP) 1; EPA registered sterilant.	Rapid review panel (RRP) 3; EPA registration uncertain.
Evidence base	Several published studies showing reduced acquisition.	Microbiological impact only; no published controlled studies demonstrating a reduction in acquisition.

H₂O₂ 35%

- Absolut sicher, falls mechanisch vorher gereinigt (B 4 Labor Sicherheit, Bioterror, Ebola etc)
- Sehr aufwändig
- Neutralisation Zeitaufwändig, bis 24h ohne Katalysator
- 2 schwere Nebenwirkungen beim personal
 - NFS, Lufu
- Kein Support mehr in CH

Automated Ultraviolet Light Systems

- Cultures obtained from surfaces inoculated with *C. difficile*, MRSA, VRE or *S. warneri* were obtained before/after UVC light decontamination
- Median of 2 log reduction of *C. difficile* spores inoculated on stainless steel disk carriers
- Surface contamination by MRSA, VRE and *C. difficile* in patient rooms has been reduced significantly

Nerandzic M et al. BMC Infect Dis 2010;10:197
Rutala WA et al. ICHE 2010;31:1025
Boyce JM et al. ICHE 2011;32:737
Rutala WA et al. ICHE 2013;34:527
Anderson DJ et al. ICHE 2013;34:466

Rapid Hospital Room Decontamination Using Ultraviolet (UV) Light with a Nanostructured UV-Reflective Wall Coating

William A. Rutala, PhD, MPH;^{1,2}
Maria F. Gergen, MT(ASCP);¹ Brian M. Tande, PhD;³
David J. Weber, MD, MPH^{1,2}

We tested the ability of an ultraviolet C (UV-C)-reflective wall coating to reduce the time necessary to decontaminate a room using a UV-C-emitting device (Tru-D SmartUVC). The reflective wall coating provided the following time reductions for decontamination: for methicillin-resistant *Staphylococcus aureus*, from 25 minutes 13 seconds to 5 minutes 3 seconds ($P < .05$), and for *Clostridium difficile* spores, from 43 minutes 42 seconds to 9 minutes 24 seconds ($P < .05$).

Infect Control Hosp Epidemiol 2013;34(5):527-529

Summary of Antimicrobial Effectiveness of UVC

Clinical Effectiveness	References
71% reduction in UTI rates and 100% in skin infection rates, 54% drop in hospital readmissions from nursing home	Kovach, BMC Infect Dis. 2017 Mar 3;17(1):186.)
46% reduction in Class I SSIs, \$478,055 saved	Am J Infect Control. 2016 Jun 1;44(6):e99-e101
87% reduction in ICU VRE infection rates, combined VRE+MRSA+C. diff infection rates reduced 29% facility wide and 61% in ICU, 390 bed days generated, \$730,000 saved	Vianna P, Am J Infect Control. 2016 Mar 1;44(3):299-303
Signifi reductions in burn unit ORs and patient room contamination, longest duration with no cases of hospital acquired C. diff infections in burn ICU in 2 years	Green, Burns. 2017 Mar;43(2):388-396. doi: 10.1016/j.burns.2016.08.027
100% reduction in total joint SSIs and \$290,990 saved in 12 months	Formwalt L. Am J Infect Control. 2016 Feb;44(2):239-41. doi: 10.1016/
57% reduction in C. diff infection rates in an LTAC	Miller R. Am J Infect Control. 2015 Dec 1;43(12):1350-3. doi: 10.1016/j.ajic.2015.07.029
70% reduction in ICU C. diff infection rates	Nagaraja, Am J Infect Control. 2015 Sep 1;43(9):940-5. doi: 10.1016/j.ajic.2015.05.003
20% reduction in C. diff + MDRO infection rates, 22% of discharge rooms treated	Haas JP, Am J Infect Control. 2014 Jun;42(6):586-90. doi: 10.1016/j.ajic.2013.12.01
57% reduction in MRSA infection rates after 18 months	JIP/June 2013 (Simmons, Moses Cone Health)
53% reduction in C. diff infection rates after 12 months	AJIC/May 2013 (Levin, Cooley Dickinson Hospital)

Unresolved Issues with Standard Cleaning/Disinfection Products

Adapted from, Otter JA. [J Hosp Infect.](#) 2013 Jan;83(1):1-13.

- Limited spectrum of disinfectant, particular spores such as *C. difficile*, Norovirus, Bioterror agents (*B.anthraxis*)
- Damage to hospital materials and equipment
- Toxicity to staff or the environment
- Susceptibility to interference with organic matter on surfaces
- Potential for biocide/antibiotic cross-resistance from residual disinfectant

Killing of *Candida auris* by UV-C: importance of exposure time and distance



Summary

Background *Candida auris* is a globally emerging yeast, causing severe infections in patients with underlying diseases. This yeast is responsible for several outbreaks within healthcare facilities, where it can be found on hospital surfaces and patient care devices. Spread from these fomites may be prevented by improving the decontamination of hospital surfaces. UV-C decontamination may constitute an effective adjunct to routine room cleaning.

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.

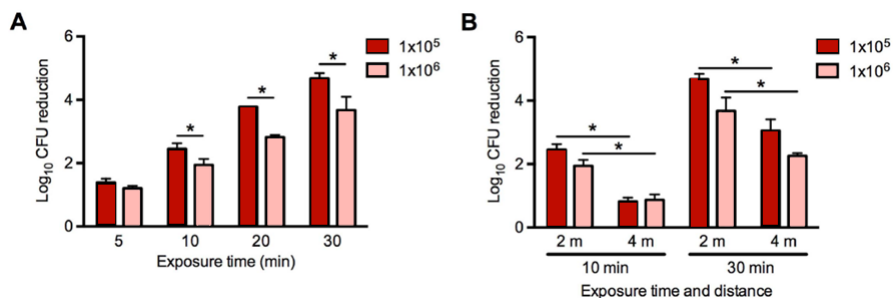
Methods *C. auris* was seeded on glass slides and exposed to UV-C for 5, 10, 20 and 30 minutes at 2 and 4 meters.

Results A maximal effect of *C. auris* killing was found after 30 min of UV-C exposure at 2 meters. With half the time or twice the distance the efficacy strongly diminished to ~10 and ~50 fold, respectively. At suboptimal exposure-times and distances the *C. auris* strains from Japan/Korea were more sensitive to UV-C killing than *C. auris* strains originating from Venezuela, Spain and India.

Conclusions Altogether, UV-C exposure-times and distance are the most critical parameters to kill *C. auris*, while strain variations of *C. auris* also determine UV-C efficacy. Future studies should aim to determine the effect and place of UV-C on surface decontamination in hospital setting.

Groot T et al. *Mycoses*. 2019 Feb 12. doi: 10.1111/myc.12903. [Epub ahead of print]

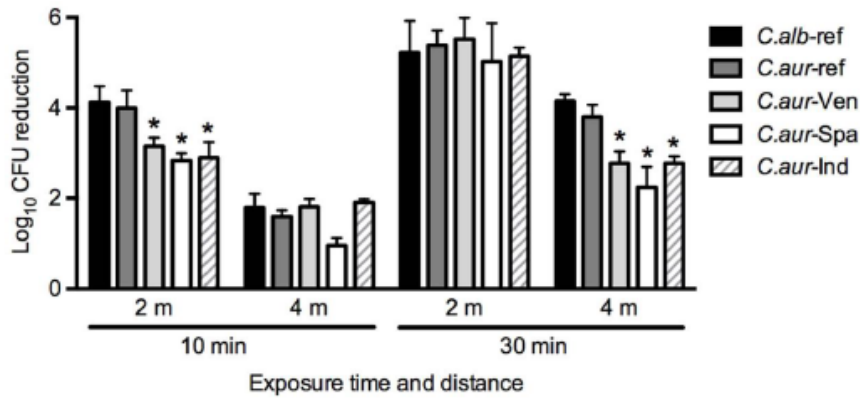
The effect of UV-C exposure time and distance on killing *C. auris*



C. auris isolate was seeded on multitest slide glasses at a density of 1x10⁵ or 1x10⁶ CFU per well. Subsequently, glasses were exposed for 5, 10, 20 or 30 minutes to UV-C at a distance of 2 meters (A) or for 10 and 30 minutes at 2 and 4 meters (B). Significant differences (p<0.05) are indicated with an asterisk.

de Groot T et al. *Mycoses*. 2019 Feb 12. doi: 10.1111/myc.12903. [Epub ahead of print]

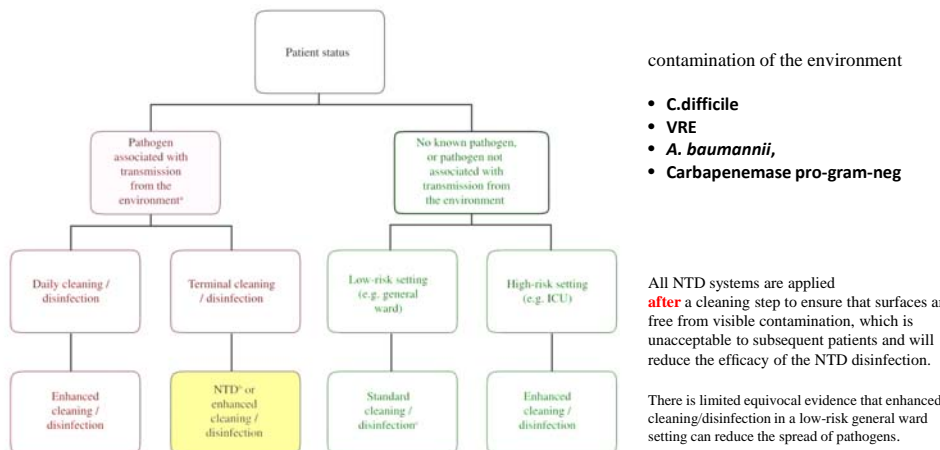
UV-C efficacy in killing *C. auris* strains from different countries



C. albicans and *C. auris* isolates from different countries were seeded on multitest slide glasses at a density of 1x10⁵ CFU per well. Glasses were exposed for 10 or 30 minutes to UV-C at a distance of 2 or 4 meters. Significant differences (p < 0.05) as compared to *C. auris* reference strains are indicated with an asterisk. Ref, reference; Ven, Venezuela; Spa, Spain; Ind, India.

de Groot T et al. *Mycoses*. 2019 Feb 12. doi: 10.1111/myc.12903.

Proposed algorithm for environmental disinfection



Otter JA. *J Hosp Infect*. 2013 Jan;83(1):1-13.

Zusammenfassung

- Reinigung / Desinfektion ohne Intervention in ca 60% ungenügend
- Sowohl H₂O₂ als auch UVc sind nur wirksam **NACH Reinigung**
- Sie ergänzen die Schlussdesinfektion bei MDRO
 - Meine Liste nach Widmer
 - VRE
 - XDR *Acinetobacter baumannii*
 - *Klebsiella pneumoniae* carbapenemase (KPC)
 - G-Neg mit Metallobetalaktamasen
- H₂O₂ sinnvoll bei Fahrzeugen, wenig genutzten Räumen
- Geräte «nur» mikrobiologisch getestet