

Will New Surface Disinfection Technologies Reduce Healthcare-Associated Infections?



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Disclosure: PDI

#APIC2021

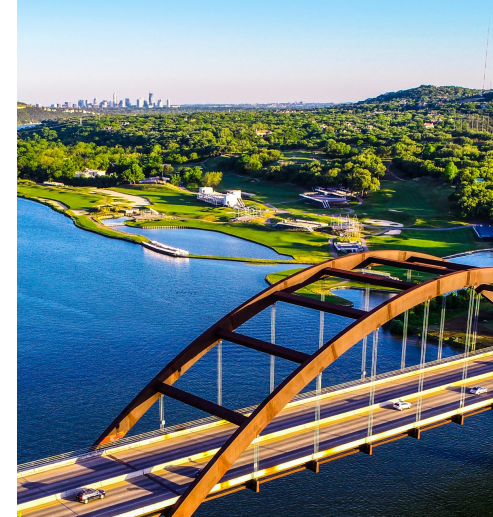
June 29, 2021



Environmental Contamination Leads to HAIs

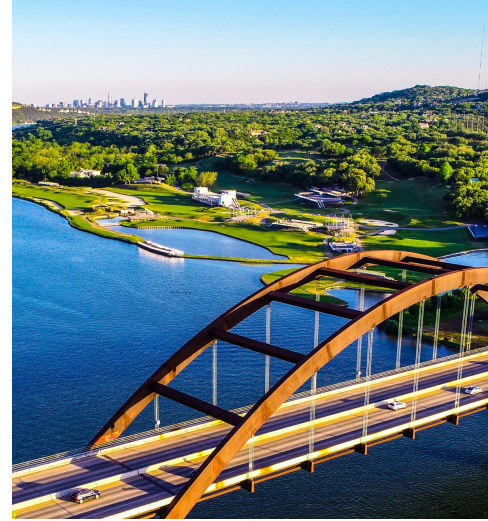
Weber, Kanamori, Rutala. Curr Op Infect Dis .2016.29:424-431

- Evidence environment contributes
- Epidemiologically important pathogens (EIP)-MRSA, VRE, *C. difficile*
- Surfaces are contaminated-~25%
- EIP survive days, weeks, months
- Contact with surfaces results in hand contamination
- Disinfection reduces contamination
- Disinfection (daily) reduces HAIs
- Rooms not adequately cleaned/disinfected



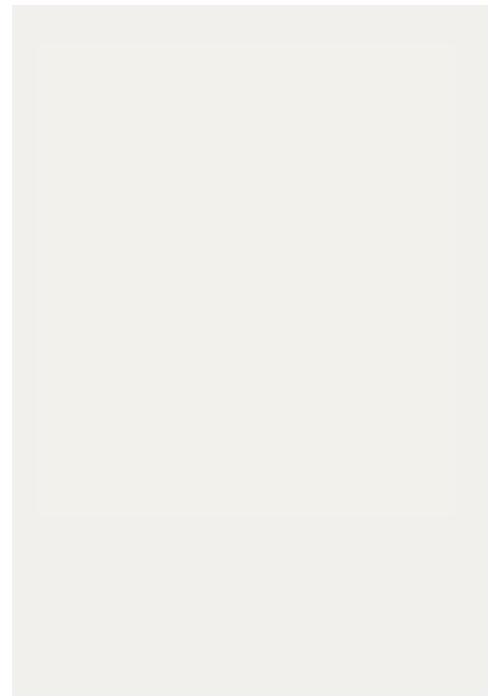
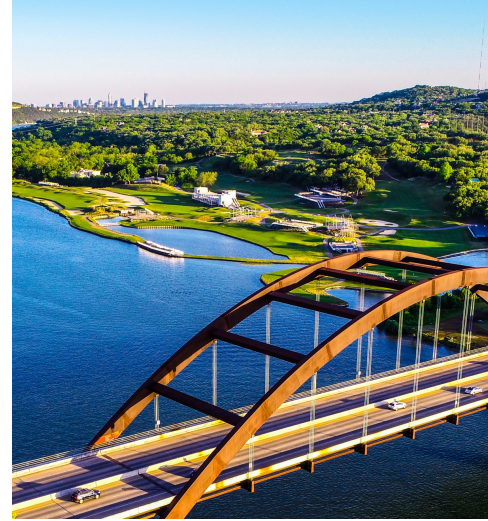
Exposure to Contaminated Room Increased Infection Risk

- Admission to a room previously occupied by a patient colonized/infected with an epidemiologically important pathogen increases the risk of acquiring the previous patient's pathogen by 39%-353%
- For example, increased risk for *C. difficile* is 235% (11.0% vs 4.6%) Shaughnessy et al ICHE 2011;32:201



Environmental Contamination Leads to HAIs

- By contaminating hands/gloves via contact with the environment and transfer to patient or patient self inoculation
- Surface should be hygienically clean (not sterile)-free of pathogens in sufficient numbers to prevent human disease
- **Two environmental surface concerns**
 - Discharge/terminal-new patient in room
 - Daily room decontamination (referred to “trash and dash”) and recontamination

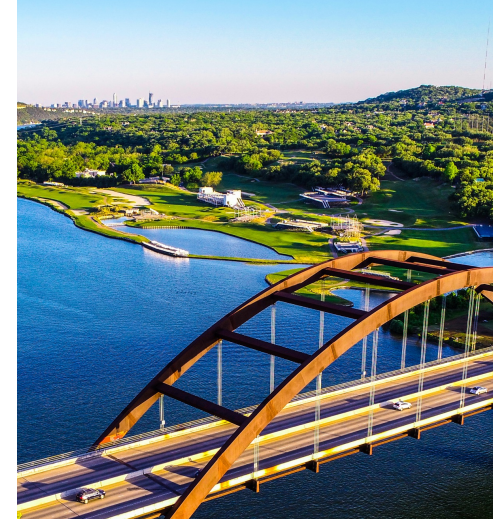


Enhanced Disinfection Leads to Reduction in Microbial Burden and HAIs

Rutala et al. ICHE 2018;38:1118

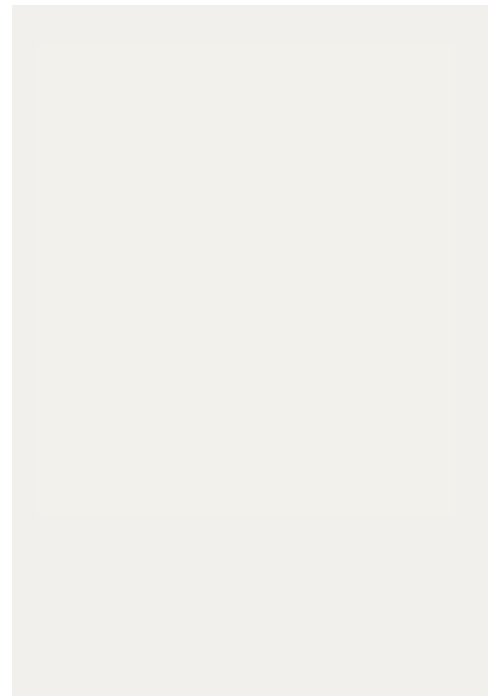
Table 2. Relationship between microbial reduction of epidemiologically-important pathogens (EIP) and colonization/infection in a patient subsequently admitted to a room of a patient colonized/infected with an EIP by decontamination method.

	Standard Method	Enhanced method		
	Quat	Quat/UV	Bleach	Bleach/UV
EIP (mean CFU per room) ^a	60.8	3.4	11.7	6.3
Reduction (%)		94	81	90
Colonization/Infection (rate) ^a	2.3	1.5	1.9	2.2
Reduction (%)		35	17	4



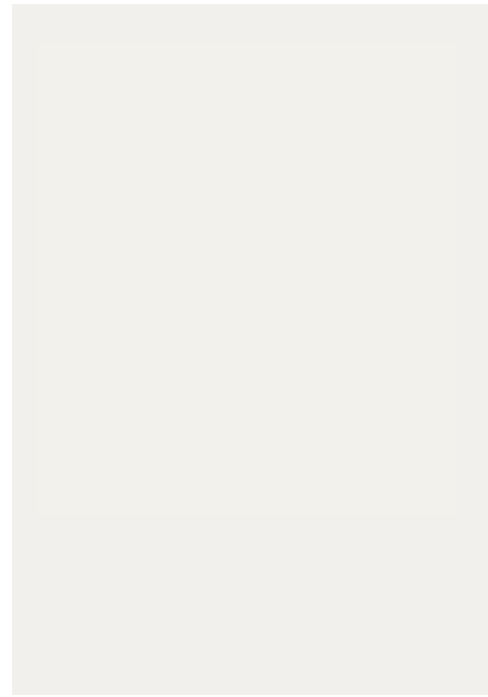
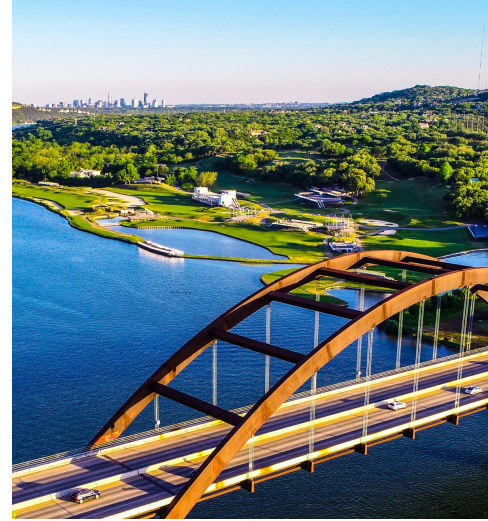
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Continuous Room Decontamination Technologies

- Visible light disinfection through LEDs
- Dry/dilute hydrogen peroxide
- Self-disinfecting surfaces (e.g., copper)
- Far UV 222 nm
- Bipolar ionization
- Multijet cold air plasma
- **Continuously active disinfectant (CAD) or persistent disinfectant that provides continuous disinfection action**
 - Allows continued disinfection and may eliminate the problem of recontamination
 - Patients, staff and visitors can remain in the room

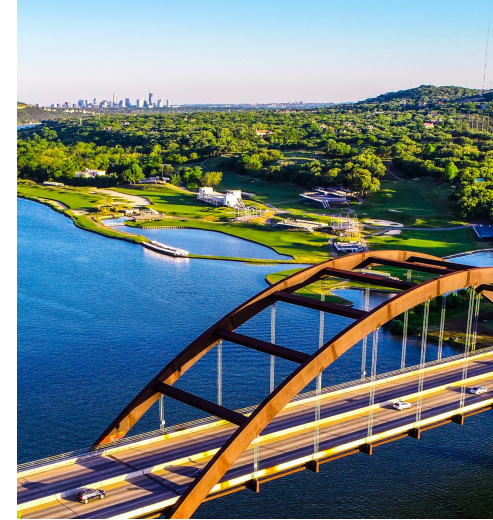


Efficacy of Continuously Active Disinfectant

Rutala et al. 2019;40:1284; Redmond et al. ICHE 2021, <https://doi.org/10.1017/ice.2021.66>

- 4-5 log₁₀ reduction in 5min over 24hr for most pathogens; ~99% reduction with *Klebsiella* and CRE *Enterobacter*. Redmond et al. found 5 log₁₀ reduction for CRE *Enterobacter*, *K. pneumoniae*, MRSA, VRE, and *C. auris*.

Test Pathogen	Mean Log ₁₀ Reduction , 95% CI n=4
<i>S.aureus</i> *	4.4 (3.9, 5.0)
<i>S.aureus</i> (formica)	4.1 (3.8, 4.4)
<i>S.aureus</i> (stainless steel)	5.5 (5.2, 5.9)
VRE	≥4.5
<i>E.coli</i>	4.8 (4.6, 5.0)
<i>Enterobacter</i> sp.	4.1 (3.5, 4.6)
<i>Candida auris</i>	≥5.0
<i>K pneumoniae</i>	1.5 (1.4, 1.6)
CRE <i>E.coli</i>	3.0 (2.6, 3.4)
CRE <i>Enterobacter</i>	2.0 (1.6, 2.4)
CRE <i>K pneumoniae</i>	2.1 (1.8, 2.4)

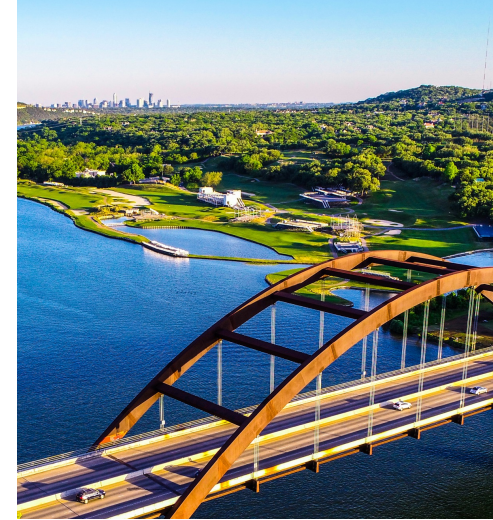


Efficacy of a CAD Against Human Coronavirus

Rutala et al. Unpublished 2021

- A novel disinfectant studied using an EPA protocol (wears/re-inoculations) demonstrated excellent continuous antiviral activity (i.e., $>4.5\text{-log}_{10}$ reduction) in 1 minute after 48 hours for a human coronavirus, 229E

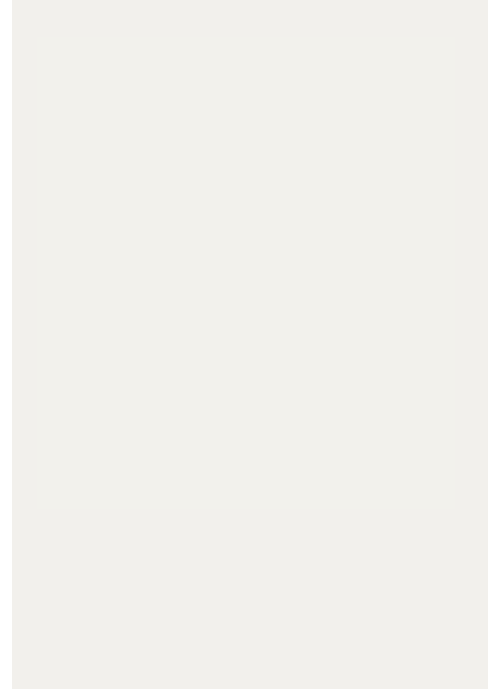
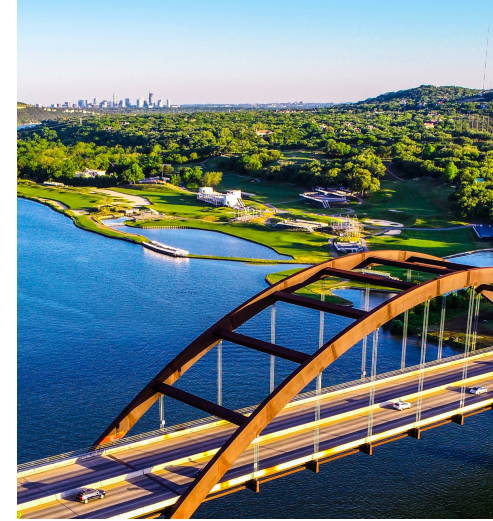
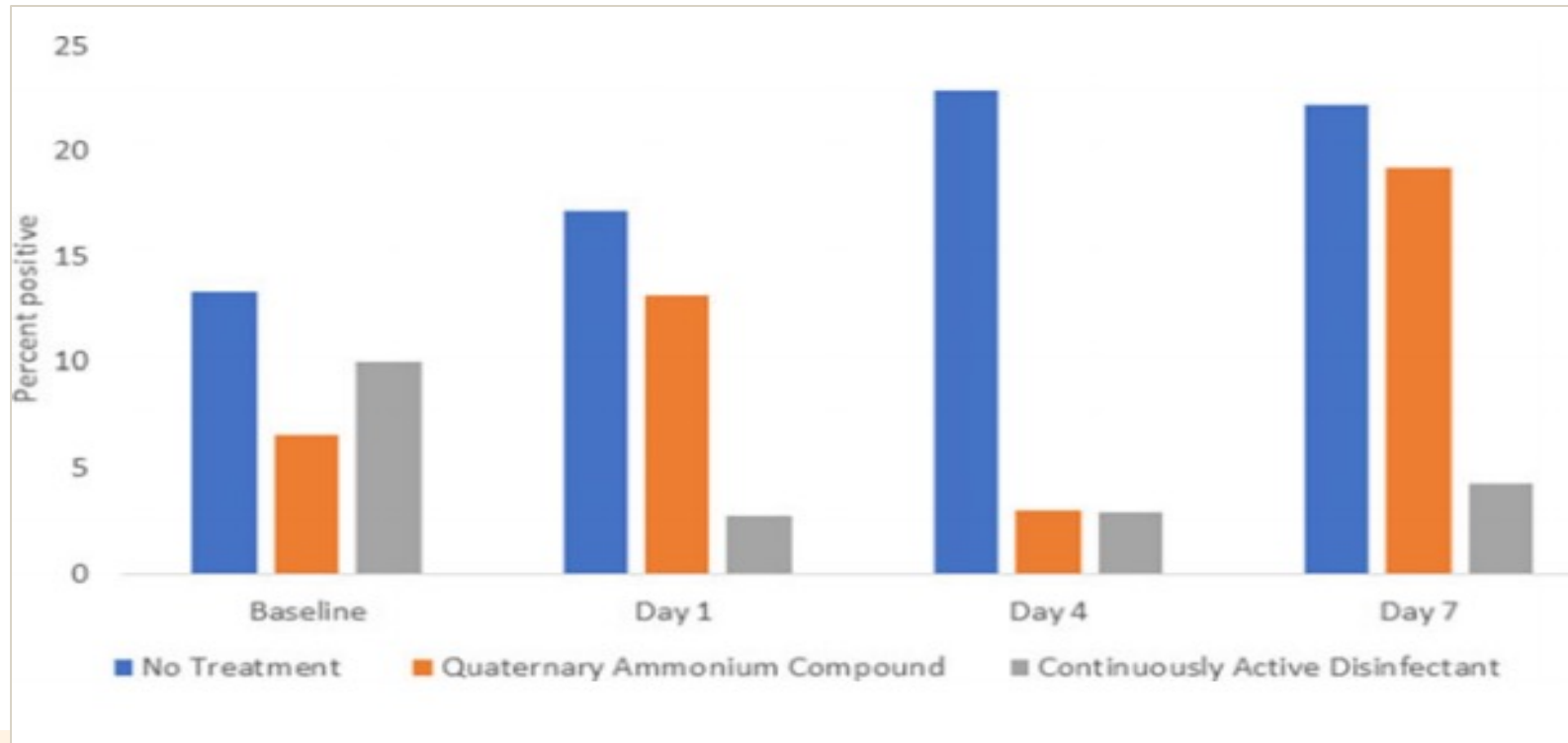
Carrier Treatment with Wears and Re-inoculations	Contact Time	Mean Viral Recovery Titer per Carrier (\log_{10})	\log_{10} Reduction
Control (sterile water, n=3)	1 minute	6.00 ± 0.25	N.A.
Test disinfectant (n=3)	1 minute	$\leq 1.50 \pm 0.00$	>4.50



Efficacy of CAD for Portable Medical Equipment

Redmond et al. ICHE 2021, <https://doi.org/10.1017/ice.2021.66>

- Comparison of *S. aureus* and enterococci recovered from PME at baseline, 1, 4, 7 days
- The percentage of sites positive for *S. aureus* and/or enterococci was significantly reduced on days 1-7 in the continuously active group (3 of 93, 3%) versus both the no treatment group (20 of 97, 21%) and the Quat group (11 of 97, 11%)



QUESTIONS?



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