Sustained Antimicrobial Activity of a Novel Disinfectant Against Healthcare Pathogens

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Disclosure: PDI

Environmental Contamination Leads to HAIs

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

- Evidence environment contributes
- EPI-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

Admission to Room Previously Occupied by Patient C/I with Epidemiologically Important Pathogen

- Results in the newly admitted patient having an increased risk of acquiring that previous patient's pathogen by 39-353%
- For example, increased risk for *C. difficile* is 235% (11.0% vs 4.6%)
- Exposure to contaminated rooms confers a 5-6 fold increase in odds of infection, hospitals must adopt proven methods for reducing environmental contamination (Cohen et al. ICHE. 2018;39:541-546)

Acquisition of EIP on Hands of Healthcare Providers after Contact with Contaminated Environmental Sites and Transfer to Other Patients

Acquisition of EIP on Hands of Patient after Contact with Contaminated Environmental Sites and Transfers EIP to Eyes/Nose/Mouth

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

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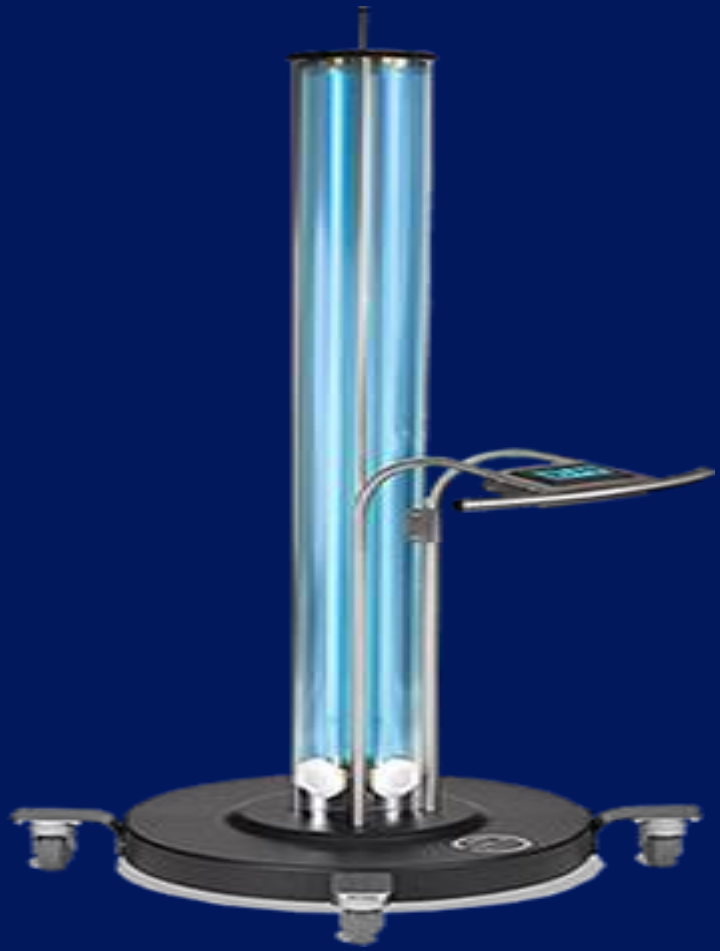
“No Touch” Approaches To Room Decontamination

(UV/VHP~20 microbicidal studies, 12 HAI reduction studies; will not discuss technology with limited data)

Weber, Kanamori, Rutala. Curr Op Infect Dis 2016;29:424-431; Weber, Rutala et al. AJIC; 2016:44: e77-e84; Anderson et al. Lancet 2017;389:805-14; Anderson et al. Lancet Infect Dis 2018;June 2018.



Enhanced Disinfection Leading to Reduction of Microbial Contamination and a Decrease in Patient Col/Infection

Anderson et al. Lancet 2017;289:805; Rutala et al. ICHE 2018;38:1118-1121

	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

Comparing the best strategy with the worst strategy (i.e., Quat vs Quat/UV) revealed that a reduction of 94% in EIP (60.8 vs 3.4) led to a 35% decrease in colonization/infection (2.3% vs 1.5%). Our data demonstrated that a decrease in room contamination was associated with a decrease in patient colonization/infection.

Environmental Contamination Leads to HAIs

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  - Discharge/terminal-new patient in room
  - Daily room decontamination (referred to “trash and dash”)

Evidence That All Touchable Room Surfaces Are Equally Contaminated

Huslage K, Rutala W, Gergen M, Sickbert-Bennett E, Weber D. ICHE 2013;34:211-2

TABLE 1. Precleaning and Postcleaning Bacterial Load Measurements for High-, Medium-, and Low-Touch Surfaces

Surface (no. of samples)	Mean CFUs/RODAC (95% CI)	
	Precleaning	Postcleaning
High (n = 40)	71.9 (46.5–97.3)	9.6 (3.8–15.4)
Medium (n = 42)	44.2 (28.1–60.2)	9.3 (1.2–17.5)
Low (n = 37)	56.7 (34.2–79.2)	5.7 (2.01–9.4)

NOTE. CFU, colony-forming unit; CI, confidence interval.

Relationship Between Microbial Burden and HAIs

Rutala WA et al. ICHE 2018;38:1118-1121; Salgado CD, et al. ICHE 2013;34:479-86

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
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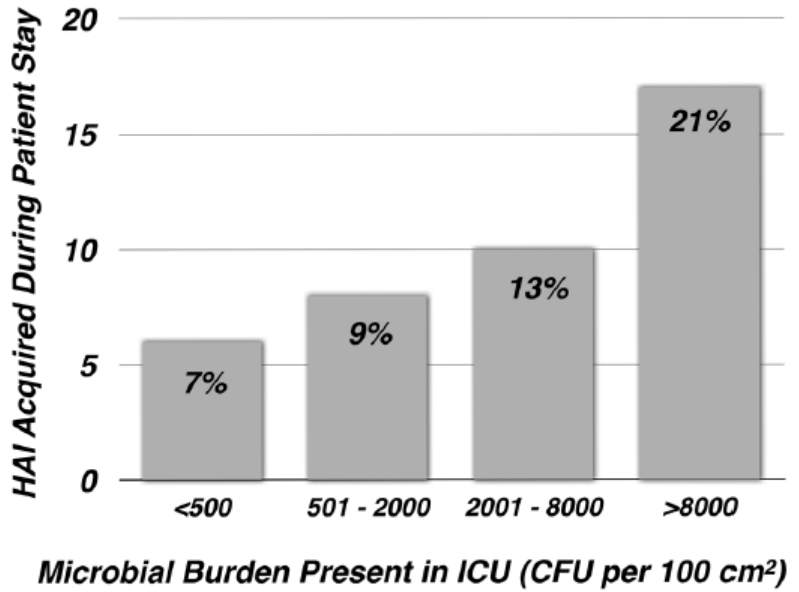


FIGURE 2. Quartile distribution of healthcare-acquired infections (HAIs) stratified by microbial burden measured in the intensive care unit (ICU) room during the patient's stay. There was a significant association between burden and HAI risk ($P = .038$), with 89% of HAIs occurring among patients cared for in a room with a burden of more than 500 colony-forming units (CFUs)/100 cm².

To reduce microbial contamination

Continuous Room Decontamination Technology

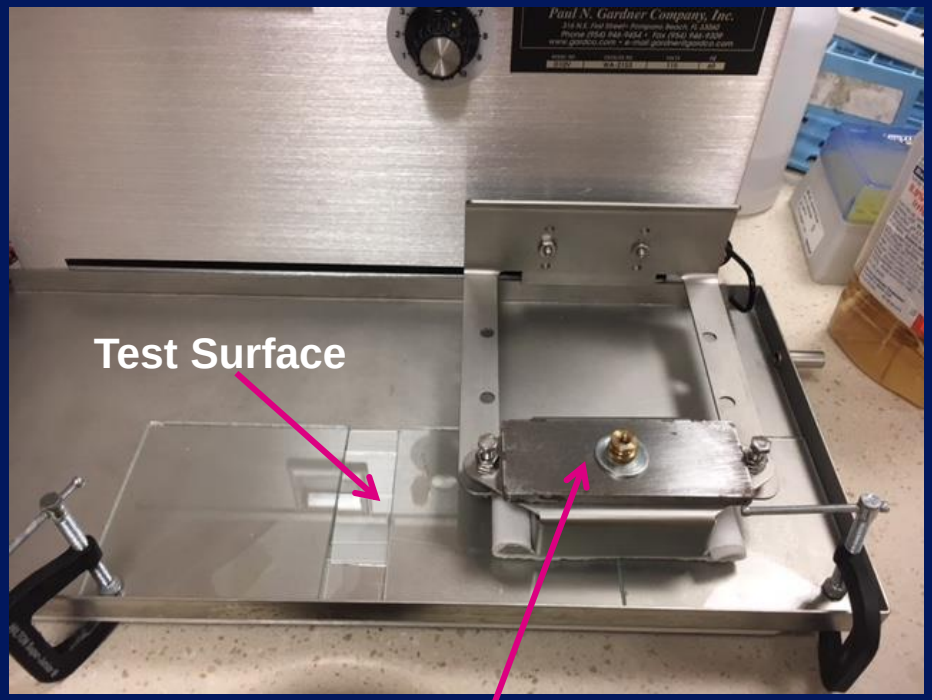
Continuous Room Decontamination Technologies for Disinfection of the Healthcare Environment

- Visible light disinfection through LEDs
- Low concentration hydrogen peroxide
- Self-disinfecting surfaces
- Persistent (or continuously active) disinfectant that provides continuous disinfection action

Evaluation of a Persistent Surface Disinfectant

"EPA Protocol for Residual Self-Sanitizing Activity of Dried Chemical Residuals on Hard, Non-Porous Surfaces"

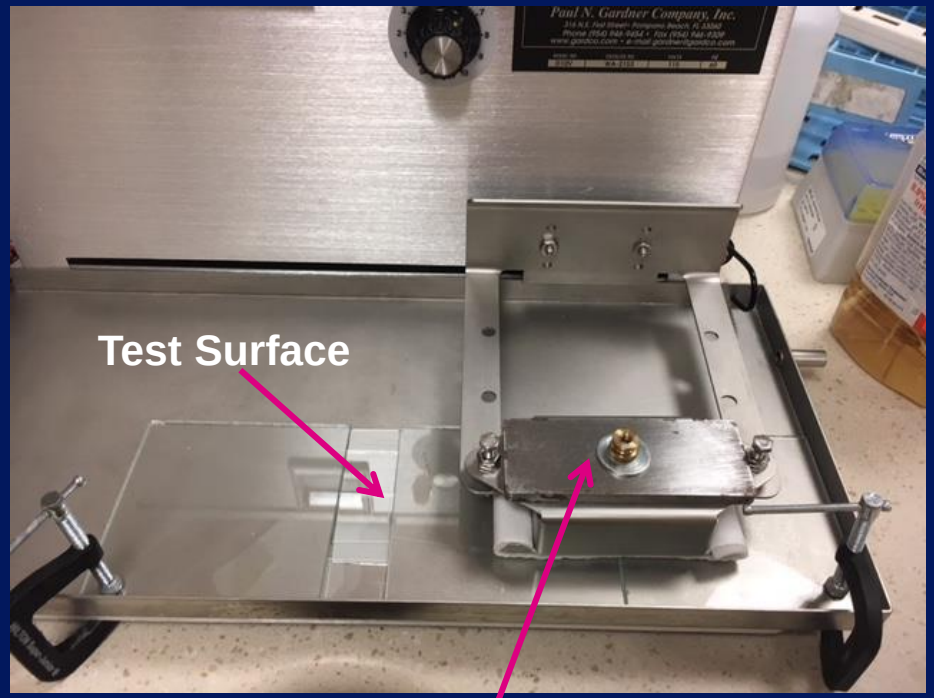
Abrasion Tester



Evaluation of a Persistent Surface Disinfectant

"EPA Protocol for Residual Self-Sanitizing Activity of Dried Chemical Residuals on Hard, Non-Porous Surfaces"

- Test surface inoculated (10^5), treated with test disinfectant, allowed to dry.
- Surface will undergo "wears" (abraded under alternating wet and dry conditions [24 passes, 12 cycles]) and 6 re-inoculations (10^3, 30min dry) over 24hr
- At the end of the study and at least 24 hours later, the ability of the test surface to kill microbes (99.9%) within 5 min is measured using the last inoculation (10^6)



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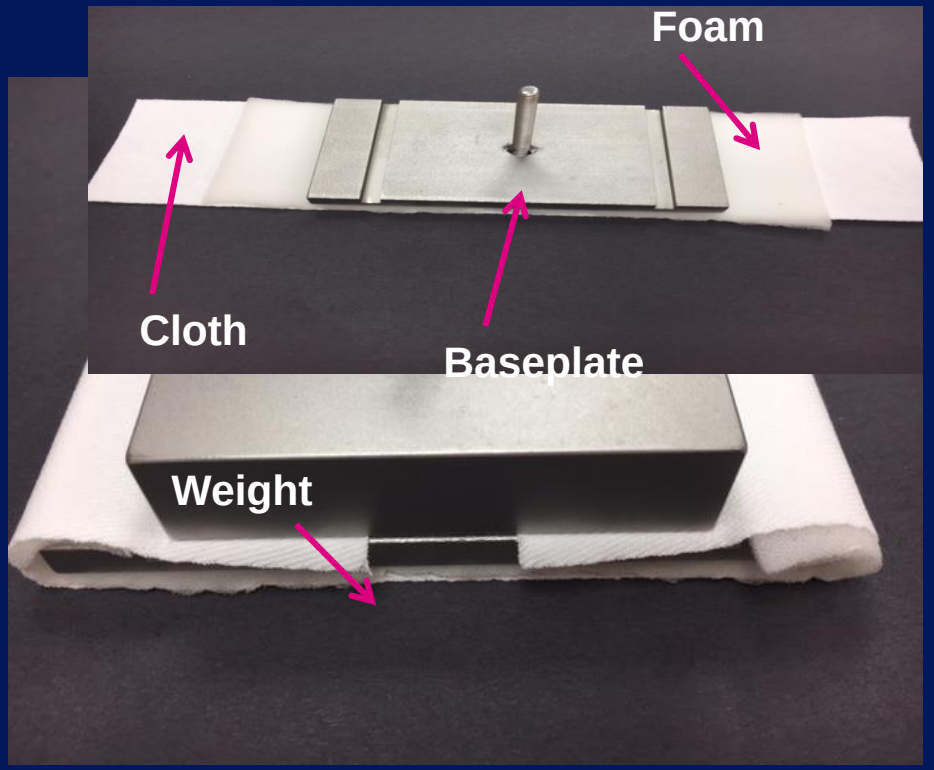

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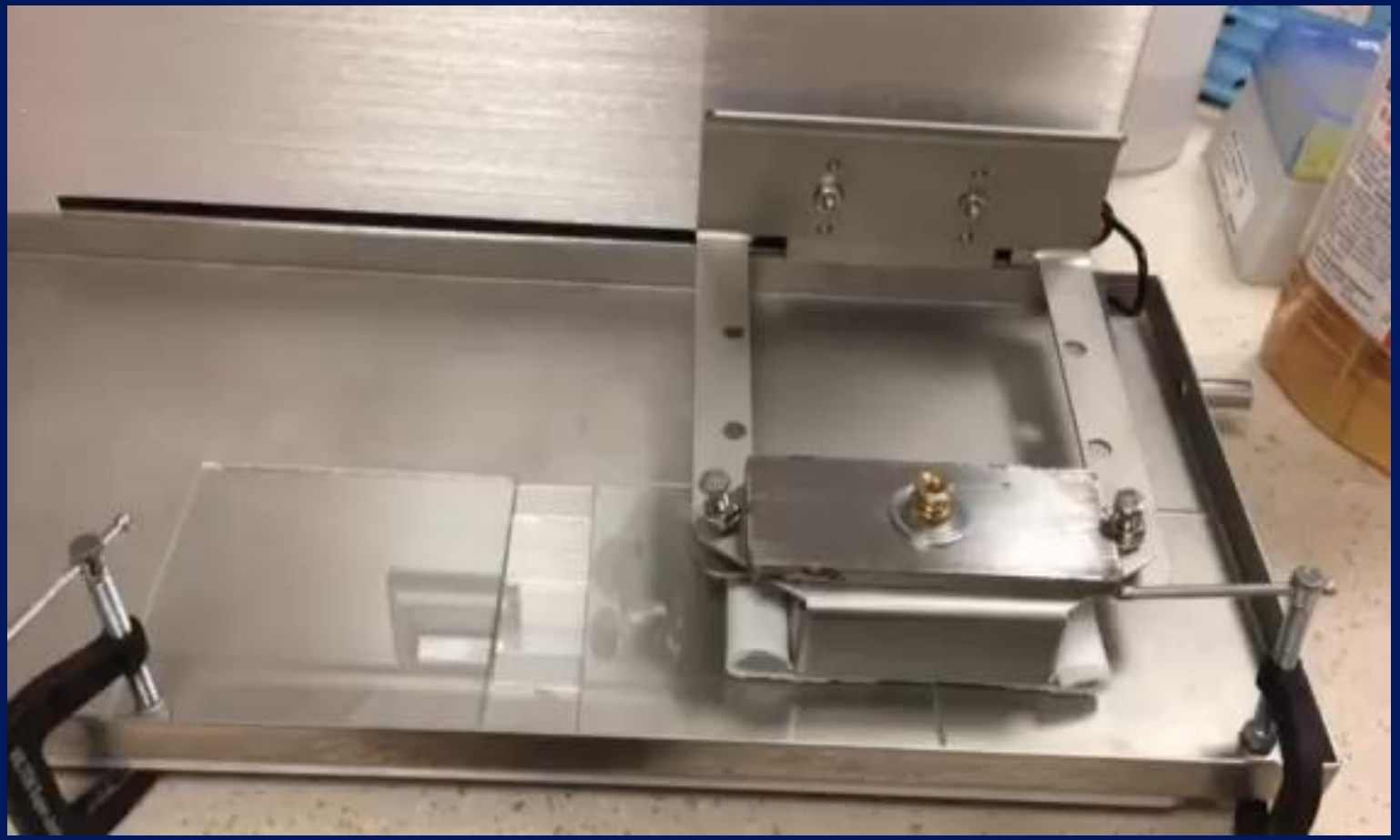

Efficacy of a Persistent Surface Disinfectant

Rutala WA, Gergen M, Sickbert-Bennett E, Anderson D, Weber D. ID Week 2018

4-5 $\log_{10}$ reduction in 5min over 24hr for most pathogens; ~99% reduction with *Klebsiella* and CRE *Enterobacter*.

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

*Test surface glass unless otherwise specified

Evaluation of a Persistent Surface Disinfectant

When the novel disinfectant was compared to three other commonly used disinfectants using the same methodology with *S. aureus*, the mean $\log_{10}$ reductions were: 4.4 (novel disinfectant); 0.9 (quat-alcohol); 0.2 (improved hydrogen peroxide); and 0.1 (chlorine).

Efficacy of a Persistent (Continuously Active) Surface Disinfectant

Summary

- Preliminary studies with a new continuously active disinfectant are promising (e.g., 4-5 $\log_{10}$ reduction in 5min over 24hr)
- Unclear why 99% reduction with *Klebsiella* and CRE *Enterobacter*; most surfaces have <100 CFU/Rodac
- Continuously active disinfectants may reduce or eliminate the problem of recontamination.

THANK YOU!

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