

Reduced Healthcare Associated Infections in an Acute Care Community Hospital using a Combination of Self-Disinfecting Copper-Impregnated Composite Hard Surfaces and Linens

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Table 1. Demographic and Patient Characteristics

Characteristic	Admissions				
	Baseline Period	New Wing	P value*	Old Wing	P value*
Age, y					
median	59.5	58.5		60.5	
(IQR)	(37.0-82.0)	(36.5-80.5)		(38.5-82.5)	
[min, max]	[15, 106]	[15, 113]		[17, 107]	
Gender					
female	8,845 (63.5)	2,806 (59.6)	<0.001	2,949 (56.1)	<0.001
Race/Ethnicity					
White	8182 (58.7)	3059 (65.0)	<0.001	2947 (56.1)	<0.001
Black	4,199 (30.2)	1,295 (27.5)	0.001	2037 (38.8)	<0.001
Asian	337 (2.4)	86 (1.8)	0.019	94 (1.8)	0.009
Hispanic/Latino	230 (1.6)	67 (1.4)	0.282	68 (1.3)	0.074
Other/Unknown	980 (7.0)	197 (4.2)	<0.001	111 (2.1)	<0.001
Comorbidities					
CHF	435 (3.1)	76 (1.6)	0.001	420 (8.0)	<0.001
Cirrhosis	60 (0.4)	12 (0.3)	0.093	41 (0.8)	0.003
COPD	310 (2.2)	27 (0.6)	<0.001	130 (2.5)	0.308
DM	192 (1.4)	42 (0.9)	0.010	85 (1.6)	0.217
ESRD	373 (2.7)	59 (1.2)	<0.001	264 (5.0)	<0.001
HIV/AIDS	19 (0.1)	6 (0.1)	0.886	22 (0.4)	<0.001
Prior Admissions					
Prior 1-30 days	541 (3.9)	187 (4.0)	0.781	348 (6.6)	<0.001
Prior 31-180 days	1,781 (12.8)	647 (13.8)	0.089	1016 (19.3)	<0.001
Prior CDI**	36 (2.58)	16 (3.40)	0.359	29 (5.52)	0.002
Prior MDRO**					
MRSA	31 (2.22)	15 (3.19)	0.250	19 (3.61)	0.093
VRE	5 (0.36)	2 (0.43)	0.840	2 (0.38)	0.945
MDRA	4 (0.29)	1 (0.21)	0.787	4 (0.76)	0.711
Admission Service					
Medicine service	6376 (66.1)	1722 (37.0)	<0.001	5134 (93.1)	<0.001
Surgery service	2928 (33.9)	2927 (63.0)	<0.001	383 (6.9)	<0.001
Admission Characteristics					
Mean LOS	4.49	4.65		4.66	
Need for ICU care	5209 (37.4)	2651 (56.4)	<0.001	2192 (41.7)	<0.001
Mortality	388 (2.8)	195 (4.1)	<0.001	94 (1.8)	<0.001

NOTE. Data are presented as n(%) of admissions, unless otherwise noted

*Compared to baseline period

**Within last 30 days

#Number (cases/1,000 admissions)

BACKGROUND

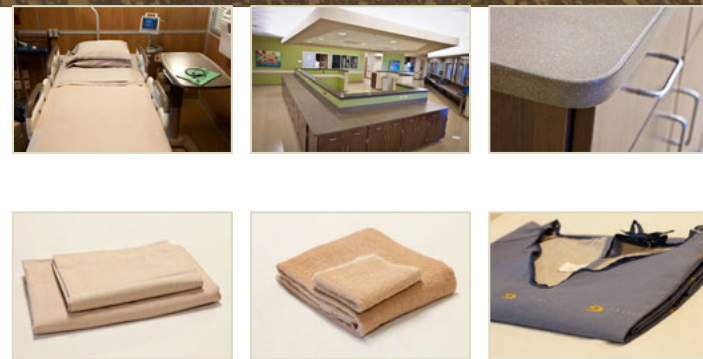
- Healthcare associated infections (HAIs) depend on both host factors and exposure to nosocomial pathogens
- Environmental contamination can serve as a reservoir for nosocomial pathogens
- Multiple pathways may lead to transmission to patients
 - hands of healthcare workers
 - patient care equipment
 - direct contact
- Reduced environmental bioburden is associated with reduced transmission of microbial pathogens and development of HAI
- Copper oxide has potent biocidal activity
- Hypothesis: Large-scale, broad deployment of copper oxide-impregnated composite hospital surfaces and linens can reduce HAIs**

METHODS

- Study site: Sentara Leigh Hospital, Norfolk VA
 - 14,000 admissions/year
 - Specialty services: orthopedics, gynecology, urology, comprehensive breast care
- Quasi-experimental study (with control group) following replacement of a 1970s-era clinical wing with a new hospital wing outfitted with copper-impregnated* products
 - *16% copper (I) oxide (weight/weight) impregnated hard/molded products and woven linens
 - Hard Products: patient rooms sinks and vanities, patient room desks, bed rails, tray tables, nurse
 - Linens: bed linens, bath linens, patient gowns
 - Manufacturers: Cupron Enhanced EOS Solid Surfaces, Cupron Inc., Richmond, VA; EOS Surfaces LLC, Norfolk, VA
- Acute care rooms (no ICU, OB, newborn, neonatal beds)
 - Low HAI Rates, stable IPC program and interventions
- Demographic and clinical data extracted from the EMR
- HAI surveillance:
 - MDRO infection: MRSA, VRE, ESBL, CRE, MDR *Acinetobacter*
 - C. difficile* infection
 - Device-associated infections: CLABSI, CAUTI
- Statistical analysis: Pearson χ^2 , $P < .05$ considered significant

RESULTS

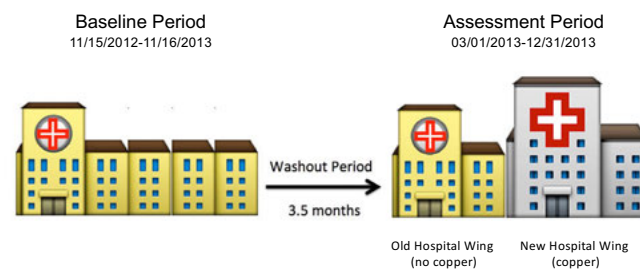
Copper Composite Hard Surfaces†



† Cupron Enhanced EOS Solid Surface (Cupron Inc, Richmond, VA, www.cupron.com; and EOS Surfaces, Norfolk, VA, www.eoscu.com)

‡ Cupron Medical Textiles (Cupron Inc, Richmond, VA, www.cupron.com)

Study Design



	Assessment Period	
	Old Wing	New Wing
Acute Care Beds	84	72
Hospitalizations (n)	5,257	4,704
Patient-Care Days	19,177	14,479
Hand Hygiene	87%	88%

Figure 1. Incidence Rates of CDI and MDRO Infections

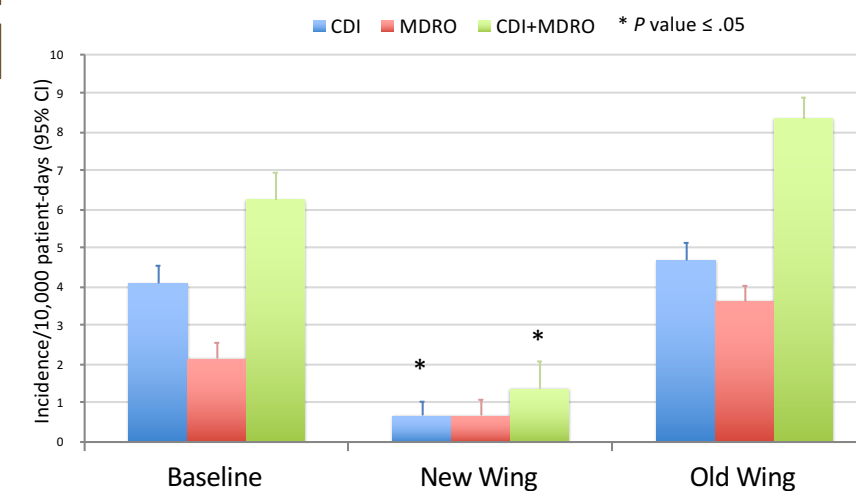


Table 2. Incidence Rates of CDI and MDRO Infections

HAI Category	Assessment Period				
	Baseline Period	New Hospital Wing, Copper		Old Hospital Wing, Non-Copper	
	Incidence Rate [95% CI] (Events)	Incidence Rate [95% CI] (Events)	P value	Incidence Rate [95% CI] (Events)	P value
<i>C. difficile</i>	4.10 [4.05-4.14] (19)	0.69 [0.65-0.73] (1)	0.048	4.69 [4.62-4.76] (9)	0.736
MDROs					
- MRSA	- (3)	- (0)		- (2)	
- VRE	- (5)	- (1)		- (3)	
- ESBL	- (1)	- (0)		- (1)	
- MDR - ACBA	- (0)	- (0)		- (0)	
- CRE	- (1)	- (0)		- (1)	
Total	2.16 [2.12-2.19] (10)	0.69 [0.65-0.73] (1)	0.252	3.65 [3.58-3.72] (7)	0.28
Total <i>C. difficile</i> + MDROs	6.25 [6.21-6.30] (29)	1.38 [1.32-1.44] (2)	0.023	8.34 [8.29-8.40] (16)	0.352

Incidence rates are expressed per 10,000 patient-days. **Bold blue** text indicated P values $\leq .05$

CONCLUSIONS

- This study is the largest clinical trial of copper or copper-containing antimicrobial surfaces reported to date
 - 67,000 patient-care days, including nearly 14,500 patient-care days in 72 copper-furnished acute care hospital beds.
 - Only study to use a combination of antimicrobial hard surfaces and linens
- The new hospital wing (copper hard surfaces and textiles) had 78% ($P=.023$) fewer HAIs due to MDROs or *C. difficile*, 83% ($P=.048$) fewer cases of *C. difficile* infection, and 68% ($P=.252$) fewer infections due to MDROs relative to the baseline period.
- No changes in rates of HAI were observed in the unmodified hospital wing.
- The incidence rates of CLABSI and CAUTI were not different during the assessment period for either the new wing or the old wing compared with the baseline period (data not shown).
- Reduction in CDI was a surprising finding but may be explained by Cu killing of vegetative *C. difficile* and/or modest biocidal activity of products against *C. difficile* endospores (1.6 log₁₀ reduction x 24 hr)
- Limitations include: retrospective study, lack of randomization, lack of blinding, potential recall bias, confounding patient variables, confounding environmental variables, regression to mean

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