



Antimicrobial Copper

Continuously Active Antimicrobial Copper Surfaces

DiMiMED - International Conference on Disaster and
Military Medicine

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Antimicrobial
Copper





Q: why copper?

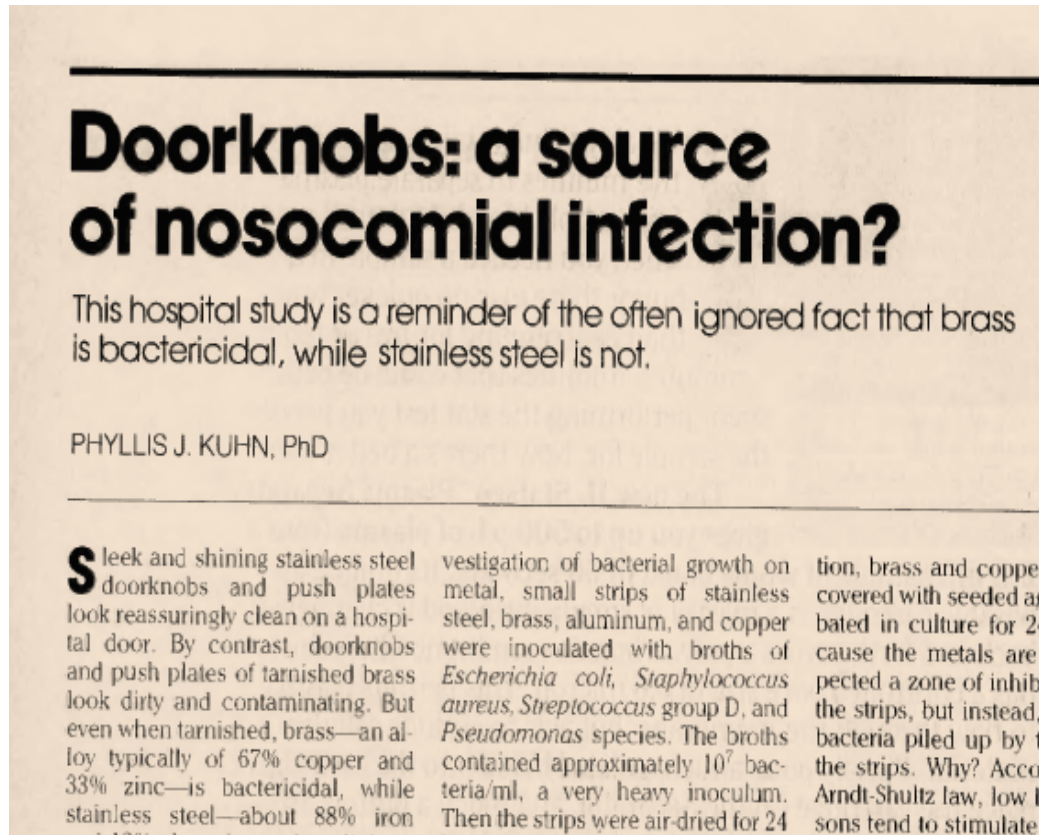
A: copper kills microbes

....including high threat pathogens
and biothreat agents

**A: copper has continuous and
persistent activity**

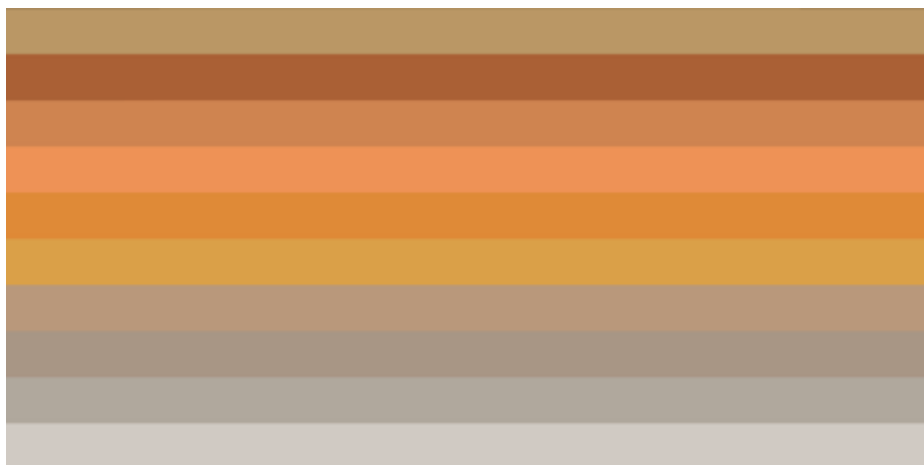


1983 – First formally reported clinical experiment





Antimicrobial Copper is...



- more than 500 metals and alloys
- permitted to claim benefits to human health by US regulator EPA
- guided by the copper industry to ensure compliance





Laboratory studies around the world have confirmed rapid and broad spectrum efficacy

Year	Highlight
1994	Legionella
2000	<i>E. coli</i>
2006	MRSA
2007	<i>C. difficile</i> (including spores)
2007	Influenza A (H1N1)
2008	USA EPA registration of >300 alloys against 6 bacteria
2009	Vancomycin-resistant <i>Enterococci</i>
2011	Rapid dry kill – VRE
2012	Prevention of horizontal gene transfer
2013	Norovirus (murine)
2014	Bacterial and viral biothreats
2015	Coronavirus (human) & Norovirus (human)
2016	Rapid dry kill - MRSA

Organisms tested:

Acinetobacter baumannii
Adenovirus
Candida albicans
Campylobacter jejuni
 Carbapenem-resistant Enterobacteriaceae
Clostridium difficile (including spores)
 Coronavirus (Human 229E)
Enterobacter aerogenes
Escherichia coli O157:H7
Helicobacter pylori
 Influenza A (H1N1)
Klebsiella pneumoniae
Legionella pneumophila
Listeria monocytogenes
Mycobacterium tuberculosis
 Norovirus or Norwalk-like virus
Penicillium chrysogenum
 Poliovirus
Pseudomonas aeruginosa
 Rhinovirus
 Rotavirus
Salmonella enterica
Staphylococcus aureus MRSA/EMRSA/MSSA)
Tubercle bacillus
 Vancomycin-resistant enterococcus (VRE)
Vibrio cholerae

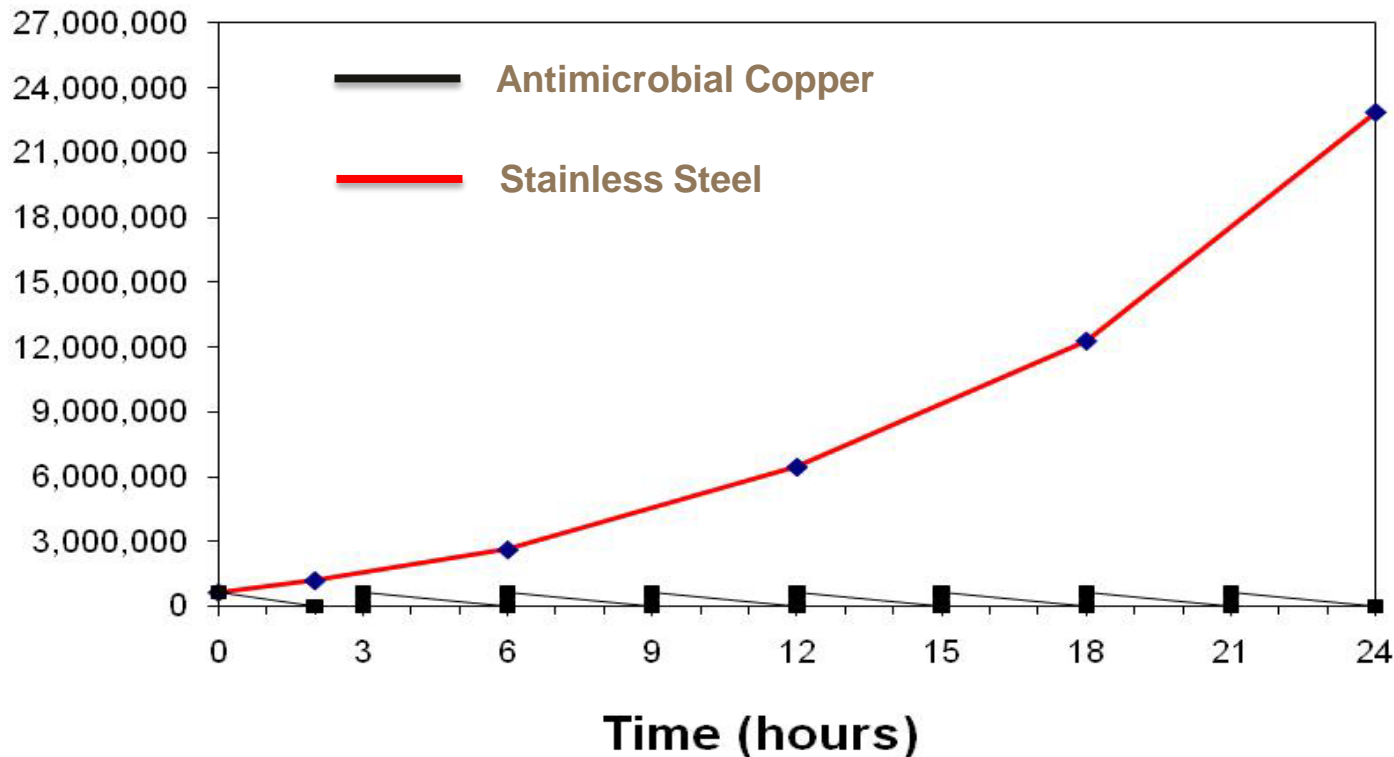
+ many more



EPA Testing - re-inoculation trials

>99% kill on copper after 8 exposures over 24 hours with no cleaning in between

MRSA colony forming units





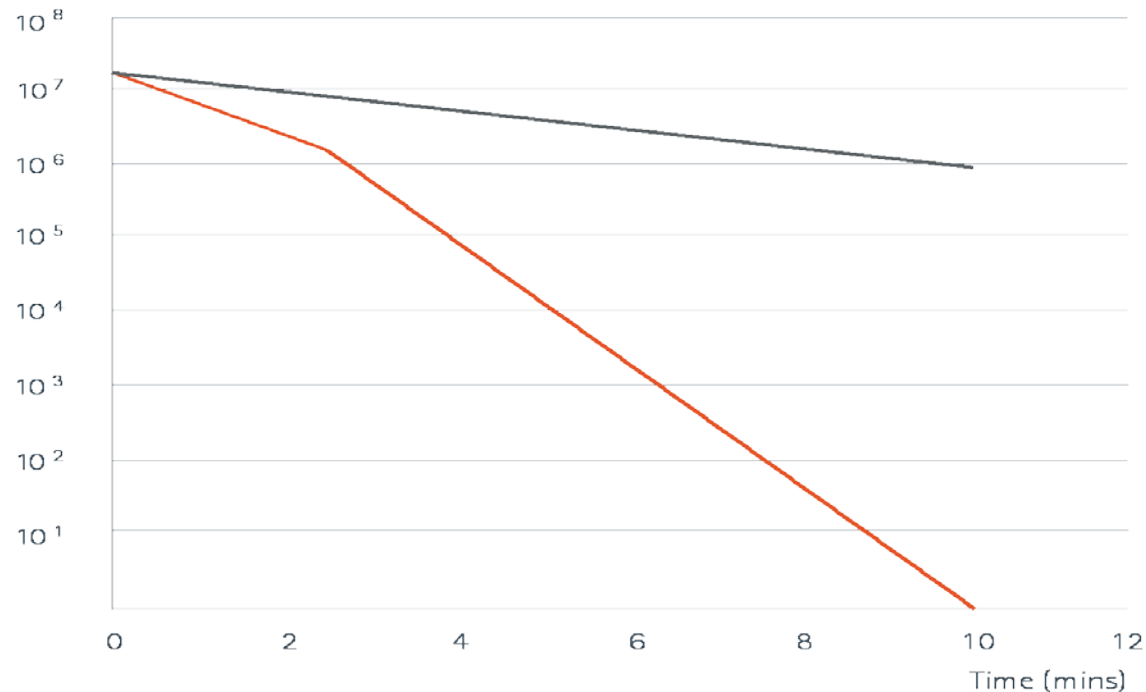
Dry contamination testing against bacteria have shown rapid kill times



Applied and Environmental
Microbiology

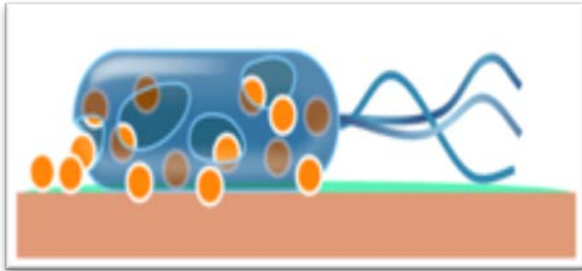
Copper Stainless steel

Colony forming units (CFU) per coupon

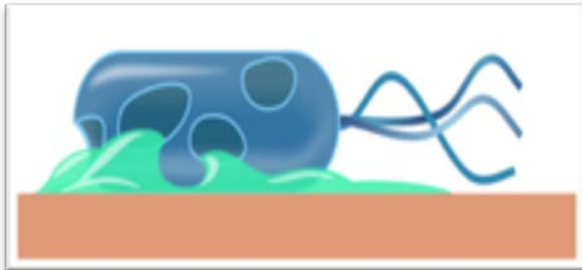


Over 200 studies have been published on copper and copper alloys

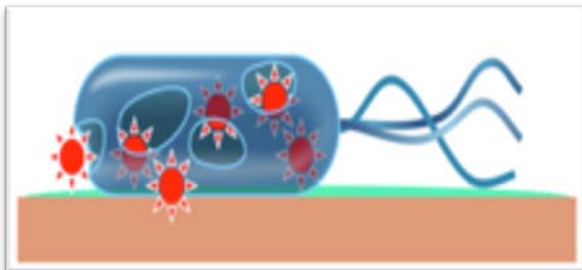
Copper's rapid 'contact kill' mechanism makes it unlikely bacteria will develop a resistance



1) Copper ions on the surface are recognized as an essential nutrient, and enter the cell



2) A lethal dose of copper ions interferes with normal cell functions and membrane integrity



3) Copper ions impede cell respiration/metabolism, sometimes causing DNA damage



Efficacy against biothreat pathogens or proxies

Recent work at *The Bundeswehr Institute of Microbiology* on biothreats, including *Burkholderia pseudomallei*, *Burkholderia mallei*, *Brucella melitensis*, *Yersinia pestis*, *Francisella tularensis*, and Orthopoxviruses (Vaccinia VACV and Monkeypox MPXV), confirms that:

- all were inactivated by at least 7 log units within 5 minutes
- MRSA and E. coli suffered irrecoverable membrane damage
- bacteria were killed, not just viable but non-culturable (VBNC)

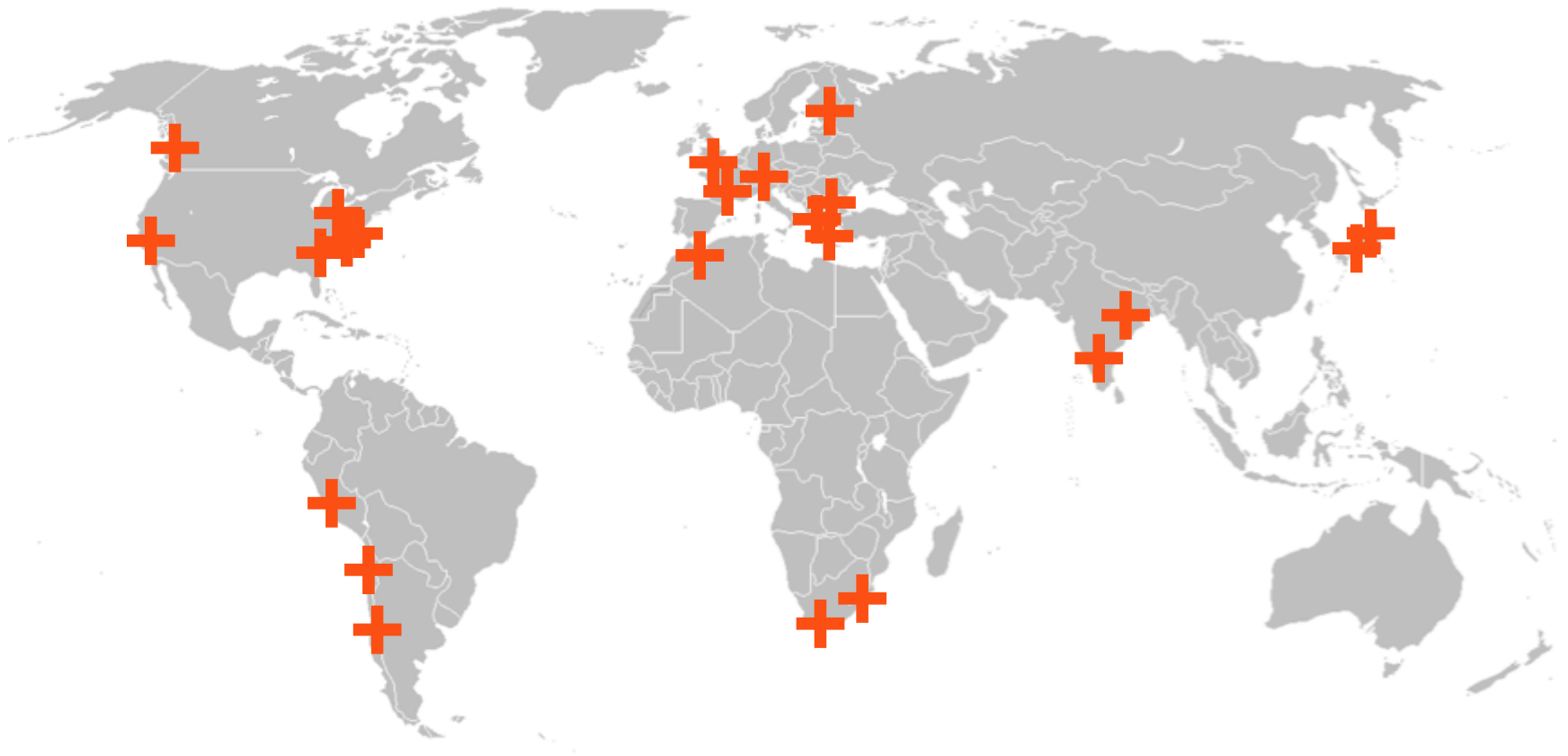




Clinical evidence



Independent clinical trials have been conducted at multiple locations around the world



US DoD funded 3 center, 3½ year trial



INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY MAY 2013, VOL. 34, NO. 5

ORIGINAL ARTICLE

Copper Surfaces Reduce the Rate of Healthcare-Acquired Infections in the Intensive Care Unit

Cassandra D. Salgado, MD;¹ Kent A. Sepkowitz, MD;² Joseph F. John, MD;³ J. Robert Cantey, MD;¹ Hubert H. Attaway, MS;⁴ Katherine D. Freeman, DrPH;⁵ Peter A. Sharpe, MBA;⁶ Harold T. Michels, PhD;⁷ Michael G. Schmidt, PhD⁴





Patients treated in ICU rooms with copper surfaces had significantly fewer HAIs:

Copper rooms: 10 HAIs in 294 patients

Control rooms: 26 HAIs in 320 patients

Normalized populations ⇒ 24 Infections in control rooms

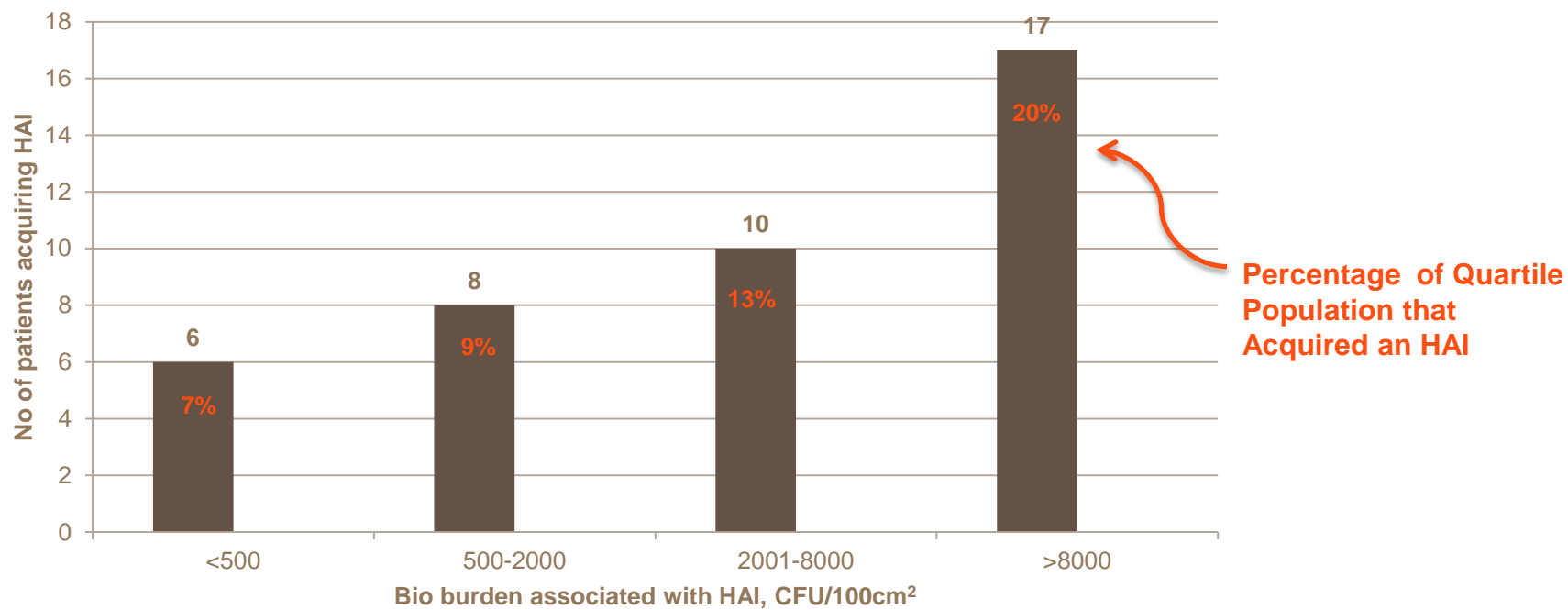
14 Infections prevented in copper rooms

or *58% reduction in HAI (N=614, p=0.013)*



Largest clinical study so far

- Of the 4,450,545 bacteria recovered during the trial, only 17%, rather than an expected 50%, were isolated from rooms with copper objects
- Acquisition of HCAs was linked to bioburden:



Fighting infections needs a systemic approach



- Antimicrobial Copper needs to be seen as a **supplement** to, not a substitute for, standard infection control practices.
- One must continue to follow all current practices, including those related to cleaning and disinfection of environmental surfaces.
- Antimicrobial Copper is compatible with hospital cleaning agents.
- Antimicrobial Copper alloy surfaces must not be waxed, painted, lacquered, varnished, or otherwise coated. The alloys oxidize to varying degrees, which does not impair their antimicrobial efficacy.

Latest paper shows copper's persistent effect

ARTICLE IN PRESS

American Journal of Infection Control ■■ (2016) ■■-■■



Contents lists available at [ScienceDirect](#)

American Journal of Infection Control

journal homepage: www.ajicjournal.org



Major Article

Copper alloy surfaces sustain terminal cleaning levels in a rural hospital

Shannon M. Hinsla-Leasure PhD ^{a,b,*}, Queenster Nartey BA ^a, Justin Vaverka BA ^a,
Michael G. Schmidt PhD ^a

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Cost / benefit analysis



Basic ROI calculation from US clinical trials

- **Low Cost Scenario (\$29K/HAI)**

- 14 infections prevented X \$29,000/Infection = **\$406,000 Savings**
- \$406,000 ÷ 338 days = **\$1,201/day**
- \$52,000 (cost of copper products) ÷ \$1,201/day
= **43.3 day payback period**

- **High Cost Scenario (\$43K/HAI)**

- 14 infections prevented X \$43,000/Infection = **\$602,000 Savings**
- \$602,000 ÷ 338 days = **\$1,781/day**
- \$52,000 (cost of copper products) ÷ \$1,781/day
= **29.2 day payback period**

*HAI cost projections based on AHRQ estimates

*Estimated \$52,000 to “copperize” 8 ICU Rooms (prototype pricing)



Example: 20-bed ICU, new build, UK

factor	reference	example
HAI rate in ICUs	25%	15%
reduction in HAIs	58%	20%
pay back time		< 3 months
no of bed days saved per year		216
cost per bed day saved per year		€189.90

Download the model for free at www.antimicrobialcopper.org



USAID Ebola Challenge Winner – highlighted application





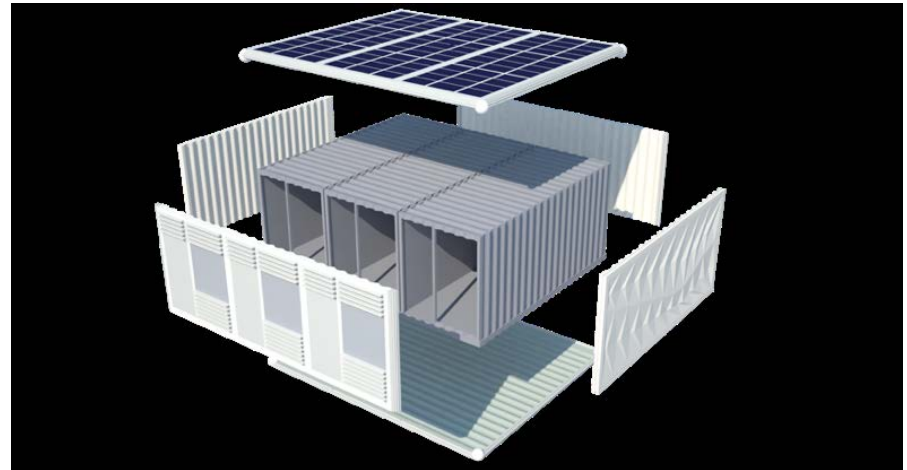
Highlighted application – award winning Ebola Emergency Treatment Unit





Zero net energy, autonomous and resilient 'off the grid' building

- Ultra-efficient building envelope
 - Snap-on R60+ thin super insulation envelope panels
 - One quarter the power for seven times the floor area
- Geothermal renewable energy
 - Surface groundsource heat exchange
 - Radiant heating and cooling
- 100% solar energy
 - Battery and genset failsafe
 - 'Off the grid' resilience
- Autonomous
 - The building is a microgrid
 - Low flow and natural ventilation
- Fast deployment
 - Snap together modules



Conclusions

5 Reasons to Consider Copper Alloys

1. **unique, continuous and persistent efficacy**
2. **verified in the lab and field**
3. **supplement to best practice**
(hand hygiene, cleaning and episodic disinfection)
4. **increase productivity and improve mission effectiveness**
5. **protect staff and improve patient outcomes**

Disclaimers

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- see the poster!

Thank you

Any questions?

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www.antimicrobialcopper.org

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