Can there be a link between relatively small-scale intervention with copper and rates of HCAIs?

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October 2011

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Antimicrobial Copper Cu+

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01.00 Introduction –

- context &
- laboratory evidence

According to the WHO *hundreds of millions of people* are affected by HCAIs around the world every year

Although the exact global burden remains unknown, because of the difficulty of getting reliable data, the death toll is estimated to be several million annually

Source: WHO data on Healthcare Acquired Infections 2011 and Health Map

HCAIs – Influence of the environment

- 80% of infections are spread by hand contact (Tierno, 2001)
- 29% of healthcare workers still do not wash their hands enough (Randle 2010)
- A contaminated hand will spread microorganisms to the next seven surfaces touched (Barker et al 2004)
- EPIC 2 Guidelines, 2007 (National **E**vidence-based guidelines for **P**reventing healthcare-associated **I**nfe**C**tions in NHS hospitals in England):

  Environmental Contamination mentioned 3 times in the 5 point summary

HCAIs – Influence of the environment

- There is scant evidence of the role environmental microbial contamination in HCAI acquisition
  - **but that is changing**

- Proposals for acceptable levels of microorganisms in the clean environment are being developed

Finding a benchmark for monitoring hospital cleanliness. Mulvey, D. et al., Journal of Hospital Infection, Volume 77, January 2011, 77 (1) 25-30

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

Laboratory highlights, Professor Bill Keevil, Environmental Health Unit, University of Southampton, UK.

1994 verifying efficacy of copper and copper alloys against legionella

2000 against E. coli

2006 against MRSA

2007 against C. difficile (including spores)

2007 against Influenza A (H1N1)

(2008 in the USA: Environmental Protection Agency registration of about 300 copper alloys)

2009 against Vancomycin-resistant Enterococci (VRE)

2011 against VRE, to show rapid kill dry contact mechanism

Copper has activity against:

1. *Acinetobacter baumannii*
2. *Adenovirus*
3. *Aspergillus niger*
4. *Candida albicans*
5. *Campylobacter jejuni*
6. *Clostridium difficile (including spores)*
7. *Enterobacter aerogenes*
8. *Escherichia coli O157:H7*
9. *Helicobacter pylori*
10. *Influenza A (H1N1)*
11. *Klebsiella pneumoniae*
12. *Legionella pneumophila*
13. *Listeria monocytogenes*
14. *MRSA*
15. *Mycobacterium tuberculosis*
16. *Poliovirus*
17. *Pseudomonas aeruginosa*
18. *Salmonella enteritidis*
19. *Staphylococcus aureus*
20. *Tubercle bacillus*
21. *Vancomycin-resistant enterococcus (VRE)*

+ many more

02.00 Clinical trials - review and update

02.01 Clinical trials - reduced contamination

Clinical trial sites reporting:

1983 **Doorknobs: A Source of Nosocomial Infection?**

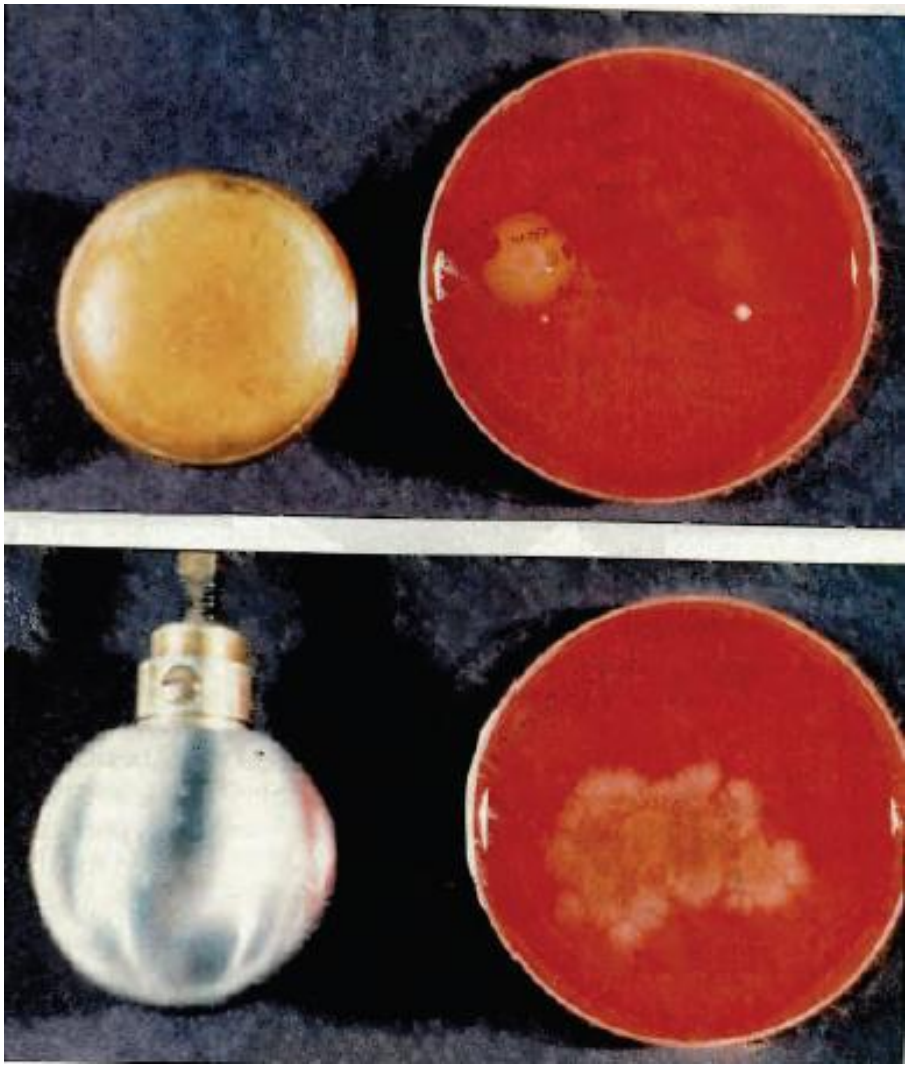
Kuhn, P. *Diagnostic Medicine, Nov/Dec 1983*.

Hamot Hosp, Pennsylvania, USA: study of brass vs stainless doorknobs.

From the conclusion:

"If your hospital is being renovated, try to retain old brass hardware or have it repeated; if you have stainless steel hardware, make certain that it is disinfected daily, especially in critical-care areas.

We have known for years that certain metals are toxic to bacteria. It is the application of this knowledge to better infection control that warrants further attention."



E. coli cultures from brass and

stainless steel door knobs after 72 hrs.

Clinical trial sites

Antimicrobial Copper Cu+

Clinical Trial at University Hospitals Birmingham NHS Foundation Trust - UK

Journal of Hospital Infection (2009) ■, 1–6

Available online at www.sciencedirect.com

ScienceDirect

ELSEVIER

www.elsevierhealth.com/journals/jhin

Role of copper in reducing hospital environment contamination☆

A.L. Casey [a], D. Adams [a], T.J. Karpanen [a], P.A. Lambert [b], B.D. Cookson [c], P. Nightingale [a], L. Miruszenko [a], R. Shillam [a], P. Christian [a], T.S.J. Elliott [a,*]

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Received 20 March 2009; accepted 28 August 2009

University Hospitals Birmingham – phase 1

University Hospitals Birmingham – phase 1

- Items sampled weekly at two times 7 am and 5 pm
- Study carried out for 5 week cycle
- Items made of copper exchanged for non copper items to prevent bias
- End point was the number of viable microorganisms on surfaces
- Standard cleaning protocols applied throughout study

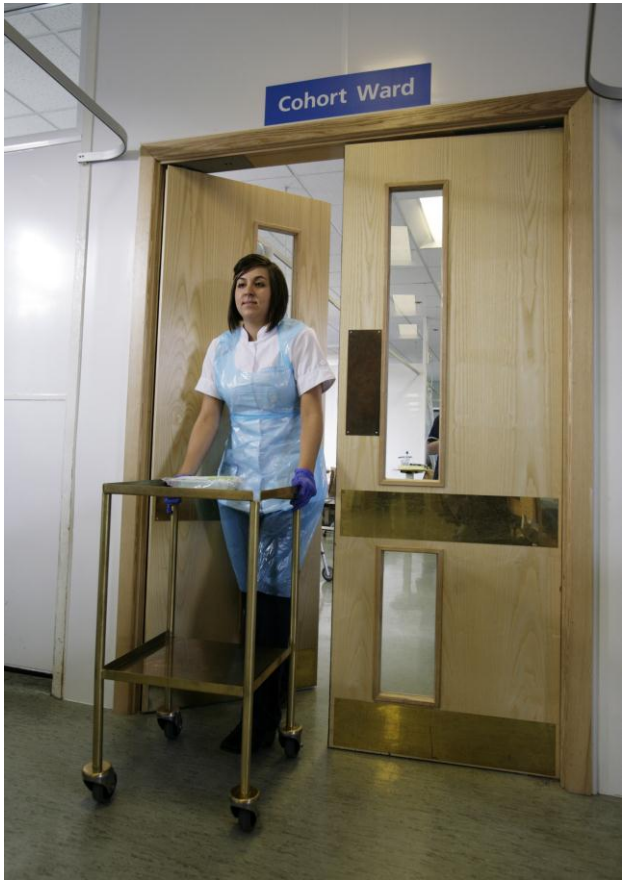
University Hospitals Birmingham – phase 1

- Selly Oak, Birmingham UK – 2008

- 20 bed “nightingale ward” – 12 weeks
  - **90 – 100%** less microbes on copper alloys vs standard surfaces
  - this reached statistical significance using paired- and non-paired non-parametric statistical analysis for 9 out of 10 areas sampled

University Hospitals Birmingham – phase 2

- More extensive range of Copper items evaluated on busy medical ward
- Evaluation during the working day
- Trial carried out over a six month period
- Cross over design with comparison to standard fittings


Cohort Ward


UNIVERSITY HOSPITAL
BIRMINGHAM NHS TRUST
It is our intention to provide the highest standards of cleanliness in all our sanitary areas.
If this facility is not clean and does not meet your expectations please speak to a member of the ward staff who will arrange for cleaning to take place.
Thank you.
FIRE ACTION
Very hot water
Very hot water
Very hot water
Very hot water

University Hospitals Birmingham – phase 2

The antimicrobial efficacy of copper alloy furnishing in the clinical environment; a cross-over study.
Karpanen TJ, et al., Infection Control and Hospital Epidemiology (Sep 2011, in press).

- 14 items made from copper containing materials and alloys, including grab rails, overbed tables and commodes
- Surfaces sampled for 24 weeks
- Switched over after 12 weeks

University Hospitals Birmingham – phase 1

- All cooper items had lower numbers of microorganisms on their surfaces
- 8 out of 14 reached significance

The antimicrobial efficacy of copper alloy furnishing in the clinical environment; a cross-over study. Karpanen TJ, et al., Infection Control and Hospital Epidemiology (Sep 2011, in press).

Calama, Chile and South Carolina, USA

- ICU locations
- Studied microbial numbers on critical touch surfaces
- Surfaces with copper included bed rails, bed levers, tray tables, chair arms, monitor pens and IV poles
- Compared to standard non-copper items
- Standard cleaning applied

Prado V, Duran C, Crestto M et al. Effectiveness of copper contact surfaces in reducing the microbial burden (MB) in the intensive care unit (ICU) of Hospital del Cobre, Calama, Chile. Poster 56.044, 14th International Conference on Infectious Diseases, Miami, March 11, 2010.

Salgado CD, Morgan A, Sepkowitz KA et al. A pilot study to determine the effectiveness of copper in reducing the microbial burden (MB) of objects in rooms of intensive care unit (ICU) patients. Poster 183, 5th Decennial International Conference on Healthcare-Associated Infections, Atlanta, March 19, 2010.

Other key clinical trial sites reporting:

- **Calama, Chile – 2010**
- 180 single bed rooms in an ICU – 30 weeks
  - **49 - 92%** less microorganisms on copper
  - Average microbial count was significantly lower in rooms with copper 1,851 vs. 11,620 cfu / 100sq cm.(p= < 0.00001)

- **Medical University of South Carolina, USA – 2010**
- 59 single bed ICU rooms – 9 weeks
  - **38 – 100%** less microorganisms on copper surfaces
  - **MRSA and VRE** were never isolated from copper objects
  - **>87%** reduction in total mean bioburden (beats terminal clean)

02.02 Clinical trials - HCAI rate?

Risk of HCAIs associated with copper - 1

- **3 centre study in USA on MICUs**
- Copper items put in eight single rooms and compared to 8 non-copper rooms
- Six items replaced: bed rails, overbed tables, chairs, call buttons, data devices and IV poles
- Patients randomised
- **Outcome measures:**
  - number of bacteria on surfaces
  - Patient colonisation by MRSA & VRE
  - HCAI rates

Risk Mitigation of Hospital-Acquired Infections Through the Use of Antimicrobial Copper Surfaces. Moran, W et al. 2011
Poster presented at the 19th Annual Health Forum and American Hospital Association Leadership Summit, July 17-19, 2011, San Diego, CA

Risk of HCAIs associated with copper - 2

- **Trial completed June 2011 – preliminary results**
- Copper surfaces significantly reduced the microbial burden on common touch surfaces (median reduction 98%)
- Overall HCAI rate for patients in copper rooms were 40.4% lower than the control patients ($p = 0.039$)

Risk Mitigation of Hospital-Acquired Infections Through the Use of Antimicrobial Copper Surfaces. Moran, W et al. 2011
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Risk of HCAIs associated with copper - 2

- **Did the rate of HCAI vary according to copper exposure?**
- movement of copper items around unit allowed sub-analysis
- patients in beds with copper rails acquired 61% fewer infections than control patients (p = 0.006)
- patients who had all test copper items present all the time had 69.1% fewer infections (p = 0.008)

Risk Mitigation of Hospital-Acquired Infections Through the Use of Antimicrobial Copper Surfaces. Moran, W et al. 2011
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03.00 Conclusions

Overall conclusions of studies 1

- Results demonstrate that copper offers the potential to significantly reduce the numbers of microorganisms both *in vitro* and in the clinical environment.

- There appears to be a quantifiable link between the built environment and the risk of HCAIs.

Overall conclusions of studies 2

- Incorporation of copper into essential items within the built environment of hospitals may offer a unique solution to control and limit HCAIs in an efficient and cost effective manner.

- Additional studies evaluating the critical and optimal placement of antimicrobial copper touch surfaces within the built environment are warranted.

Thank you

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Questions?

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