Risk Mitigation of Hospital Acquired Infections Through the Use of Antimicrobial Copper Surfaces

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Changing What’s Possible
Risk Mitigation of Hospital Acquired Infections Through the Use of Antimicrobial Copper Surfaces

DISCLOSURES

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Core competencies

- Infectious Diseases
- Internal Medicine
- Epidemiology
- Microbiology
- Infection Control
- Database Management
- Manufacturing
- Metallurgy
- Vendor Relations

Research Team
Healthcare Acquired Infections

Approximately 2 Million infections per year

4.5% patients admitted to hospitals acquire an infection

- 5% or 100,000 deaths in 2004 in the United States
- Or a 1:20 chance of dying should you acquire a HAI

In an ICU ~27% or a 1:4 chance of dying

Kills more than Automobile Accidents, Fires and Drowning

Greater number of annual deaths than HIV and Breast Cancer combined
Healthcare Acquired Infections

4th leading cause of death in the US behind Heart Disease, Cancer & Stroke

Accounts for an additional $47 Billion in added health care costs in the US

CDC published study estimates HAI add 208% to hospital bill

2009-CMS prevents reimbursement for certain preventable conditions, mistakes & HAI

2012-CMS will incentivize non-rural acute care hospitals for lowering HAI rates with higher reimbursement rates.
Strategy For Controlling Risk For Hospital Acquired Infection

Hospital Acquired Infections

- Colonization
- Severe Illness Underlying Disease
- Immunosuppression
- Invasive Foreign Bodies
- Increased Length of Stay
- ICU Care

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HAI Prevention: Current Approaches

**Transmission Based Approach**

- HAI Bundles
- Hand-Hygiene
- Management of patients (colonized & infected) via contact (barrier) precautions
- Environmental Cleaning and Disinfection
- What about the role of the Built Environment?

**Prevent Emergence**

- Antibiotic Stewardship
The Challenges of HAI from the Environment

1. Ubiquity of Microbes in Environment
2. Resilience of bacteria on surfaces
3. Persistence of Contamination
4. Aerobic colony count from a hand contact surface should be < 2.5 cfu/cm²; pathogens (MRSA, C. diff, VRE) should < 1 cfu/cm²

Does the Built Environment Represent a Risk to the Patient?

- **Meta Concept:** The lower microbial burden will equate to a lower risk as a consequence of lower colonization rates which in turn will result in fewer infections, which in turn will yield better outcomes, and lower costs.

- **Hypothesis:** The higher microbial burden found on a object/surface the greater likelihood that the patient/healthcare worker/visitor might acquire a microbe from that surface.
Combining an Opportunity with a Challenge

2 Questions: Can solid copper and its alloys be effective

1. as a simple, inexpensive and continuously active approach to control burden as copper kills 99.9% of bacteria within 2 hours?

2. in the control of HAIs?
What to Sample? What to Use?

Can solid copper and its alloys be effective in the reducing bacteria that cause infectious disease?
What to Sample?
What to Use?

- Surfaces selected for assessment/intervention
  - Bed
  - Tray Table
  - Chair Arms
  - IV Pole
  - Input Device
  - Nurse call device

- Surfaces screened but not selected for assessment/intervention
  - Laundry Hamper
  - Door Handles
  - Drawer Pulls
  - Faucet Handles
  - Keyboard, Mouse
  - Soap/EtOH dispenser
  - End Table Surface
Assessing the Built Environment

A

B

C

D

E
Sampling the Built Environment
All in weeks work...
**Principal Observation**

Clinical environments carry an average microbial burden 57 times higher than the levels commonly accepted as benign (under 250 cfu/100cm² - *Mulvey, 2011*

**Burden values above the line suggest an infection risk, below the line are considered benign**

**Phase 1**

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Intervention with Copper
Intervention with Copper

Total Copper Surface Area 1.54 m²
Copper significantly lowered burden!

Burden values above the line suggest an infection risk, below the line are considered benign.

After Intervention with Copper, Risk Mitigation

Comparative Bacterial Load, US Trials

Sampling conducted while routine clinical care was underway.

Data illustrate the ubiquity and continuous risk that burden presents to the patient and how introducing copper surfaces resulted in a continuous amelioration of burden and potentially risk.
Sampling conducted while routine clinical care was underway

Data illustrate the ubiquity and continuous risk that burden presents to the patient and how introducing copper surfaces resulted in a continuous amelioration of burden and potentially risk.
The Challenge

Will the limited placement of copper surfaces within the built ICU environment ameliorate the rates of HAI and/or HAC?
Our Challenge

What are the appropriate metrics to address the Meta-Question of whether Antimicrobial Copper is Effective at reducing the Contraction of an HAI?

1. Numbers of HAI contracted during the hospitalization in the ICU
2. Average Length of Stay
3. Acquisition of colonization by MRSA, VRE
4. APACHE-2 Score (Acute Physiology And Chronic Health Evaluation)
5. Number of re-admissions for Any reason
6. Number of re-admissions for infection or complication
Our Criteria/Question/Outcome

n Outcome driven-from the standard

CDC/NHSN surveillance definition of health care–associated infection and criteria for specific types of infections in the acute care setting

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CDC/NHSN SURVEILLANCE DEFINITION OF HEALTH CARE-ASSOCIATED INFECTION

For the purposes of NHSN surveillance in the acute care setting, the CDC defines an HAI as a localized or systemic condition resulting from an adverse reaction to the presence of an infectious agent(s) or its toxin(s). There must be no evidence that the infection was present or incubating at the time of admission to the acute care setting.

HAI s may be caused by infectious agents from endogenous or exogenous sources.

- Endogenous sources are body sites, such as the skin, nose, mouth, gastrointestinal (GI) tract, or vagina that are normally inhabited by microorganisms.
- Exogenous sources are those external to the patient, such as patient care personnel, visitors, patient care equipment, medical devices, or the health care environment.

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The Challenge

- Will the limited placement of copper surfaces within the built ICU environment ameliorate the rates of HAI and/or HAC?

- The answer:
  1. Trial concluded 14 June 2011.
  2. Data are being analyzed.
  3. Infections will be validated by blinded reviewers.
  4. Preliminary findings...
    - Yes, preliminary analysis suggests differences seen are significant.
Preliminary Findings

Dose and object were important

Considering Copper Arm vs. Non Copper Arm

- Relative Risk Reduction of -40.4%
- N=651, p=0.039*

Average patient was exposed to 75% of the maximum dose in the copper arm and saw 2.8% of the copper dose in the non-copper arm of the study

100% of the time in Copper Bed or Non Copper Bed

- Relative Risk Reduction of -61.0%
- N=541, p=0.006*

Received 100% Copper Dose / Not exposed to Copper

- Relative Risk Reduction of -69.1%
- N=462, p=0.008
Summary

- We know that hospital acquired infections (HAI) result in a substantial loss of life and an additional cost to the US healthcare system of $45 billion dollars.

- We learned:
  
  Objects surfaced with copper consistently had bacterial burdens ~ 98% less than equivalent objects which was below the recommended value of 2.5 cfu/cm²

  Limited Placement of copper surfaces significantly reduced the rates of HAI and HAC in the MICU

  Rate of reduction linked to exposure frequency

  Built Environment likely accounts for at least 50% of the HAI seen in an MICU
Conclusions

- Risk mitigation of the environmental burden resulted in a concomitant mitigation of the rates of HAI and HAC rates for patients treated in rooms with antimicrobial copper touch surfaces.

- Use of Antimicrobial Copper Surfaces represents the first instance where a “no-touch”, but continuously active antimicrobial material was able to significantly reduce the rate at which infections were contracted by hospitalized patients.
Conclusions

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

- Incorporation of copper into essential items within the built environment of hospitals offers a unique solution to control and limit HAIs in an efficient and cost effective manner.
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Thank you!
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Conclusions, Phase II

Copper reduces microbial burden on common touch surfaces in ICU’s.

Reduction is significant and consistent

97% average reduction on the rails of the bed

- Median value on copper bed rails was 30 CFU/100 cm2

Microbial reduction in clinical setting approaches reduction observed under ideal laboratory conditions (i.e. 99.9%).

Microbial burden observed on Copper surfaces routinely approaches targeted terminal cleaning levels.

Random sampling supports hypothesis that copper surfaces continuously reduce bacteria between cleanings.

The majority of the microorganisms were Staphylococci

MRSA was only isolated 5 times from 3,610 copper objects

MRSA incidence = 15X higher on control surfaces.