You are connected to the WCLN Webinar “Benefits of Microbial Burden Management”

We will begin the webinar at 12:00 noon
CONTINUOUS CONTROL OF MICROBIAL BURDEN IN CLINICAL ENVIRONMENTS FOSTERS PATIENT SAFETY THROUGH REDUCTIONS IN HEALTHCARE ASSOCIATED INFECTIONS

Michael G. Schmidt, Ph.D.
Professor, Microbiology and Immunology
Medical University of South Carolina
Abstract

• National health-service providers, private health insurers, and healthcare practitioners have each called for increased practices that foster patient safety.
• Healthcare associated infections (HAI) represent one of the most significant risks to patient safety, occurring at an alarmingly high rate of 1 per 25 hospitalizations in the US.
• Components fabricated from solid copper alloys have an ability to continuously control the concentration of microbes in situ at levels recommended subsequent to terminal cleaning (<250 cfu/100cm²).
• In one clinical trial, limited placement of copper surfaces was shown to mitigate the rate of HAI acquisition through a reduction to environmental burden.
• The HAI rate was significantly lower in rooms with copper surfaces (11.8 to 4.8 per 1,000 patient days (p= 0.013)). Here we report on the in situ evaluation of copper surfaces within an ambulatory-surgical care center.
• Results
  – Thirteen different objects were evaluated over 500 days.
  – Objects fabricated using copper alloys were found to harbor significantly lower concentrations of bacteria than control facsimiles (p<0.0001).
  – The median burden associated with the copper objects was below the limit of detection.
• These results represent the first evaluation of copper alloy surfaces in a setting of ambulatory-surgical care
• Support previous observations that copper alloys continuously control the concentration of bacteria within built clinical environments.
• Collectively these data serve to advance the conclusion that an application of copper touch surfaces throughout healthcare can enhance infection control efforts augmenting patient safety.
Continuous control of microbial burden in clinical environments fosters patient safety through reductions in healthcare associated infections

Disclosures

1. Some of the work described here was supported by the US Army Medical Research and Materiel Command under Contract No. W81XWH-07-C-0053. The views, opinions and/or findings presented here are those of the author(s) and should not be construed as an official US Department of the Army position.

2. Unrestricted research grant from Olin Brass to evaluate the antimicrobial effectiveness of CuVerro™ Products.

3. Unrestricted research grant from Ministry of Health of the Republic of Chile by investment funds for refurbishing the Intensive Care Unit of the Roberto del Río Hospital and the Corporación Nacional del Cobre de Chile (CODELCO) administered through DUAM S.A.

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Continuous control of microbial burden in clinical environments fosters patient safety through reductions in healthcare associated infections

**Learning Objectives**

1. Understand the linkage between the intrinsic burden of the built clinical environment and Healthcare Associated Infections (HAI)
2. Review the opportunity that burden management of the built environment affords healthcare resulting in improvements to patient outcomes and satisfaction.
3. Evaluate the clinical opportunity afforded by interventions for limiting HAI
4. Evaluate the cost effectiveness of burden management in mitigating HAI acquisition rates

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If one full wide bodied jet was lost each day would anyone fly?
In the United States 1:25 Contract an infection
HAI > HIV/AIDS + Breast Cancer
Accounts for an additional ~$147 Billion in health care costs in the United States
ECONOMIC IMPACT OF HAI

Annual Revenue ($Billion)

Cost Cyber-Crime
Wal-Mart Stores
Exxon Mobil
Berkshire Hathaway
Apple
McKesson
United Health Group
CVS Health
General Motors
Ford Motor Company
Healthcare Associated Infections
AT&T

TOP 10 FORTUNE 100 COMPANIES
Cleaner environment

>90% Reduction

Lower RISK of infection

Fewer infections  > 50% Reduction

Better outcomes & lower costs
Solutions for Clean Hospital Environments

• **Hand Hygiene**

• **Chemical cleaners & disinfectants**

• **Extended Cleaning with Robots**
  – Ultraviolet
  – Hydrogen Peroxide

• **Inherently bactericidal surfaces**
Daily Cleaning
Daily Cleaning
Terminal Cleaning

Frequency, on average once every 5th day
When We Clean

Evidence that transmission of many healthcare acquired pathogens is related to contamination of near-patient surfaces and equipment....

Hospitals should develop programs to optimize the thoroughness of high touch surface cleaning as part of terminal room cleaning at the time of patient discharge or transfer.
How Well We Clean?

**TABLE. Comparison of Rates of Cleaning for 14 Types of High-Risk Object (HRO) in 36 Acute Care Hospitals, Before and After Intervention**

<table>
<thead>
<tr>
<th>Type of HRO</th>
<th>Mean % of HROs cleaned (range)</th>
<th>95% CI</th>
<th>Mean % of HROs cleaned (final results)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sink</td>
<td>79 (38–97)</td>
<td>72.4–84</td>
<td>171 (70–98)</td>
<td>80.1–90.7</td>
</tr>
<tr>
<td>Tray table</td>
<td>74 (35–100)</td>
<td>70.4–84</td>
<td>171 (70–98)</td>
<td>80.1–90.7</td>
</tr>
<tr>
<td>Toilet seat</td>
<td>71 (3–100)</td>
<td></td>
<td>171 (70–98)</td>
<td>80.1–90.7</td>
</tr>
<tr>
<td>Flush handle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Side rail</td>
<td></td>
<td></td>
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<tr>
<td>Bedside rail</td>
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<td>Chair</td>
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<tr>
<td>Telephon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bathroom</td>
<td>29 (0–82)</td>
<td>22.1–36.2</td>
<td>71 (19–95)</td>
<td>64.1–78.1</td>
</tr>
<tr>
<td>Bathroom behind</td>
<td>28 (0–90)</td>
<td>20.9–35.8</td>
<td>74 (15–100)</td>
<td>66.1–81.6</td>
</tr>
<tr>
<td>Bathroom light switch</td>
<td>25 (0–84)</td>
<td>17.1–33.1</td>
<td>64 (8–100)</td>
<td>55.9–72.9</td>
</tr>
<tr>
<td>Room door knobs</td>
<td>22 (0–73)</td>
<td>15.9–28.4</td>
<td>66 (25–100)</td>
<td>59.7–73.2</td>
</tr>
<tr>
<td>Bedpan cleaner</td>
<td>22 (0–79)</td>
<td>15.9–28.3</td>
<td>62 (0–100)</td>
<td>51.7–71.4</td>
</tr>
</tbody>
</table>

Note: All P values are <0.01; CI, confidence interval.

48% of surfaces are not clean after terminal cleaning.

http://journals.cambridge.org/abstract_S0195941700027077
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MICROBES UBIQUITOUSLY ATTACH BIOFILMS ARE THE CONSEQUENCE
MICROBES UBIQUITOUSLY ATTACH
BIOFILMS ARE THE CONSEQUENCE

EVEN THE ‘SAFE OBJECTS’ ARE NOT IMMUNE!
CONSIDER THE PATH OF MICROBES
When we look, the **risk** is omnipresent!
Risk is omnipresent, despite cleaning

DANGER
Risk is Clustered
Burden Matters! There was a significant association between burden and HAI risk ($p=0.038$) with 89% of HAI occurring among patients cared for in a room with a burden $>500$ cfu/600cm$^2$. 

Cumulative Bacteria Resident on the 6 Objects

<table>
<thead>
<tr>
<th>Burden (CFU/100 cm$^2$)</th>
<th>Patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;500</td>
<td>83</td>
<td>7%</td>
</tr>
<tr>
<td>501 - 2000</td>
<td>88</td>
<td>9%</td>
</tr>
<tr>
<td>2001 - 8000</td>
<td>79</td>
<td>13%</td>
</tr>
<tr>
<td>&gt;8000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Burden data was available for 333 patients.
AN OPPORTUNITY AFFORDED BY ANTIMICROBIAL COPPER TO HEALTH CARE

PART 2
HUMANS HAVE BENEFITED FROM COPPER SINCE ANCIENT TIMES
But then... Humans appreciated that Copper Had Remarkable, Antimicrobial, Properties
CONTACT WITH COPPER RESULTS IN RAPID DEATH FROM MULTI-COMPONENT MECHANISM

Stainless Steel
4 hours

Copper
10 minutes

Respiration (CTC)  DNA (SYTO9)

Collapsed membrane potential

Destruction of nucleic acid as a consequence of free radical production
CLINICAL OPPORTUNITY COPPER
AFFORDS HEALTHCARE
PART 3
Our opportunity as Reality
Our opportunity as Reality
Commercially Available Healthcare Products from Copper Alloys.
Commercially Available Healthcare Products from Copper Alloys.
DOES IT IMPROVE CLEANLINESS?
Burden Significantly Lower with Copper

16 rooms sampled weekly for a period of 21 months, n=1012
Risk was Significantly Lower with Copper

Copper continuously lowered risk
Risk was consistently lower with Copper.
Copper minimizes risk

### Copper Alloy Surfaces

<table>
<thead>
<tr>
<th>Area</th>
<th>Below Threshold</th>
<th>1-250</th>
<th>&gt;250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail-Stretcher Bed</td>
<td></td>
<td></td>
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<tr>
<td>Rail-Med/ Surg Bed</td>
<td></td>
<td></td>
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<tr>
<td>IV Poles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overbed table</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Bedside Table Pulls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient Headwall-Light Switch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main-Light Switch</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Alcohol Gel Dispenser Push Plate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handle Pass Thru Patient Side</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Handle Pass Thru Hallway Side</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Door Lever</td>
<td></td>
<td></td>
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<tr>
<td>Soap Dispenser Push Plate</td>
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</tr>
<tr>
<td>Faucet Handle - Patient Bath</td>
<td></td>
<td></td>
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<tr>
<td>Sink - Patient Bath</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Grab Bars</td>
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<tr>
<td>Toilet Flush Valve Handle</td>
<td></td>
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<tr>
<td>Keyboards</td>
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<tr>
<td>ADA Auto Push Plate</td>
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### Occupied Areas

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• Components fabricated from solid copper alloys are consistently able to limit the concentration of microbes on commonly touched surfaces within occupied and unoccupied patient rooms at levels prescribed subsequent to terminal cleaning (<250 cfu/100 cm²)

• Unoccupied rooms harbor significant concentrations of microbes subsequent to terminal cleaning

• ▲ Average Burden Observed △ Median Burden Observed
DOES IT IMPROVE CLEANLINESS?

YES, IN A HOSPITAL SETTING

WHAT ABOUT IN OUT PATIENT SURGERY CENTERS?
Copper was effective at controlling burden within an outpatient surgery center.

Components Evaluated
(N=413, Control, 282, Copper 131)
Copper was effective at controlling burden within an outpatient surgery center.
COULD SOMETHING SO SIMPLE LIKE THIS WORK?
Copper Surfaces Reduce the Rate of Healthcare-Acquired Infections in the Intensive Care Unit

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

MEDICAL UNIVERSITY OF SOUTH CAROLINA, MEMORIAL SLOAN KETTERING CANCER CENTER RALPH H JOHNSON VA MEDICAL CENTER COPPER DEVELOPMENT ASSOCIATION
Yes, copper surfaces significantly reduced HAI

HAI 8.43%

*58.1% Lower

HAI 3.4%
COPPER SURFACES SIGNIFICANTLY REDUCED HAI

Prevented 16 Infections
Conservative Savings of $768K and 301 days of Hospitalization

HAI 8.43% *58.1% Lower HAI 3.4%
CONCLUSIONS

Copper continuously complements cleaning controlling the bacterial burden within the built environment resulting in improved patient outcomes
CONTINUOUS ACTION OF COPPER

PLACEMENT OF COPPER COMPONENTS

FACILITATES THE ACHIEVEMENT OF TERMINAL CLEANING STANDARDS ON A CONTINUOUS BASIS
Part 4: What will it save?

Cost of Hospital-Acquired Infections

Cost of Intervention with Antimicrobial Copper Touch Surfaces
AHA Statistics:
- 5,686 Registered Hospitals in U.S.
- 914,513 U.S. Hospital Beds.
- Average size hospital = 160 Beds

CDC reports:
- 2,000,000 Healthcare Associated Infections (HAI's) per year.
- 100,000 Deaths per year from HAIs
- ~2 infections/bed ~ One person dies per 20 HAIs

AHRQ Reports HAIs results in:
- Additional patient hospital stay of 19.2 days
- Increase in-Hospital Mortality by 600%
- Increase average hospital charges by $43,000

DOD Clinical Trials conclude that copper:
- Reduces Bacterial Contamination by ~ 90% Reduces HAIs > 50%
## Impact of HAI

<table>
<thead>
<tr>
<th></th>
<th>Average LOS Length of Stay</th>
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</thead>
<tbody>
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<td>Without HAI</td>
<td>5.2 days</td>
</tr>
<tr>
<td>With HAI</td>
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</tr>
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## Impact of HAI

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<th>% In-Hospital Mortality</th>
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<tr>
<td>Without HAI</td>
<td>5.2 days</td>
<td>1.5%</td>
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<td>~ 6X risk</td>
</tr>
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</table>

(http://www.phc4.org/reports/hai/09/docs/hai2009report.pdf)
## Impact of HAI

<table>
<thead>
<tr>
<th></th>
<th>Average LOS Length of Stay</th>
<th>% In-Hospital Mortality</th>
<th>Average Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without HAI</td>
<td>5.2 days</td>
<td>1.5%</td>
<td>$9,377</td>
</tr>
<tr>
<td>With HAI</td>
<td>24.4 days</td>
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<td>$52,096</td>
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</tbody>
</table>

## Impact of HAI

<table>
<thead>
<tr>
<th></th>
<th>Average LOS Length of Stay</th>
<th>% In-Hospital Mortality</th>
<th>Average Charge</th>
<th>Re-admission in 30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without HAI</td>
<td>5.2 days</td>
<td>1.5%</td>
<td>$9,377</td>
<td>16.3%</td>
</tr>
<tr>
<td>With HAI</td>
<td>24.4 days</td>
<td>9.0%</td>
<td>$52,096</td>
<td>40.7%</td>
</tr>
<tr>
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<td>+19 days</td>
<td>~ 6X risk</td>
<td>+$43,000</td>
<td>+2.5x risk</td>
</tr>
</tbody>
</table>

What if…

Model Impact Estimator

About the Model Impact Estimator

The Model Impact Estimator is a tool designed to help health care innovators make cost calculation estimates based on 2011 Medicare utilization data. By inputting the percent change in utilization in one or more service categories, users can generate impact estimates for their proposed models. We emphasize that the impact estimates are estimates and should not be construed as an actuarial assessment. Since these estimates are based on the assumptions made by the user, the Centers for Medicare & Medicaid Services (CMS) does not endorse, in part or in full, the outputs of this tool.

About the data

The Model Impact Estimator estimates are derived from the aggregated 2011 Medicare costs data located on the Public Use File webpage on the CMS website. This tool uses the most current 2011 Medicare cost and utilization data that was available at the time of its publication. Although the tool focuses on cost, the source data also has aggregated demographic, spending, utilization, and quality indicators at the hospital referral region (HRR) level. As the underlying data is updated, some discrepancies may occur. For more information about the source data, please visit the CMS.gov Public Use File webpage. Please note that data cells in the tool containing user counts of less than 30 are represented by a hyphen (-).

How to use the tool

1. Select the State and Hospital Referral Region where the model will be implemented.
2. View the estimated total and per beneficiary per month (PBPM) impact for the selected Hospital Referral Region and the national average among 14 major Medicare service categories.
3. In the % change column, input the estimated impact of your model. Use negative values if you expect your model to reduce cost and positive values if you expect your model to increase cost. The table generates estimates based on your assumptions. (The validity of these estimates will vary based on the validity of your underlying assumptions.) Please see the Notes section for additional information.
4. Input the estimated implementation cost of your model, the estimated number of beneficiaries the model will include and the model duration. The tool will generate estimates based on these inputs.
• Using the CMS model
  – An investment of $6.52/patient* will yield $13,052 /per patient!
    1. Assume it will cost $3,000 to outfit the room with 10 copper objects
    2. Use 23 rooms as the number of rooms for the ICU, $69,000 capital cost
    3. Assume average length of stay of 4 days/or 92 patients per room/per year
       – *$6.52/patient, assuming 5yr placement
    4. Assume a -58% reduction to infections

• Model predicts an ANNUAL SAVINGS of $6,005,704 per year from 23 rooms from one time investment of $69K! ~ 87 x ROI/yr

◆ Replacement Rails
  ✓ IV Pole/Infusion Stand
  ✓ Overbed table
  ✓ Keyboard
  ✓ Computer mouse
  ✓ Sink
  ✓ Faucet
  ✓ Door lever
  ✓ Light Switches
  ✓ Cabinet pulls
Today…

• Using the CMS model
  – An investment of $6.52/patient* will yield $13,052 /per patient!

  1. Assume it will cost $3,000 to outfit the room with 10 copper objects.
  2. Use 23 rooms as the number of rooms for the ICU, $69,000 capital cost.
  3. Assume an average length of stay of 4 days/or 92 patients per room/per year.

• Assume a 58% reduction to infections
  • Model predicts an ANNUAL SAVINGS of $6,005,704 per year from 23 rooms — same investment of $69K! ~ 87 x ROI/yr

  • Replacement Rails
    – IV Pole/Infusion Stand
    – Overbed table
    – Keyboard
    – Computer mouse
    – Sink
    – Faucet
    – Door lever
    – Light Switches
    – Cabinet pulls

  ~ PREVENTING AN INFECTION WORTH AN INVESTMENT OF $6.52 TO SAVE $43K
## Infection – Cost Model - Savings

<table>
<thead>
<tr>
<th></th>
<th>Average Size Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of beds</strong></td>
<td>160</td>
</tr>
<tr>
<td><strong>Number of HAI per bed</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Number of HAI each year</strong></td>
<td>320</td>
</tr>
<tr>
<td><strong>Cost of HAIs each year</strong></td>
<td>$15 million*</td>
</tr>
<tr>
<td><em><em>Annual Savings</em> @ $43,000/HAI</em>*</td>
<td><strong>Average Size Hospital</strong></td>
</tr>
<tr>
<td><strong>With Copper Surfaces in Room:</strong></td>
<td></td>
</tr>
<tr>
<td># HAI$s saved</td>
<td>185</td>
</tr>
<tr>
<td>$ saved</td>
<td>$7.9 million</td>
</tr>
</tbody>
</table>

*If @ $29,000/HAI*  
<table>
<thead>
<tr>
<th>Average Size Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>185</td>
</tr>
<tr>
<td>$5.4 million</td>
</tr>
</tbody>
</table>
Potential Savings from Copper Surfaces

Hospital Savings of $5.4 - $7.9 MM per year
- Savings are Above and Beyond* Current Proactive Measures!

- Single Patient Rooms
- Prominently located sinks and alcohol hand hygiene dispensers
- Hand washing compliance programs
- Regular cleaning of surfaces
- Bundles for controlling infections (e.g., CLABSI, CAUTI)

*Each of these measures were instituted prior to DOD trial
Copper continuously complements cleaning controlling the bacterial burden within the built environment resulting in improved patient outcomes
Cleaner environment >90% Reduction

Lower RISK of infection

Fewer infections > 50% Reduction

Better outcomes & lower costs
SUMMARY

1. BUILT ENVIRONMENT REPRESENTS A CLEAR AND PRESENT DANGER TO PATIENT CARE

2. COPPER ALLOYS WERE FOUND TO SUSTAIN THE LEVELS ACHIEVED FROM TERMINAL CLEANING

3. COPPER ALLOYS CONTINUOUSLY SUSTAIN THE TERMINAL CLEANING STANDARD WITHIN VACANT ROOMS
CONCLUSION

Placement of Copper Components facilitates the achievement of terminal Cleaning standards on a continuous basis.
BLUF

Placement of Copper Components facilitates the achievement of terminal Cleaning standards on a continuous basis
One Out of Many

Healthcare Associated Infections
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