Copper Clean™ Antimicrobial Surface Patches as a Supplementary Measure to Decrease Occurrence of Healthcare Acquired Infections.

From 2007-2012, Copper Alloys underwent prodigious testing in hopes of achieving US EPA certification to neutralize microorganisms that contribute to healthcare acquired infections. This testing, which was facilitated through multiple studies and performed by intra-institutional research teams, included laboratory research testing as well as statistically significant clinical trials. The antimicrobial properties of copper and its alloys have been well known for centuries. Advances in materials and processes had produced copper alloys that were highly functionalized, with increased durability, tarnish resistance, and toughness. And yet, by the early 2000's, these advanced alloys had yet to find their way into widespread patient care. The goal of the project was to close that gap and facilitate the translation of antimicrobial copper technology "from the lab bench to the bedside."

The laboratory portion of the project involved comprehensive in-vitro testing of copper alloys against strains of bacteria and viruses known to cause HAI's. Copper alloys were found to effectively neutralize a host of these dangerous pathogens in various exposure times. The protocols vary but researchers found copper alloys to neutralize nearly 100% of: Methicillin-Resistant Staphylococcus aureus (MRSA) - in 80 minutes (Gould et al., 2009); Vancomycin-Resistant Enterococci (VRE) - in 60 minutes (Gould et al., 2009); Escherichia coli O157:H7 (E. coli O157:H7) - in 15 min (Espirito Santo et al., 2008); Clostridium difficile (C. difficile) an anaerobic spore forming bacterium - in 24-48 hours (Weaver et al., 2008); Influenza A (H1N1) - 75% reduction in 60 min, nearly 100% reduction in 6 hours (Noyce, Michels, & Keevil, 2007); Norovirus - nearly 100% in 5 min under dry inoculum conditions (Warnes & Keevil, 2013).

Based on these laboratory research results, the EPA contracted an independent 3rd party laboratory to perform three test protocols against the copper alloys: efficacy as a sanitizer, residual self-sanitizing efficacy, and the most stringent, continuous reduction efficacy. The antimicrobial capacity of the copper alloys tested in these protocols provided the required data for certified copper alloys (such as the Copper Clean alloy) to make public health claims against the 6 specific bacteria tested under the EPA-approved test protocols. (Anderson & Michels, 2008). Thereby, Copper Clean Antimicrobial Surface Patches have been shown, when cleaned regularly, to kill greater than 99.9% of the following bacteria within 2 hours of exposure: MRSA, VRE, Staphylococcus aureus, Enterobacter aerogenes, Pseudomonas aeruginosa, and E. coli O157:H7.

The clinical trial, which was funded by a grant through the US Department of Defense, was conducted over 21 months at 3 US medical centers encompassing over 40 medical ICU beds. The findings of the trial, which were published in Infection Control and Hospital Epidemiology and showed that A) healthcare components do harbor dangerous levels of bacteria that translate to increases in HAI's and B) outfitting critical components with copper decreases the microbial burden on these components by 83% (Schmidt, Attaway, Sharpe, et al., 2012). Additionally, the trial revealed that C) this decrease in microbial load can be traced to a statistically significant (58%) reduction in HAI occurrence. (Salgado et al., 2013)

The Centers for Disease and Prevention found the average annual direct cost to treat a hospital acquired infection is between US $28,400 and $33,800. (Scott, 2009) For the clinical trial in question, the additional cost of copper outfitted components in comparison to their non-copper counterparts was $52,000 for all rooms. The data indicates that the copper surfaces reduced the average infection rate by 14 infections over 21 months. These numbers reveal a payback period of between 37.1 days and 44.2 days depending on the cost of the infections. (Michels Keevil, Salgado, and Schmidt, 2015)

Given these results, it is difficult to understand why copper and copper alloys have not received widespread adoption into healthcare settings. Some of this delay may be due to industry dogma, but a greater share of the blame is more likely contributable to the switching cost associated with copper surface adoption. The copper components used in the clinical trial above were largely custom parts with copper surfaces built in from the manufacturer. Though the difference in cost between these standard and copper components is relatively small, implementing such components in ICU rooms means existing components must be replaced with new copper-equipped components - which can be financially burdensome. This is the core problem that Copper Clean Antimicrobial Surfaces addresses. Copper Clean™ Antimicrobial Surface Patches are durable, self-sanitizing metal stickers that are applied to high-touch surfaces in medical facilities to kill surface-borne bacteria*. Copper Clean™ patches are made from a proprietary copper alloy that is was registered by the EPA in the testing protocols above. By antimicrobial copper as an adhesive backed patch, Copper Clean™ allows medical facilities to retrofit existing bedrails, tray tables, IV poles, call buttons, door handles, and other high-touch surfaces with self-sanitizing antimicrobial copper. Installation is incredibly quick, with virtually no down-time.

The cost effective patches are long lasting but not permanent. This provides facilities with the flexibility to either polish the patches in place or easily replace them with new patches as they wear with use. Based on the financial numbers associated with HAI's above, the cost of outfitting high-touch surfaces with Copper Clean™ Surface Patches can be recouped within weeks of installation. Furthermore, the distinguished design of the patches consistently provide patients, visitors, and staff with confidence that their healthcare facilities invests in measures to improve sanitization and decrease infection rates.

Five Questions to Explore When Considering the Use of Copper Clean Surface Patches in Healthcare Settings

Does Copper neutralize harmful microorganisms in laboratory settings?

Copper Clean Patches hold EPA public health registrations which permit **99.9% neutralization claims against 6 of the most common microorganisms within 2 hours.** (Anderson & Michels, 2008)

Do healthcare components that harbor pathogens contribute to HAI's?

A comprehensive clinical trial revealed significant microbial presence on surfaces within ICU rooms and also showed copper surfaces to provide a **83% average reduction in microbial count** over the 21 month trial. (Schmidt, Attaway, Sharpe, et al., 2012)

Can copper be used to reduce microbial burden components in clinical setting?

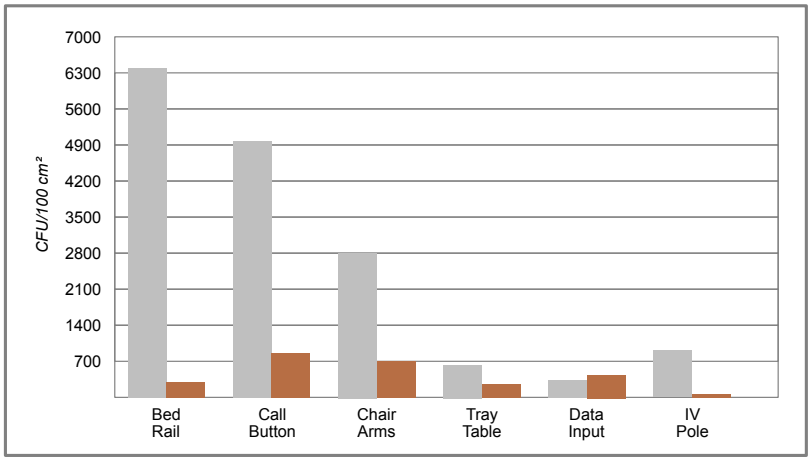

Figure 2. Microbial burden measured on six objects in ICU rooms outfitted with copper (orange bars) and not outfitted with copper (grey bars). (Schmidt, Attaway, Sharpe, et al., 2012)

Does a reduction in microbial load translate to a reduction in HAI's?

The clinical trial also found a **58% reduction in patient infection rates** in rooms outfitted with copper surfaces. This finding showed a high level of statistical significance, indicated by a p-value of .013. (Salgado et al., 2013)

Are copper components a financially feasible tool to fight HAI's?

By retrofitting existing components with Copper Clean™ patches the initial cost can be curtailed even further, creating an estimated **pay-back period of less than 1 month**.