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RESEARCH BRIEFS

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Surfaces in an outpatient setting are exposed to multiple patients become colonized with microorganisms. Copper and alloys containing greater than 60% copper reduce bacterial burdens on solid surfaces by 99.9% within 2 hours.[1] Copper surfaces have been found to substantially diminish the density of bacteria to levels below those considered a risk to patients for the acquisition of an infection.[2-5]

In this study, we investigated the impact of copper surfaces on the bacterial burden found on high-touch surfaces of phlebotomy chairs in an outpatient infectious disease clinic. Quantitative cultures were obtained from phlebotomy chairs located in an outpatient infectious diseases practice. Results from control (wood/composite) chairs and the copperized therapy chairs were compared. A total of 437 patients used the chairs during the 15-week study period.

Solid copper alloy metal (90% copper, 10% nickel) was inlaid across the arm tops and plastic trays of 2 phlebotomy chairs; the arm sides remained wood (Frigo Design, Brewerton, NY). A control chair retained the original wood arms and plastic composite tabletop.

All chairs were wiped down at the end of each day with a nonalcohol-based quaternary ammonium compound (QAC) cleanser wipe (PDI Sani-Cloth HB germicidal disposable wipes), and the floors of the therapy suites were cleaned once nightly with QAC solution (Virex). Chair locations were rotated every 3 weeks. The number of patients who used each chair was noted.

Arm tops, arm sides, and tray tops of each therapy chair were cultured twice per week in midafternoon. Surfaces were wiped with moistened sterile rayon/polyester wipes (Kimberly-Clark) and placed in sterile containers. Samples were delivered to the Medical University of South Carolina in cold packages within 18 hours.

Bacteria were liberated from each wipe by adding 3 mL of sterile phosphate-buffered saline, 0.5% Tween 80, and 0.07% lecithin to a tube containing a wipe and vortexed at high speed for 1 minute. Samples (100 μL) were plated onto tryptic soy agar (TSA; Becton Dickinson [BD]), sheep blood agar (total microbes), mannitol salt agar (total staphylococci; BD), MacConkey agar (total gram negative; BD), ChromAgar methicillin-resistant *Staphylococcus aureus* (MRSA; BD), bile esculin azide (Hardy Diagnostics), and vancomycin agar (vancomycin-resistant *Enterococcus* [VRE]). Plates were incubated for 48 hours. The microbial burden associated with each surface was expressed as colony-forming units (CFUs) per 100 cm^2.

The Kruskal-Wallis test was used to compare median microbial burden values (EpiInfo, Centers for Disease Control and Prevention). A P value of less than or equal to .05 was considered statistically significant.

Copper surfaces were found to reduce the bacterial population present on the trays and arm surfaces (Figure 1). An 88% ($P < .0001$) median reduction for the total aerobic bacteria of copperized trays and a 90% reduction ($P < .0001$) on copperized arms were observed. The majority of microorganisms identified were mannitol-fermenting and nonfermenting staphylococci. The remaining unidentified microbes grew well on TSA blood agar at 37°C. MRSA and VRE were not recovered.

The majority of the samples from copperized surfaces had less than 2.5 CFUs/cm^2, which is the suggested standard for surface-level cleanliness.[6] There were 134 copperized surfaces sampled; 23 data points were excluded from the analysis (6 data points were excluded for loss, 16 data points were excluded secondary to zero patients using the chair on that given day, and 1 data point was excluded for sample damage). Of 97 evaluable samples, 60 (62%) attained this strict microbiological standard for cleanliness.

There were 60 noncopperized surfaces sampled; 7 data points were excluded (3 data points were excluded for loss and 4 data points were excluded secondary to zero patients using the chair). Of the 53 evaluable samples, only 5 (10%) achieved the microbiological standard for cleanliness (bacterial concentrations less than 2.5 CFUs/cm^2).

The microbicidal properties of copper were found to confer an "antimicrobial halo" within the general vicinity of the arm top in that the microbial burden associated with the wooden side arms of the copper-covered chair arms was significantly lower—by 70%—than the control.

The calculated ratio of patients to the median burden enabled us to conclude that use of the chair with the copper arm tops resulted in a 17-fold lower risk of exposure to environmental microbes than when patients used the standard chair. Similarly, patients who used chairs with copper trays were predisposed to a 15-fold lower risk.

Despite routine disinfection efforts, high-touch areas can harbor high densities of microorganisms. As proposed by White et al,[6] bacteriological standards for assessing surface hygiene in the hospital environment comprise identification of either an indicator organism (such as MRSA) or a heavy burden of any microbe. In this study, 90% of samples from noncopper chairs exceeded 2.5 CFUs/cm^2 with routine daily cleaning.

Covering high-touch surfaces with antimicrobial copper may provide an adjunctive infection control measure to minimize the spread of bacteria. The microbicidal activity of copper was effective in significantly reducing the total median burden by 90% on arm tops and by 88% on copperized trays. In addition, the microbicidal properties of copper were able

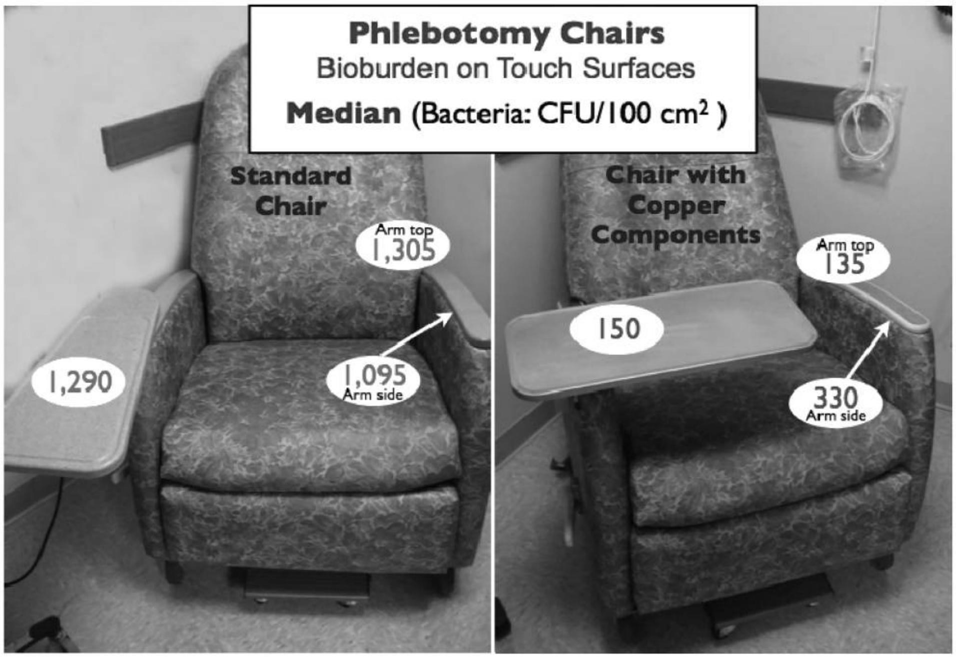

FIGURE 1. Antimicrobial copper surfaces reduce the concentration of bacteria on common touch surfaces of phlebotomy chairs. CFU, colony-forming unit.

to confer an antimicrobial halo as high as 70% next to the copperized arm top.

Our study has several limitations. This was a nonblinded study and may have resulted in biased cleaning of copperized chairs, although housekeeping was unaware of the study. Microbial densities on environmental surfaces may be affected by patient characteristics that were not evaluated.

Deployment of copper surfaces within high-risk patient environments is warranted to enhance patient safety.

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