dividuals were not tested again after an initial negative TST result, could potentially be almost $250,000 per year for our institution. The potential cost per TB case prevented is likely to be significantly greater than the cost per individual with TST conversion. Because of the 61% decrease in new TB cases in the United States, from 26,673 cases in 1992 to 10,521 cases in 2011,[4,5] and the low yield of repeat annual screening of individuals with negative TST results, other TB screening options for these individuals should be considered and weighed against the potential drawbacks of delayed identification of TB among healthcare workers. These options might include less frequent repeat screening of individuals with negative TST results or repeat TST of individuals with negative TST results only in the event of a known or suspected TB exposure. In the era of efforts to reduce healthcare costs in the United States, the cost of annual TST screening of individuals who initially have negative TST results warrants a reevaluation of the CDC guidelines for annual TB screening for similar health facilities in developed countries.

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Hospital Basins Used to Administer Chlorhexidine Baths Are Unlikely Microbial Reservoirs

Basins, commonly used to bathe patients who are unable to bathe themselves, frequently become contaminated with potential pathogens[1,2] and may serve as a source for nosocomial transmission.[3] Chlorhexidine (CHG) has bactericidal activity against a broad spectrum of pathogens and is increasingly used in antiseptic patient baths. The purpose of this study was to ascertain whether basins used to administer CHG bed baths are likely to become contaminated.

Bed bath conditions were simulated by mixing 30 mL of a 4% CHG product or soap preparation to 1 L of warm (37°C) tap water in a 6-L plastic basin (Medical Action Industries). Two commercial brands of CHG (Hibiclens, Molnlycke Health Care [hereafter, CHG-A], or Scrub Care, Cardinal Health [hereafter, CHG-B]) and 1 brand of soap (SensiCare SeptiSoft, ConvaTec) were used. Basins were inoculated with 10^8 colony-forming units (CFUs) of 1 species of bacteria, mixed for 30 seconds, incubated for 20 minutes at room temperature, emptied, and allowed to dry for 1 hour. A 100-cm^2 area on the bottom of the basin was sampled for 10 seconds in 2 directions with a cotton swab premoistened with normal saline. Swab tips were placed in 2 mL of trypticase soy broth (Difco) and vortex-mixed for 30 seconds, and the solution was quantitatively cultured on sheep blood agar (Remel). Cultures were incubated at 37°C for 24 hours, and colonies were counted and expressed as CFUs per square centimeter. Tap water with and without a bacterial inoculum served as positive and negative controls, respectively.

Residual effect studies were conducted as described above with the exception of the bacterial inoculum. Basins were allowed to dry for 3 hours, and then the 100-cm^2 area was inoculated with 10^7 bacteria. After 1.5 hours of incubation at room temperature, the 100-cm^2 area was sampled as noted above. All experiments (immediate and residual effect) were performed in triplicate (4 bacteria × 5 bath solutions × 3 replicates × 2 incubation conditions = total of 120 basins).

Four species of bacteria were utilized to broadly represent potential pathogens that could contaminate bed baths: *Staphylococcus epidemidis* 1457, *qacA/B*-positive methicillin-resistant *Staphylococcus aureus* (MRSA), *Enterococcus facaelis* (ATCC 29212), and *Escherichia coli* (ATCC 25922).

The Kruskal-Wallis test was used to compare the median

bacterial counts between bath solutions, and the Wilcoxon rank sum test was used for pairwise comparisons. *P* values for pairwise comparisons were adjusted for multiple comparisons.

Soap and CHG were equally effective at preventing initial contamination of the basins compared with tap water ($P < .0001$; Figure 1*A*). Combining results of the 4 tested bacterial species, the median bacterial counts were 0, 0, 0.22, and 198.9 CFUs/cm^2 for CHG-A, CHG-B, soap, and tap water, respectively. The *qac*-positive MRSA strain was recovered in slightly higher numbers in CHG-A and CHG-B compared with the other bacterial species (median, 0.5 CFUs/cm^2 for MRSA vs 0 CFUs/cm^2 for other bacterial species; $P = .057$). The negative control basins (tap water without bacterial inoculum) yielded extremely low values in both the immediate effect and the residual effect tests, and data are not reported. CHG-A and CHG-B had a marked residual effect on bacterial contamination compared with soap or tap water ($P < .0001$; Figure 1*B*). Combining results of the 4 tested bacterial species, the median bacterial counts were 0.17, 0.22, 41.7, and 1,407 CFUs/cm^2 for CHG-A, CHG-B, soap, and tap water, respectively. There was no significant difference in residual activity between CHG-A and CHG-B. When results from basins containing CHG-A and CHG-B were combined, there was no difference in median bacterial counts for the 4 tested species of bacteria ($P = .23$).

Basins used to administer bed baths may become contaminated with bacteria during the bathing process or when the basins are used for other purposes.[1-3] Contaminated basins may serve as a reservoir for potential pathogens and have been implicated in catheter-associated urinary tract infection.[3] CHG is bactericidal against a broad range of pathogens and is increasingly used in infection prevention practices.[4] Patient CHG bathing has been associated with a decrease in the incidence of central line–associated bloodstream infection as well as infection due to MRSA, vancomycin-resistant enterococci, and *Clostridium difficile*.[5-7] We hypothesized that the broad-spectrum antimicrobial activity of CHG and its long-lasting residual effect[8] might reduce the risk of basin contamination if the basins were used to administer a CHG bed bath. Our findings indicate that both soap and CHG inhibit the initial contamination of the basin during simulated bathing. CHG is known to have long-lasting residual antimicrobial activity on human skin.[4] Similarly, strong residual activity was noted on the surface of the plastic basins used in our simulated CHG bed bath assay. The CHG residual activity was in marked contrast to the minimal residual activity noted for soap. Limitations of our study include that it is a laboratory simulation of a clinical event, that it utilized 4 bacterial species that may not reflect the complex microbiology involved in basin contamination, and that the inoculum size could be greater in a bed bath of a patient with heavy skin contamination.

Although high-level bacterial resistance to CHG has not been documented, strains of MRSA that are less susceptible to CHG due to *qac*-mediated efflux pumps are prevalent.[8,9] We noted that in the immediate effect assay *qac*-positive MRSA were recovered slightly more frequently than other bacterial species. However, this trend was not observed in the residual activity assay. It should be noted that the mean bactericidal concentration of CHG for *qac*-positive *S. aureus* is approximately 2–4-fold higher than strains that do not possess *qac* genes but remains less than 0.01% (wt/vol).[8,10] The concentration of CHG in the simulated bed bath was approximately 1.2 mg/mL, which would exceed the mean bactericidal concentration of a *qac*-positive *S. aureus* by at least 10-fold. Although these data are reassuring, institutions that utilize CHG for patient bathing should be vigilant for the emergence of CHG-resistant *S. aureus*.

In conclusion, CHG used in simulated bed baths exerted a strong antibacterial effect that inhibited bacterial colonization of the plastic bath basins for at least 3 hours. Basins used to administer CHG bed baths are not likely to serve as bacterial reservoirs for nosocomial transmission.

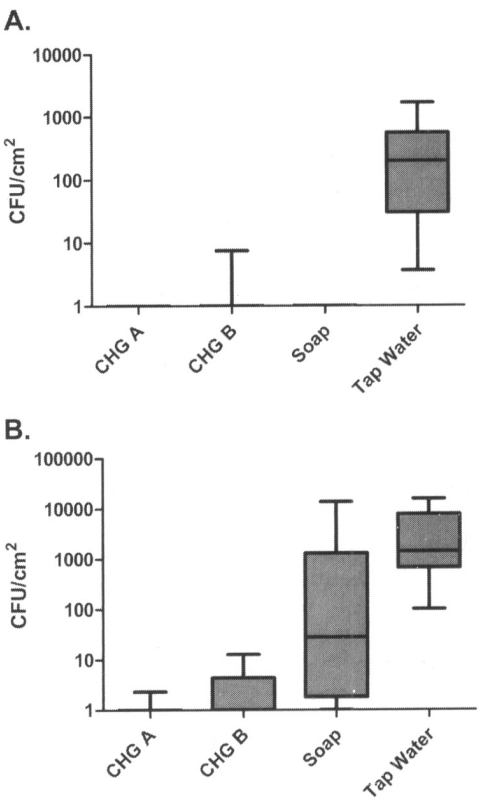

FIGURE 1. *A*, Immediate effect of chlorhexidine (CHG) or soap on bacterial colonization of plastic bed bath basins. *B*, Three-hour residual effect of CHG or soap on bacterial colonization of plastic bed bath basins. Lines within boxes indicates median values, boxes indicate 25th and 75th percentiles, and error bars indicate minimum and maximum values. All values expressed as colony-forming units (CFUs) per square centimeter.

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