Handwashing with Contaminated Soap Results in Hand Contamination and Transfer of Bacteria

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Abstract

BACKGROUND/OBJECTIVE: Previous studies establish that open refillable bulk soap dispensers are often contaminated with species of *Klebsiella* and/or *Serratia* bacteria. In this study we evaluate whether these bacteria remain on the hands after handwashing and assess whether they can be transferred to other surfaces. **METHODS:** Hands were sampled using the glove juice method before and after handwashing with contaminated or uncontaminated soap. In addition, some participants touched an agar surface. **RESULTS:** No *Klebsiella* or *Serratia* were detected on the hands before using the test soaps or after using the uncontaminated control soap. Between 15 and over 190,000 of the marker bacteria remained on each hand exposed to the contaminated soaps and the transfer of the bacteria was visible on the agar touch plates. **CONCLUSIONS:** Use of contaminated soap may contribute to the transmission of opportunistic pathogens such as *Klebsiella pneumoniae* and *Serratia marcescens*.

Background

Bulk Sealed

Permanently mounted soap dispensers provided in public restrooms can be refilled either with sealed cartridges/bags or by pouring soap from a larger bulk container such as a gallon jug. Since soap contaminated with bacteria has been linked to outbreaks, the CDC recommends against the use of bulk soap dispensers in healthcare settings. However, in non-healthcare settings, bulk dispensers are still quite common and are often contaminated. Recent reports have found that 23-25% of open refillable bulk soap dispensers found in public restrooms are contaminated with unsafe levels of potentially pathogenic organisms. Sealed dispensing systems were free from contamination. With a growing immunocompromised population, it is prudent to investigate how remediation of this unnecessary health risk could reduce the risk of community-acquired infections. The objective of this study was to evaluate whether bacteria from contaminated soap remains on the hands after handwashing and to assess whether they can be transferred to other surfaces.

Methods

A laboratory simulation of handwashing with contaminated bulk soap was conducted. The testing methods were based on a modification of the FDA Tentative Final Monograph (TFM) for Effectiveness Testing of an Antiseptic Handwash or Health Care Personnel Handwash (FR59:116, 17 June 1994, pp. 31448-31450). Soap formulation chemistry, bacteria used, and levels of soap contamination tested simulated contaminated bulk soap found in public rest rooms. Two different handwash methods were tested. In the first study the handwash was designed to mimic an ideal procedure, e.g. one conducted by a healthcare worker (5 mL of soap, 30 sec wash, 30 sec rinse). In the second study the handwash was modeled after the typical washing behavior observed in the general public (1.5 mL of soap, 10 sec wash, 10 sec rinse). A total of 5 soap samples were tested; one uncontaminated control, one sample contaminated with *Klebsiella pneumoniae*, and three samples contaminated with *Serratia marcescens*. *Klebsiella* and *Serratia* were used since they were two of the most common types of bacteria found in contaminated bulk soap, accounting for over 2/3 of all contaminants. Contaminated samples were prepared by repeatedly inoculating unpreserved soap formulations with bacteria until the soap became contaminated. A range of levels of contamination were tested from relatively low (<10,000 CFU/mL, <4 Log_{10}CFU/mL) to high (>10,000,000 CFU/mL, >7 Log_{10}CFU/mL) bacterial contamination. The number of contaminating bacteria on both hands of 6 participants were measured before and after handwashing with each test soap (N=12) using the glove juice method. In addition, after washing with each soap 1 or 2 participants touched an agar surface with one or both of their hands (N=2 or N=4).

Results

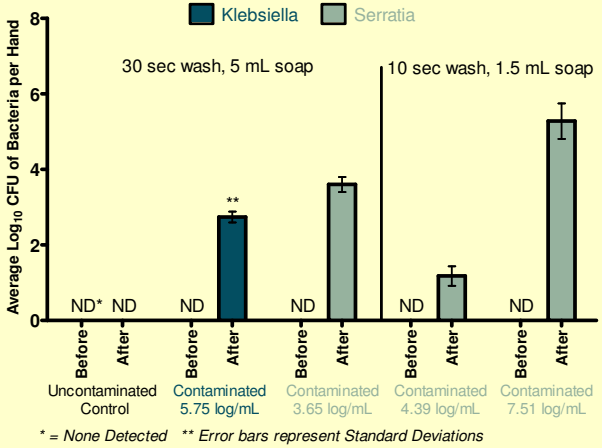
✓None of the participants had detectable amounts of *Klebsiella* or *Serratia* on their hands before washing

✓No *Klebsiella* or *Serratia* were detected on hands after washing with an uncontaminated control soap

✓After handwashing with contaminated soap between 15 to over 190,000 bacteria from the soap remained on each hand (averaging from 1.18 to 5.28 Log_{10} CFU).

✓Use of soap with the highest contamination level resulted in the greatest contamination level on the hands.

Bacteria on the Hands Before and After Handwashing with Contaminated Soap



* = None Detected ** Error bars represent Standard Deviations

✓Both *Klebsiella* and *Serratia* from the contaminated hands of participants were transferred to agar surfaces following handwashing with contaminated soap.

Conclusions

✓**Washing hands with contaminated soap results in contamination of the hands and transfer of the bacteria to surfaces.**

✓**Contaminated bulk soap may contribute to the transmission of opportunistic pathogens such as *Klebsiella* and *Serratia.***

✓**Further research is needed to evaluate the public health risk of using contaminated bulk soap by patrons of public restrooms.**