PREVIOUS PRESENTATION. These data were presented in part at IDWeek 2017 on October 7, 2017, in San Diego, California, in the following poster (2170): Voskertchian A, Akinboyo I, Johnson J, Colantuoni E, Sick-Samuels A, Aucott SW, Milstone AM. Association of Active Surveillance and Decolonization Program on Incidence of Clinical Cultures Growing *Staphylococcus aureus* in the Neonatal Intensive Care Unit.

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Comparison of Two Glove-Sampling Methods to Discriminate Between Study Arms of a Hand Hygiene and Glove-Use Study

In the absence of a gold standard for sampling gloved hands, we aimed to compare direct-imprint versus sponge-stick sampling methods to identify an effective glove-sampling method with the ability to detect a difference between the 2 study arms (Figure 1).

METHODS

This study, approved by the University of Maryland, Baltimore Institutional Review Board, was performed in 2 units at the University of Maryland Medical Center in Baltimore, Maryland. This study is imbedded in a randomized trial in which healthcare personnel (HCP) entering contact precaution rooms are randomized to either intervention or usual care. Intervention participants are directed by research staff to cleanse gloves with alcohol-based hand rub (ABHR) at each World Health Organization (WHO) hand hygiene opportunity.[1] For usual care, HCP behavior at each WHO hand hygiene opportunity is silently recorded. We excluded HCP if they were providing care for patients with *Clostridium difficile* or if they previously participated. The primary outcomes were (1) total colony-forming units (CFUs) and (2) presence of pathogenic bacteria.

In both study arms, at the last hand hygiene opportunity before exiting the room or after the HCP had completed 7 opportunities, gloved hands were sampled to assess bacterial contamination. One hand of each HCP was sampled using the sponge-stick method (3M, St Paul, MN), and the other hand was sampled by direct imprint of the glove onto a 150-mm tryptic soy agar (TSA) plate (Teknova, Hollister, CA), with the right hand being randomized to receive one or the other method.

In the sponge-stick method, the large flat side of the sponge was used to make vertical overlapping "S" strokes and then flipped to make horizontal overlapping "S" strokes along the palmar side of the hands, fingers, and thumb. Next, each finger and thumb were sampled using 3 upward strokes per digit and then 3 downward strokes using the opposite thin edge of the sponge. Last, using the tip of the sponge, the fingertips were sampled 3 times each. In the direct imprint method, the research team instructed the HCP to imprint for 5 seconds their gloved fingertips, thumb, and palm.

Direct agar imprint samples were incubated overnight, and colony counts were performed. Sponge-stick samples were processed as previously described.[2] From the eluent, 1/10 dilutions were made. Each dilution was plated on TSA in triplicate for quantitative culturing. Plates were incubated overnight, colonies were counted, and the number of CFUs per milliliter was then calculated.

For each sampling method, CFUs and presence of bacteria were compared across study arms to detect differences between the intervention and the usual care arm (Figure 1). The results from each sampling method were then compared to detect a difference among the differences. For example, we assessed for a difference in total colony counts between intervention and usual care using the sponge-stick sampling method and then assessed for a difference using the direct imprint sampling method. The Wilcoxon rank-sum test was

used to compare the median distribution of CFUs recovered. The differences between the categories of presence of bacteria were analyzed using a Fisher exact test for each method.

RESULTS

A total of 42 HCP were enrolled in the study. During each patient encounter, HCP reached a median of 3 WHO hand hygiene moments before their gloves were sampled. The average time spent sampling for sponge stick was 20 seconds, and for the TSA plate it was 13 seconds. When comparing the intervention versus usual care using the direct imprint method, the median CFU values were 2 and 31, respectively ($P < .01$). For the sponge-stick method, the median CFU values were 1 and 6, respectively ($P = .25$). When comparing the number of gloves positive for bacteria in each of the arms, the direct agar method detected bacteria on 16 of 25 gloves (64%) in the intervention and 17 of 17 gloves (100%) in the usual care arm ($P < .05$). Using the sponge stick method, bacteria was detected on 16 of 25 gloves (64%) in the intervention and 15 of 17 gloves (88%) in the usual care arm ($P = .15$).

DISCUSSION

In this study, in the absence of a gold standard, we compared two glove-sampling methodologies, direct imprint and sponge stick, to detect a difference between two arms in our study relative to CFUs and the presence of bacteria. With the direct-imprint method, we detected a significant difference in both outcomes between the intervention and usual care groups. With the sponge-stick method, we did not detect a significant difference.

Prior to this study, few data were available on microbial sampling of gloved hands, and no gold standard exists. The glove-juice method is recognized as a standard for microbial sampling of hands, but not for sampling gloved hands.[3–5] In the glove-juice method, the participant places a hand in a sterile glove and sampling solution is added. The hand is vigorously massaged for 1 minute. The broth is then cultured for bacteria. The glove-juice method cannot be employed for sampling gloves during patient care because it would not only sample the glove but also bacteria on the HCP's hands. The use of this method would also be more disruptive to patient care and likely not tolerated by clinicians during a clinical study.

This study is limited by its small sample size. Possibly, with a larger sample, a difference between the 2 study arms would also be detected using the sponge-stick method. However, the direct imprint method has a shorter sampling time and a shorter laboratory processing time. It is also a less expensive method, making it preferable overall. Our data also support the use of the direct imprint method for the culturing of gloved hands.

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