Increasing hand hygiene compliance (HHC) has been shown to decrease rates of nosocomial disease. Although adoption of waterless hand sanitizer dispensers has led to increased HHC, the ultimate goal of universal compliance has not been reached. A 2009 multi-center study assessing hand hygiene (HH) found a baseline compliance of 26% in intensive care units (ICUs) and 36% in non-ICU settings. Bischoff et al. demonstrated that technical improvements can increase HHC. In that study, an education/feedback program coupled with sink and soap handwashing failed to improve HH. However, HHC increased (23%-48%) following the introduction of a novel agent-dispensing lever functions as a doorknob. The device is installed on a door replacing the doorknob, and each time the door handle is used to open the door, waterless hand sanitizer is dispensed into the user’s hand. In agreement with prior studies, this new device has the potential to increase HHC by minimizing barriers to handwashing.

We conducted a pilot study to determine the feasibility of use of a sanitizer-dispensing door handle, and to compare the HHC between the standard wall-mounted dispenser and the sanitizer-dispensing door handle. We hypothesized that HHC would improve with the sanitizer-dispensing door handle.

METHODS

Our protocol was approved by the institutional review board. This study was conducted over a 2-week period at 1 of our institution’s hospital inpatient ultrasound locations composed of 3 examination rooms. A single water sink and soap dispenser and 4 wall-mounted hand sanitizers are available for HH in the clinical area. During week 1—the control week—baseline HHC rates for each exam room were determined. During week 2—the trial week—a sanitizer-dispensing door handle (TurnClean, Altitude Medical, Inc, Baltimore, MD) was installed in 1 of the examination rooms, and compliance rates were reassessed for the trial room and the 2 control rooms.

The department personnel participated in a 20-minute training session to learn about the new device and practice using it before the trial week. Standard hospital-issued HH signs were posted in the hallway outside of the examination rooms, but not on the exam room doors, during the control and trial weeks. During the trial week, standard hospital-issued HH signs were posted in the hallway outside of the examination rooms, but not on the exam room doors, during the control and trial weeks. During the trial period, we compared the HHC for a traditional wall-mounted unit and a novel sanitizer-dispensing door handle device in a hospital inpatient ultrasound area. HHC increased 24.5%-77.1% (P < .001) for the exam room with the sanitizer-dispensing door handle, whereas it remained unchanged for the other rooms. Technical improvements like a sanitizer-dispensing door handle can improve hospital HHC.

Key Words:
Nosocomial disease
Handwashing
Infection control
week, a diagram depicting proper use of the sanitizer-dispensing door handle was placed on the trial room door. HHC was defined as using a wall-mounted hand sanitizer or the sink and soap before entering the examination room during the control week, and as using a wall-mounted sanitizer or sink and soap or the sanitizer-dispensing door handle during the trial week. Hourly HH rates were calculated based on the percentage of time a hand hygiene event occurred before entering a patient care area for all exam rooms in use between 8 AM and 6 PM. Two alternating volunteers who were not known to the personnel were placed in an inconspicuous location to monitor HH while not altering behavior.

Using a 2-tailed t test, the mean hourly HHC rates were compared for the trial room at baseline and the control rooms at baseline, the trial room and the control rooms during the trial week, the control rooms during the trial week and at baseline, and the trial room before and after the installation of the sanitizer-dispensing door handle. Significant difference was rated as $P < .05$.

### RESULTS

The hourly HHC for the control and the trial week for all 3 ultrasound examination rooms is depicted in Table 1. The HHC rate in the trial room was not 100% because some staff left the exam room door open between the different patient encounters.

The mean hourly HHC rate was the same for the trial room and control rooms at baseline ($P = .19$), increased in the trial room compared with the control rooms during the trial week ($P < .001$), remained unchanged in the control rooms during the 2 weeks ($P = .11$), and increased in the trial room after the installation of the sanitizer-dispensing door handle (24.5% vs 77.1%; $P < .001$).

### DISCUSSION

Similar to prior studies, we found suboptimal baseline HHC at our clinic. The introduction of a sanitizer-dispensing door handle led to a significant improvement in HHC—from 24.5% at the baseline measurement to 77.1% during use of the trial door handle. Our preliminary results demonstrate the feasibility of use of a sanitizer-dispensing door handle in a clinical setting as well as the resulting improved HHC. The improvement in HHC likely stems from the more integral incorporation of handwashing into the daily clinical workflow by making handwashing synchronous with door opening. This hypothesized explanation of the improved handwashing compliance is supported by prior literature that has demonstrated that ergonomics and proximity are important factors in HHC. The goal of our pilot study was to conduct the initial assessment of a novel device. A more comprehensive trial is needed to fully determine the long-term benefit of a sanitizer-dispensing door handle above and beyond that of a traditional wall-mounted dispenser. Other factors such as personnel training level; personnel satisfaction of use; hospital ward acuity level; and the use of a specific cleaning agent, previously identified as having an significant impact on HHC. Other studies have also suggested that the use of a specific cleaning agent, previously identified as having an

### Table 1

<table>
<thead>
<tr>
<th>Hourly HHC</th>
<th>Mean rate</th>
<th>Min rate</th>
<th>Max rate</th>
<th>Hand hygiene events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control week</td>
<td>Room 1 (control)</td>
<td>21.8</td>
<td>0</td>
<td>42.9</td>
</tr>
<tr>
<td></td>
<td>Room 2 (trial)</td>
<td>24.5</td>
<td>0</td>
<td>66.7</td>
</tr>
<tr>
<td></td>
<td>Room 3 (control)</td>
<td>18.0</td>
<td>0</td>
<td>42.9</td>
</tr>
<tr>
<td>Trial week</td>
<td>Room 1 (control)</td>
<td>14.8</td>
<td>0</td>
<td>38.4</td>
</tr>
<tr>
<td></td>
<td>Room 2 (trial)</td>
<td>77.1*</td>
<td>66.7</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>Room 3 (control)</td>
<td>12.2</td>
<td>0</td>
<td>42.9</td>
</tr>
</tbody>
</table>

*Statistically significant improvement in HHC between the control and the trial week.
effect on HHC, also need to be considered in future research. Future studies could also explore the influence of the door handle dispensing system on the HHC rates among nonmedical employees, visitors, and patients—groups that pose special challenges in hospital-wide handwashing initiatives.

Due to the way our ultrasound clinic is set up, entering the room for patient examination represents the vast majority (>95%) of indications for HH. However, there may be situations during an exam that would require additional handwashing with the use of wall-mounted dispensers or sink and soap inside of the room. Therefore the utility of a sanitizer-dispensing door handle may not be broadly applicable to all clinical settings and no 1 device will ever comprehensively ensure adherence to the World Health Organization guidelines. Different strategies for HH such as educational campaigns, compliance monitoring, and resource placement optimization combined with technological solutions like the 1 examined in this study will be required to achieve and sustain optimal results.

Introduction of a new HH technology like the door handle can be expensive. Based on our communication with the manufacturer, the cost of a sanitizer-dispensing door handle unit is comparable to that of a standard hospital door handle of a similar durability. Similarly, the replacement cartridges for the device are priced in line with Purell (Johnson & Johnson, New Brunswick, NJ) cartridges for wall-mounted sanitizers. For an average 200-bed US hospital, the manufacturer estimates, the installation of the sanitizer-dispensing door handles would cost approximately $30,000 with an additional expected annual maintenance cost of approximately $60,000. Because health care-acquired infection has been estimated to cost $9,000-$19,000 per year, the door handles would have to prevent 5-10 infections each year in that hospital to be considered income neutral.

Our study has limitations. We tested a small number of examination rooms in a single clinical setting over a short period of time. Due to the short duration of our study, a significant variability in the patient volume was observed between the control and trial week—during the trial week the clinic was simply less busy. To our knowledge, there is no difference in the use of the 3 different examination rooms. The installation of a door handle device may result in variable HHC, especially if door opening is not required to initiate a patient encounter. We tested a door handle device model that dispenses hand sanitizer upon opening the door; however, there is another model from the same manufacturer that includes door handle dispensers on both sides of the door, thus facilitating HH with entrance to and exit from a patient room. Our study also may have benefited from the novelty effect of the device, and the long-term benefits of a sanitizer-dispensing door handle are unclear. Over time, personnel may discover workarounds and bypass the door handle dispenser. Also, we did not survey the practitioners’ satisfaction with use of the device; even the best technological solution can be boycotted by unhappy users. The observed incremental improvement in HHC was likely exaggerated due to the low baseline compliance. Finally, we did not measure the effects of increased HHC on microbial loads with hand swabs/cultures nor on the rates of nosocomial disease.

The drastic improvement in HHC rate seen in our study highlights the important role that technical improvements can play in multidisciplinary efforts to improve handwashing and to reduce nosocomial infections.

References