American Journal of Infection Control ■■ (2016) ■■-■■

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major articles

Effectiveness of an extended period of flashing lights and strategic signage to increase the salience of alcohol-gel dispensers for improving hand hygiene compliance

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Key Words:
Infection control
human factors
hand hygiene
flashing lights

Background: Multiple factors affect compliance with hand hygiene, including conspicuity of alcohol-gel dispensers. Previous studies have shown that flashing lights increase hand hygiene compliance; however, the durability of this effect has not been studied.

Methods: We affixed flashing lights to hand sanitizer dispensers for a total of 6 weeks. Regression analysis was used to compare compliance rates between the beginning and end of the intervention. Our secondary objective was to determine whether compliance rates in cold weather could be improved by adding a sign separated in time and space from the dispensers.

Results: Flashing lights improved hand hygiene compliance from 11.8% to 20.7%, and this effect was unchanged over the 6-week study period. Fully charged lights resulted in a greater compliance increase. A preemptive sign did not have a significant effect on hand hygiene rates nor did absolute temperatures.

Conclusions: Flashing lights are a simple, inexpensive way of improving hand hygiene. Brighter lights appear to have a greater effect; however, this must be balanced with annoyance in specific settings. Temperature did not have a significant effect; however, this may be because the relationship does not fit a linear model. Other interventions, such as signs, may need to be tailored specifically to individual hospital environments.

The hospital environment is information-rich, attention-seeking, and distracting, with many signs, colors, ambient noises, frequent alarms, and public address system announcements. Our hospital's main entrance has flashing lights at the automated teller machine, auditory cues directing attention to parking payment machines, and many other directions, posters, and signs. Additionally, individuals entering the hospital may be easily distracted or preoccupied by their cellphones, bags, coffee mugs, and gloves. Consequently, hand alcohol-gel dispensers, inconspicuous objects in most hospitals such as ours, are easily and frequently ignored.

Previous work by our group demonstrated that baseline hand hygiene compliance at our hospital's entrance was 12.4%[1]; another study showed hand hygiene rates as low as 0.52% at baseline at their hospital entrance.[2] Several studies have explored methods of improving hand hygiene compliance. The design and location of hand sanitizer dispensers are important factors. Birnbach et al increased compliance at their hospital entrance from 0.52% to 11.67% by locating freestanding hand sanitizer dispensers and adding signs in the lobby.[2] Cure et al looked specifically at the characteristics of various dispensers and found visibility and accessibility were significant factors affecting compliance.[3]

We previously established that increasing the conspicuity of alcohol-gel dispensers with a flashing red light over a 1-week period doubled hand hygiene rates from 12.4% to 25.3%.[1] It was uncertain whether our intervention for increasing attention to alcohol-gel dispensers would have a durable effect on handwashing beyond 1 week. Individuals could become accustomed to the change in environment and return to baseline hand hygiene rates. Our primary objective was to determine how long flashing red lights could sustain hand hygiene compliance.

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Conflicts of interest: None to report.

0196-6553/
http://dx.doi.org/10.1016/j.ajic.2016.01.002

Our previous study found that colder temperatures resulted in worse hand hygiene compliance at the hospital entrance, possibly because of an increased proportion of individuals wearing gloves.[1] We hypothesize that placing signage explicitly directing individuals to remove gloves and wash hands on entering the building will increase hand hygiene compliance during winter months. In fact, the signs should be placed before the dispensers in an attempt to forewarn individuals, a concept known as positive guidance,[4] similar to traffic signs on highways warning drivers of upcoming exits or turns. Therefore, our secondary objective was to determine if a preemptive sign placed before the dispensers directing people to remove their winter gloves would further improve hand hygiene compliance.

METHODS

We observed handwashing at the main entrance of the General Campus of The Ottawa Hospital, the same location as in the previous study by our group. This location allowed us to observe numerous hand hygiene opportunities in a short time period. Approval from the hospital's research ethics board was obtained before study initiation.

We used the secret shopper methodology to observe individuals. Handwashing events, regardless of the technique, were counted from 7:30-8:30 AM Monday-Friday for 1 week prior to intervention (January 19-23, 2015) to obtain a mean control hand hygiene rate. Eight hand alcohol-gel dispensers were located on 4 sides of 2 separate stands; flashing red lights were installed on the 2 dispensers facing the entrance doors to the hospital (Fig 1). Lights remained flashing for the entirety of the intervention period (6 weeks, from January 25-March 6, 2015). Handwashing events were again counted from 7:30-8:30 AM Monday-Friday during weeks 1 (January 26-30, 2015), 3 (February 9-13, 2015), 5 (February 23-27, 2015), and 6 (March 2-6, 2015) of the intervention period.

Four bicycle lights, costing CaD$50, were used for our study. The lights included lithium-ion batteries, advertised to provide 28 hours of flashing life between charges; on testing by our group, they lasted >72 hours. Two lights were installed at a time, while the other 2 were being charged. Lights were changed every 24-48 hours to ensure that lights would remain flashing for the duration of the intervention.

In our previous study, we noted that our lights were tampered with by individuals when affixed with putty. Because of the longitudinal nature of this study, a researcher was not present for most of the time the lights were deployed to prevent such tampering. We secured the lights using translucent plastic containers attached to the stands directly above the hand alcohol-gel dispensers (Fig 2).

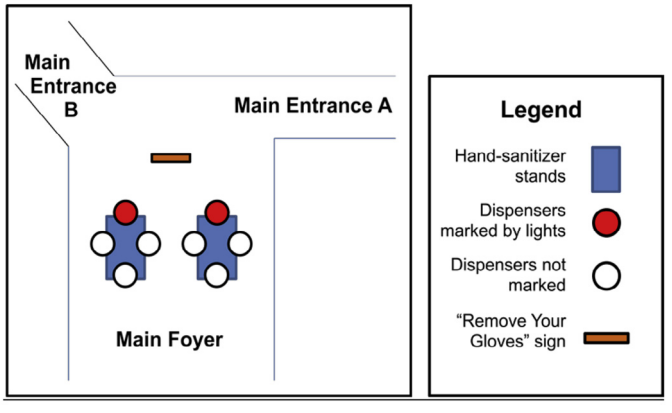

Fig 1. Layout of the alcohol-gel dispensers at The Ottawa Hospital, General Campus.

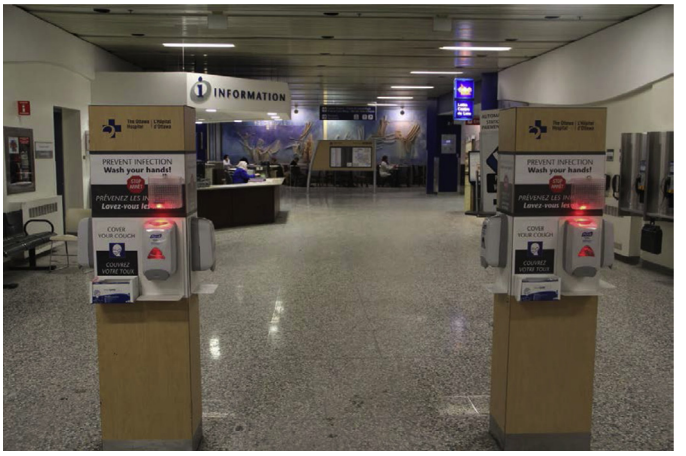

Fig 2. Picture of the flashing lights installed, locked into the plastic containers on top of the alcohol-gel dispensers.

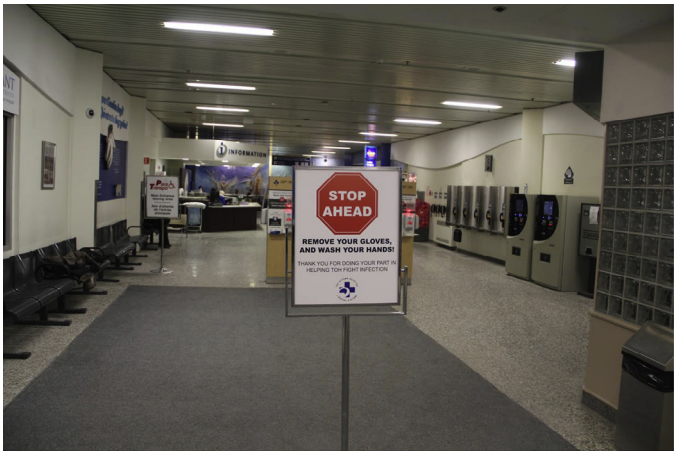

Fig 3. Picture of the preemptive sign directing individuals to remove winter gloves.

To test our secondary objective, a sign was placed approximately 10 m ahead of the alcohol-gel dispensers during the fifth week of the intervention. This sign informed individuals of the upcoming opportunity for handwashing and directed them to remove their winter gloves or mitts (Fig 3).

As in our previous study, temperatures were recorded for each day of observation based on reports from Environment Canada. The published temperature for the City of Ottawa at 8:00 AM was used for each study period. At the end of the study period, snowfall reported by Environment Canada for the City of Ottawa at 8:00 AM was also retrospectively recorded.

We used a *t* test to compare the percent of people washing their hands on days when lights were deployed and the percentage during the control period prior to lights deployment. A linear regression model was used to determine if the increase in hand hygiene compliance was sustained over the 6-week study period. A linear regression model was also used to determine if temperature had an effect on hand hygiene. To determine if placing a sign ahead of the dispensers further improved hand hygiene compliance, a *t* test was used to compare the week when the sign was deployed with all other weeks when only the lights were deployed.

After the first week of the intervention, it was noted that there was variation in hand hygiene rates when lights were exchanged with fully charged ones. Lights were noted to be considerably brighter when they were fully charged compared with when they had already