Observation-based evaluation of hand hygiene practices and the effects of an intervention at a public hospital cafeteria

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Abstract

Background: Hand hygiene is important before meals, especially in a hospital cafeteria where patrons may have had recent contact with infectious agents. Few interventions to improve hand hygiene have had measureable success. This study was designed to use a poster intervention to encourage hand hygiene among healthcare workers (HCWs) and hospital visitors (HVs) upon entry to a hospital cafeteria.

Methods: Over a five-week period, a poster intervention with an accessible hand sanitizer unit was deployed to improve hand hygiene in a hospital cafeteria. The dependent variable observed was hand hygiene attempts. Study phases included a baseline, intervention and follow-up phase, with each consisting of 3 randomized days of observation for 3 hours during lunch.

Results: During the 27 hours of observation, 5,551 participants were observed and overall hand hygiene frequency was 4.79%. Hygiene attempts occurred more frequently by HCWs than HVs (p=0.0008), and females than males (p=0.0281). Hygiene attempts occurred more frequently after poster introduction than baseline (p=0.0050), and this improvement was due to an increase in frequency of HV hand hygiene rather than HCW hand hygiene.

Conclusions: The poster intervention tool with easily accessible hand sanitizer can improve overall hand hygiene performance in a U.S. hospital cafeteria.

Background

For hospital cafeteria patrons, hand hygiene is especially important in the prevention of spreading infection. The hands of healthcare workers (HCWs) and hospital visitors (HVs) may become contaminated with potentially pathogenic bacteria (1) or viruses (2) through exposure to infected patients or from contaminated hospital surfaces such as registration counters, elevator buttons, escalator handrails, and other public surfaces (3). The public hospital cafeteria is a communal environment where bacterial and viral agents could be shared and acquired by patrons if proper hand hygiene is not practiced. This in turn, could lead to hospital-acquired infection (HAI) of patients treated or visited by HCWs and HVs. With viruses estimated to account for approximately 60% of all human infections (4), and the transfer of viruses to food during food handling an important route of spread of viral gastroenteritis (2), prevention of infection should be the main route of control. In community settings, such as hospitals, it is generally acknowledged that person-to-person transmission of infectious disease is associated with airborne and surface-to-surface transmission, as well as poor hygiene practices (2). U.S. Centers for Disease Control and Prevention (CDC) recommends hand hygiene prior to eating to prevent the spread of infection and illness (5). However despite this recommendation, compliance with hand hygiene procedures remains low, with rates generally below 50% of hand hygiene opportunities (6-8).

Handwashing compliance is defined as the ratio between hands washed or sanitized and total number of handwashing opportunities. Due to low compliance rates, multidrug

resistant bacteria (9) and viruses can be transmitted by HCWs (10). Many factors may contribute to low compliance by HCWs with hand hygiene procedures, including access to hand hygiene supplies, skin irritation from hand hygiene agents, inadequate time, interference with patient care, lack of information on the importance of hand hygiene, and lack of knowledge of hand hygiene guidelines (11). However, these studies have focused on hand hygiene in the hospital ward, and may not consider compliance barriers for HCWs outside of the ward, such as communal dining areas, where consumption and socializing may be distractions. Numerous efforts have been employed in various studies to overcome hand hygiene barriers, but compliance levels remain low (7, 12-15). Handwashing compliance improvement efforts have focused on increasing availability of proper tools for hand hygiene; education and training; use of prompts such as visual reminders, or peer pressure; and, the presence of others. Intervention studies have shown that increasing the availability of hand sanitizers, or changing the number or location of sinks alone, was not effective at improving compliance rates (16-19). Similarly, there is no evidence that posters or educational materials alone can improve compliance rates (20,21). However, intervention studies using posters have concluded that to be effective, posters should use persuasive, positive and motivating messaging, while including the audience's social context (17, 20). The use of disgust-evoking images may be effective at triggering hand hygiene behaviour (22), while humour or cartoons are not recommended in the hospital setting (20). Improvement of handwashing compliance may require an approach to include the cognitive, emotional and behavioral aspects of HCWs (23,24). This study aimed to implement and test the effectiveness of a hand hygiene campaign among HCWs and HVs in a U.S. hospital cafeteria. Hand hygiene frequency was

evaluated prior to and following implementation of a motivating poster. Alcohol-based hand sanitizer was used as the hand hygiene tool, and positioned in an easily accessible location.

Methods

The study was completed in a hospital cafeteria located in the Midwestern U.S. All observations were anonymous; therefore, the study was given exempt status after review by the Institutional Review Boards of the participating university and hospital. For the purpose of this study, a hand sanitization attempt was considered observed use of foaming antiseptic hadrub (composed of 62% ethyl alcohol) in the cafeteria from the provided sanitizer station. Direct observation was completed by one observer, and used to determine frequency of hand hygiene attempts by HCWs and hospital visitors to the cafeteria. Direct observation is considered the most robust technique for monitoring hand hygiene when completed by trained persons (25). To avoid a Hawthorne effect, where participant behavior is influenced by the awareness of the physical presence of the observer, the researcher was indistinguishable in the busy cafeteria setting.

According to the World Health Organization (25), hand hygiene is any action of hand cleansing, which includes handwashing, antiseptic handwashing, antiseptic handrubbing, or hand antisepsis. Antiseptic handrubbing is defined as application of an antiseptic handrub to reduce or inhibit the growth of microorganisms without the need for a source of water, and no drying or rinsing devices (25), for example, use of hand sanitzer. Although in the U.S., the Food Code published by the Food and Drug Administration (FDA) specifies that hand sanitizer should only be used after washing with soap and

water (26), the CDC has issued hand hygiene guidelines including suggested use of sanitizer for HCWs, and recent studies suggest that hand sanitizer has replaced handwashing as the standard tool for hand hygiene in hospital settings (27).

The observer used a data sheet checklist to record observations. The poster (Figure 1) was designed to increase awareness and knowledge of hand hygiene, while encouraging participants to sanitize hands. The poster included various design techniques that targeted the hospital-population, motivational messaging, and bright graphics (28). Posters, based on food safety infosheets, used clear language, graphics, and included practical advice for participants. Food safety infosheets (www.foodsafetyinfosheets.com) are standalone communication tools designed to meet the specific information needs of food handlers and generate dialogue among this group in their work setting. The infosheets contain a news story about an outbreak of foodborne illness, graphics, and prescriptive information. Pilot testing was completed using the posters and sample cafeteria consumers, in attempt to improve poster efficacy, prior to implementation in the cafeteria setting.

The study was divided into three phases, with each phase further divided into three observation periods of three hours each. Observation periods occurred during the lunchtime rush, from 11 a.m. to 2 p.m., on randomly selected days. This allowed for an average of 3 observation periods per week.

The trained observer collected data on gender, hand hygiene attempts, and noted whether participants were HCWs or HVs. HCWs were defined as those individuals wearing a hospital identification badge, while all other participants were defined as HVs. If the observer was unable to determine whether the individual was a HCW or HV, the individual was coded as unknown (U). Throughout the observation periods, the observer

maintained view of the sanitizer units. Participants remained anonymous and unaware of the observer's presence.

Prior to study commencement one wall-mounted foaming alcohol (62%) sanitizer unit existed in the hospital cafeteria; following study commencement the hospital provided a second freestanding foaming alcohol (62%) sanitizer unit. The first phase of the study was the control or baseline phase, and consisted of three observational periods of three hours. Following the baseline phase a 16 x 20 inch poster was introduced near the pre-existing sanitizer unit at the entrance to the self-serve area of the cafeteria. Poster placement was approximately 5-8 feet from the wall mounted sanitizer unit. An additional freestanding sanitizer unit was placed next to the poster. The poster was displayed for one week prior to subsequent intervention observations. Subsequent observations were collected on three occasions for three hours. To determine the effectiveness of the poster, the poster was removed after the intervention phase for a period of 4 weeks to allow for learning curves where participant information retention or behavior change may be highest. Following the one-month period, observations were completed during the follow-up phase (at three periods of three-hour durations) to determine any continued impact the posters had on hand hygiene frequency.

Descriptive statistics were used to report the effects of subject and gender on the frequency of hand sanitization attempts during the three observation periods. Data was analyzed using logistical regression under a generalized linear model. Individual participants were not assumed to be independent because participants may have entered the cafeteria several times a day, and prior enterers may have influenced participants. As a solution for the lack of independency, instead of treating each individual as an

independent observation, the proportion of sanitization attempts per day were treated as a close-to-independent observation from day-to-day. Additionally, U participants were deleted from the data set and not included in the analysis. This was due to insufficient data for this subject group. Only two (one male and one female) of the 98 observed U participants attempted sanitization, providing insufficient data from which to draw conclusions.

Results

During the nine days of observation, a total of 5,649 participants were observed in the hospital cafeteria. Table 1 displays a breakdown of total participants during the three study phases. U participants (98 in total, with only 2 sanitization attempts) were not included in the data analysis due to insufficient data.

Of the 5,551 participants observed, only 266, or 4.79%, made an attempt to use the provided hand sanitizer. A breakdown of sanitization attempts by study phase are summarized in Table 2. During the baseline, intervention and follow-up phases, sanitization was attempted 3.16%, 4.69% and 6.17% of total opportunities per phase, respectively. There was a significant ($p=0.0050$) difference between sanitization rates during the baseline phase versus the intervention and follow-up phase (combined to compare pre-poster to post-poster). Additionally, there was a significant ($p=0.0115$) difference between sanitization rates during the baseline period and the intervention period, however; no significant difference ($p=0.7879$) was found between sanitization rates in the intervention period and the follow-up period.

Of the 266 sanitization attempts, 241 (90.60%) were completed by HCWs, and 25 (9.40%) by HVs. Sanitization attempts by HCWs and HVs over the three phases is summarized in Table 2. HCWs attempted sanitization on more total opportunities (5.25%) than HVs (2.60%)(p=0.0008).

Sanitization attempts by HVs increased significantly from the baseline to intervention/follow-up phase (p=0.0049). However, no difference was found between HCW sanitization attempts over the three phases (p=0.4798). Overall sanitization rates were higher during the intervention/follow-up phases than during the baseline, however, this increase is due to increased sanitization rates by HV.

Of the 266 total sanitization attempts, 227 (85.34%) were completed by females and 39 (14.66%) were completed by males. A breakdown of sanitization attempts by gender is summarized in Table 3. Females attempted sanitization more frequently than males (p=0.0281).

HCWs attempted sanitization more frequently than HVs (5.25% of opportunities versus 2.60%)(p=0.0008). Additionally, a significant difference (p=<0.0001) was found between male HCW sanitization attempts and female HCW sanitization attempts, with female HCWs attempting sanitization more frequently than male HCWs (5.77% versus 2.99% respectively). However, when sanitization attempts by female HVs and male HVs were compared (3.13% versus 1.84% respectively), there was no significant difference (p=0.5017).

Discussion

The poster interventional tool in this study was found to be associated with an increase in the observed number of hand sanitization attempts by HVs from the baseline to intervention, and this improvement was maintained during the follow-up phase. Sanitization attempts varied between baseline, intervention and follow-up phases, as well as between subject (HCW, HV and U) and gender.

This study found a significant increase (3.16-5.43%) in overall sanitization attempts between the pre- (baseline) and post-poster (intervention/follow-up) periods; however, this increase is primarily due to increased sanitization attempts by HV over the three phases, rather than HV and HCW combined. Sanitization attempts increased from the baseline to intervention phase, however, no significant difference was found between the intervention and follow-up phases. This is consistent with other poster intervention research (29), and may suggest the presence of a learning curve in this poster intervention study, where participant behavior change was most affected during the intervention phase (when the poster first appeared) and gradually evened out during the follow-up phase (after the poster was present for a month). The increase in overall sanitization attempts in this study may be attributed to the poster design. The large poster used bright graphics, clear, and motivating messaging, invoked a sense of responsibility, and offered practical advice encouraging cafeteria patrons to use hand sanitizer prior to eating. Although included in initial designs, disgust-evoking images were not included on the final poster due to a decision by hospital administration. Work by Jenner et al. (19) found that conveying training messages passively on posters does not effect behavior change, but rather they suggest using persuasive messages framed in terms of gains rather than losses, and invoke a sense of personal responsibility. Porzig-Drummond et al. (24) evaluated the

emotion of disgust as a strategy for promoting hand hygiene and determined that compared to education and control intervention videos, the disgust video had modestly improved hand hygiene practice among participants. Furthermore, in a critique of the 'Clean Your Hands Campaign' in England and Wales, Gould et al. (20) found posters and patient reminders to be ineffective; however, when hand hygiene posters included the name of the hospital ward, there was a decrease in HAIs over a four-year period. Although overall sanitization rates generally increased from the baseline to intervention/follow-up phase, the poster was found to affect HCWs and HVs differently. Sanitization attempts by HVs increased significantly from the baseline to intervention/follow-up phase; however, no difference was found between HCW sanitization attempts over the three phases. This may suggest the poster design in this study was better suited to HVs than HCWs. Future posters should be designed and piloted for HVs and HCWs separately for maximum benefit.

This study found low (<10%) sanitization rates across all hospital cafeteria patrons; however, HCWs attempted sanitization nearly twice as often as HVs. This is consistent with previous studies that suggest hygiene rates are generally below 50% of hand hygiene opportunities for HCWs (7,6). However, the cafeteria setting versus a patient-ward setting may account for this result being at the lower end of estimates. In a study of handwashing frequencies in retail food services it was found that hand hygiene rates in restaurants were as low as 5%, but higher in schools (22%), childcare (31%) and assisted living facilities (33%) (8). Other research has found HCWs practice hand hygiene more frequently than non-HCWs (29), and this is expected as the HCW profession emphasizes hand hygiene practices and hand hygiene training.

In addition to subject, gender affected sanitization attempts by participants. Female HCWs attempted sanitization more frequently than male HCWs; however, when sanitization attempts by female and male HVs were compared no difference was found. This may be due to limited observation data for HVs, and may have caused a skew in the results of this study. Considering gender apart from subject, the majority (85.34%) of sanitization attempts were completed by females, and a small portion (14.66%) by males, with females attempting sanitization more frequently than males. This is consistent with other research, and may be due to differing motivating factors between the genders (30-33, 29). Females may be more motivated by knowledge of risk and reminders of why hand hygiene is important; whereas males may be motivated by disgust evoking visuals (30). This suggests that differences in gender motivation should be considered when designing hygiene campaigns.

Although there is no evidence that posters or educational materials alone can improve compliance rates (20, 21), Chapman et al. (28) found that poster-like infosheets targeted towards food handlers changed microbial risk-reduction practices, including hand hygiene. Chapman et al. (28) studied the potential for the novel communication tool to compel food handlers in a food service setting to change their behavior. Infosheets were posted in highly visible locations, such as kitchen work areas and at handwashing stations. Video observation was used to determine that infosheets positively influenced the food safety behaviors of food handlers, as demonstrated through increased handwashing frequency and reduced number of cross-contamination events.

Research suggests that future intervention studies be multifaceted, combine education with written material, reminders, and continued performance feedback (37). If posters are

to be used as visual reminders, the poster used in this study may be improved upon by including disgust-evoking images, the name of the hospital ward involved in its development, and targeted subject or gender. Additionally, similar to infosheets, posters could include brief stories of recent infectious outbreaks in hospitals (28). Future research could focus on HCW hand hygiene behaviors outside of the patient ward, in communal areas such as the hospital cafeteria. Using more direct approaches, such as feedback on practice, using role models and peer pressure, may improve hand hygiene; however these results have not been sustained (37-40). Recent literature has focused on the perceptual, cultural and social influences on hand hygiene behavior (14,16,22,41,42). Education and training may be necessary to address knowledge gaps in proper hand hygiene procedure; future interventions should focus on promoting cultural change.

Communal hospital areas, such as cafeterias, have the potential for cross-transmission of bacterial and viral infections. HCWs, HVs and patients sharing tools and surfaces may unknowingly infect themselves or one another. Bacterial and viral contamination of the hands occur due to the nature of the HCW's job, but appropriate hand hygiene can reduce this contamination and minimize hospital acquired infections (12). HVs and patients should also be aware of their role in infection prevention in the hospital setting, and take appropriate hand hygiene action. Hand hygiene interventions in cafeteria settings could target HCWs, HVs and patients, acknowledging the communal setting a hospital provides and evoking a sense of responsibility for infection prevention.

This study has several limitations. While direct observation is considered the gold standard for monitoring hand hygiene behavior, there is a potential for bias from the Hawthorne effect. Although it was believed participants were unaware of the observer,

there may have been incidences where this was not the case. Additionally, ethical concerns have been raised about covert observation (21). This study monitored sanitization attempts by cafeteria patrons at the food line, however the results do not account for participants that may have sanitized hands elsewhere, such as after using the washroom or at a work station. A third limitation is in the use of only one hospital cafeteria. Hand hygiene compliance varies between hospitals and units within hospitals (43, 29), and therefore for the study to replicable, more hospitals would need to be studied. Another limitation may have been in poster placement. Although the aim was to place posters in a prominent location at the beginning of the food line, placement of pre-existing sanitizers and the cafeteria layout limited this. Further research may be warranted into the ideal placement and number of posters as an interventional tool. Finally, although an increase in hand sanitization attempts was found in this study, these improvements may not be maintained. Intervention studies attempting to increase handwashing compliance in healthcare settings have found increases in compliance in the short term, but follow-up studies indicate deterioration in these compliance rates (44-45). Further studies are needed to evaluate the poster intervention for a sustained improvement on sanitization attempts.

In conclusion, this hand sanitization campaign found that a poster intervention tool with easily accessible hand sanitizer can be marginally successful at improving overall hand hygiene performance of HV in a hospital cafeteria in the U.S.

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Table 1: Observed total participants and sanitization attempts and percentages (%) during the baseline, intervention, and follow-up phases.

Observation phase	Baseline	Intervention	Follow-up	Total
Participant total	1,612	1,897	2,042	5,551
Sanitization attempts and %	51 (3.16%)	89 (4.69%)	126 (6.17%)	266 (4.79%)

Table 2: Observed sanitization rates by subject over the baseline, intervention and follow-up phases.

Observation phase	Baseline	Intervention	Follow-up	Observation total *
HCWs	48/1286 (3.73%)	81/1570 (5.16%)	112/1732 (6.47%)	241/4588 (5.25%)
HVs	3/326 (0.92%)	8/327 (2.45%)	14/310 (4.52%)	25/963 (2.60%)

HCW = Healthcare Worker; HV = Hospital Visitor; *p=0.0008

Table 3: Observed sanitization rates by gender for HCWs and HVs over the baseline, intervention and follow-up phases.

Observation phase	Baseline	Intervention	Follow-up	Observation total*
Males	10/423 (2.36%)	14/491 (2.85%)	15/536 (2.80%)	39/1450 (2.69%)
Females	41/1189 (3.45%)	75/1406 (5.33%)	111/1506 (7.37%)	227/4101 (5.54%)

*p=0.0281

Figure 1: Novel posted designed to encourage hand sanitization in the hospital cafeteria setting.