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Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Brief report

Impact of sink location on hand hygiene compliance for *Clostridium difficile* infection

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Key Words:

Sink location

Clostridium difficile infection

Hand hygiene with soap and water after the care of a patient with *Clostridium difficile* infection is essential to reduce nosocomial transmission in an outbreak situation. Factors that may pose barriers to user completion of infection prevention measures, such as hand hygiene, are of interest. We undertook a quantitative study to evaluate the relationship between sink location and compliance with handwashing among health care workers and visitors in a surgical transplant unit. We found that placement of 2 more easily visible sinks in a surgical transplant unit was associated with improved adherence to handwashing.

Published by Elsevier Inc. on behalf of the Association for Professionals in Infection Control and Epidemiology, Inc.

Clostridium difficile infection (CDI) is a common cause of health care-associated diarrhea and places a significant burden on our national health care system.^{1,2} To prevent the spread of *C difficile*, compliance with infection prevention measures, such as contact precautions and handwashing, is crucial for all persons who come in contact with the infected patient in an outbreak situation.³ The Centers for Disease Control recommendations for hand hygiene for prevention of CDI include handwashing with soap and water and use of gloves and gowns when caring for the patient.⁴ However, a number of barriers to hand hygiene may exist, posing challenges to adherence. These include lack of education and awareness of proper hand hygiene technique and opportunities, inadequate handwashing supplies, lack of visibility and accessibility to sinks, and health care worker experience level.⁵⁻⁷ Adherence to the Centers for Disease Control recommended practices decreases the transmission of infection in health care settings.^{8,9}

As part of CDI reduction efforts in our institution, we found that compliance with hand hygiene in health care workers specifically for CDI was low. After assessment of barriers and facilitators with unit staff through discussions at staff meetings, lack of a readily visible accessible sink was identified as a major barrier to adherence to hand hygiene. We undertook a quantitative study to assess

the impact of sink placement with hand hygiene compliance for *C difficile*.

METHODS

Direct observations to collect data on the infection prevention practices of health care workers and visitors for CDI-positive patients were conducted on a single transplant medical-surgical unit at a large academic medical center. Observations were collected from June 7–July 1, 2014, at various times during both weekdays and the weekend. All individuals entering patient rooms were observed and documented, including nursing staff, medical staff, visitors, nutritionists, food service workers, pharmacists, occupational therapists, and laboratory staff.

A single trained observer performed direct observations outside of patient rooms under contact isolation precautions for *C difficile* for no longer than 3 hours at a time. Health care workers caring for patients under contact isolation precautions were not made aware of the observer's presence, and the observer was not a part of the hospital's infection control team.

Current infection control policies for CDI-positive patient rooms at our institution are described as follows. Prior to entering the patient room, individuals must perform hand hygiene using an alcohol containing hand gel and put on gloves and a gown. Before exiting the patient room, all persons must remove their gown and gloves and wash their hands with soap and water. Individuals that completed each step of the precautions were considered fully

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Conflicts of interest: None to report.

compliant. If an individual failed to complete each step of the isolation precautions they were considered to be noncompliant. An individual was considered partially compliant if they completed some, but not all of the contact isolation precaution protocol. As part of the assessment of barriers and facilitators of hand hygiene, it became apparent that health care workers were not using the sink inside the patient room because of clutter, lack of hands-free foot pedals, and concern that the faucet handles may be contaminated with *C difficile* spores. Therefore, the usual practice was to remove personal protective equipment inside the room but perform hand hygiene with soap and water outside the patient room. Subsequently, the observer was instructed to conduct observations outside the room on exit.

Time was measured for each component of the contact isolation precautions. Time before was considered as the time taken to put on gloves and a gown and perform hand hygiene prior to entering the patient room. Time in the room was counted as the time that an individual spent in the patient room prior to removing any personal protective equipment or performing hand hygiene. Time after included the removal of gowns and gloves and completion of hand hygiene on exiting the patient room.

Although there were 36 sinks on the unit before our intervention, all but 2 of them were in the patient rooms. Each patient room had a sink, but it was not used by health care workers because of patient clutter, lack of access because of the presence of furniture, or general unfamiliarity with the patient room layout. There have been many institutional initiatives over the years to reduce clutter in patient rooms; however, these have not been successful. In the unit under study, a transplant patient's length of stay is >7 days; therefore, it remains difficult to minimize clutter around the existing sinks. The 2 hallway sinks were located at the end of the hallways and were not readily visible from most patient rooms. Subsequently, 2 additional sinks were placed in highly visible locations on the unit. These sinks included foot pedals for ease of use and convenience. Each sink was equipped with proper and adequate supplies for handwashing. The location of the sinks was chosen after walk rounds were conducted with engineering, facilities planning, infection control, and unit staff to determine the optimal locations for sink placement based on workflow. Post-intervention, the observations were conducted after the sinks had been in place for 6 months. The time periods observed before and after were approximately the same, pre- and postimplementation.

A pooled *t* test was used for testing differences in time proportions. Contact isolation precaution compliance was analyzed using a χ^2 test. *P* value <.05 was the threshold for statistical significance. SAS software (Cary, NC) was used for statistical analysis.

RESULTS

There were 69 total observations made in the course of our study. Individuals observed included 28 nursing staff, 19 medical staff, 9 visitors, 2 nutritionists, 4 food service staff, 4 pharmacists, 2 occupational therapists, and 1 laboratory staff. Compliance with hand hygiene and contact precautions before and after sink placement is shown in Table 1.

Overall, contact precaution compliance increased 22% after the intervention, from 13% to 35% (*P* = .001). The proportion of non-compliant individuals did not change because both pre- and post-intervention, 30% of individuals observed failed to be compliant with every component of the isolation contact precautions. The number of individuals who were partially compliant reduced from 57% to 35%.

Completion of proper hand hygiene on exiting the CDI patient room improved by 18% with the addition of the 2 new visible sinks (*P* = .03). The number of individuals who failed to perform any hand

Table 1

Relationship between compliance with hand hygiene and contact precautions and sink placement

Compliance	Preintervention	Postintervention	<i>P</i> value
No HH before	72.5 (58/80)	51.6 (32/62)	.0104*
Indeterminate HH before	7.45 (12/92)	10.1 (7/69)	.5727
Alcohol gel before	27.5 (22/80)	48.4 (30/62)	.0104*
No HH after	54.6 (42/77)	37.1 (23/62)	.0404*
Indeterminate HH after	16.3 (15/92)	10.1 (7/69)	.2602
Alcohol gel after	11.7 (9/77)	11.3 (7/62)	.9417
Soap and water after	33.8 (26/77)	51.6 (32/62)	.0339*
Fully compliant	13.2 (12/91)	34.9 (24/69)	.0012*
Partially compliant	56.0 (51/91)	34.8 (24/69)	.0076*
No compliance	30.8 (28/91)	30.4 (21/69)	.9637
Gown worn	57.1 (52/91)	60.9 (42/69)	.6353
Gloves worn	58.2 (53/91)	62.3 (43/69)	.6021

NOTE. Values are % (n/N).

HH, hand hygiene.

*Significant at α = 0.05.

Table 2

Relationship between time taken to perform a task and when the intervention took place

Activity	Preintervention	Postintervention	<i>P</i> value
Time before room entry (s)	38.1	60.8	.1220
Time in room (s)	424	493	.6485
Time after room exit (s)	26.1	26.1	.9965

hygiene after being in a CDI patient room decreased from 54% to 37% (*P* = .04). After the intervention, the number of individuals who performed proper hand hygiene prior to entering the patient room increased by 19% (*P* = .01). The percentage of individuals who failed to perform any hand hygiene before entering the patient room was reduced by 21% (*P* = .01). The distance of the sinks from the central nurse's station was 9.98 meters for one sink and 2.27 meters for the other. The sink closer to the nurses station was within easy range of most of the patient rooms and was the one that was the more heavily used.

On average, the time taken by individuals prior to entering the CDI patient room increased by 22 seconds because of the increased incidence of bundled activities. The average amount of time spent in the patient room increased by 1.32 minutes. The time taken to remove gloves and a gown and to perform hand hygiene after interacting with a CDI-positive patient did not change after the intervention (Table 2).

Feedback from staff showed a high level of satisfaction, and they reported that the 2 new visible sinks enhanced the likelihood of completing proper hand hygiene on exiting the patient room.

DISCUSSION

In our study we found that the placement of additional sinks in a visible and easily accessible location increased the performance rate of proper hand hygiene on exiting a CDI-positive patient room. Additionally, fewer individuals chose to use alcohol gel after leaving a CDI room. This may have been the result of the placement of additional sinks on the unit where observations were conducted. Previously, no easily visible sinks were available for immediate use on exiting patient rooms, and health care workers would need to walk to another part of the unit to find a sink. This may have created inconvenience and a systems barrier for visitors and health care workers unfamiliar with the unit.

It is important to consider our conclusions within the confines of our study, which has limitations. All observations and data collection were completed by a sole individual. A Hawthorne effect is

very likely, which could have resulted in an overestimation of hand hygiene compliance rates.¹⁰ Additionally, the scope of our study is limited to a single unit with relatively few observations. However, the intervention was undertaken in the setting of a CDI cluster, and a rapid quality improvement process was initiated. Other interventions undertaken at the same time, such as increased visibility of CDIs on the unit white board, conferences, and seminars on *C difficile* prevention, may have impacted the hand hygiene rates.

These limitations notwithstanding, health care workers on this unit housing severely immunocompromised patients had an increased incidence of handwashing with additional sinks being placed. Systems assessment and interventions to reduce systems barriers are essential to improving health care worker and visitor compliance with a complex behavioral intervention, such as hand hygiene for the care of a patient with CDI.

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