Mentor’s hand hygiene practices influence student’s hand hygiene rates

Michelle Snow, RN, MSPH, MSHR, George L. White Jr, PhD, MSPH, Stephen C. Alder, PhD, and Joseph B. Stanford, MD, MSPH
Salt Lake City, Utah

Background: There were 5 objectives for this prospective quasi-experimental study. The first was to determine the effect of mentor’s hand hygiene practices on student’s hand hygiene rates during clinical rotations. The second was to assess the difference in hand hygiene rates for students with and without prior medical experience. The third was to assess the student’s opinion and beliefs regarding hand hygiene.

Methods: Sixty students enrolled in a certified nursing program were selected to participate in the study. Each study group was observed twice during the 30-day span. The first observational period was conducted on day 1 of clinical rotation. The second observational period was conducted on day 50 of clinical rotation. Students were observed for hand hygiene. Also assessed were medical experience, sex, gloving, age, and mentor’s hand hygiene practices. After observational period 2, a brief questionnaire was given to students to determine their opinion and beliefs regarding hand hygiene. The questionnaire was divided into 5 sections: student’s commitment to hand hygiene, their perception of hand hygiene inconvenience, the necessity of hand hygiene, the student’s ability to perform hand hygiene, and their opinion on the frequency of medical staff’s hand hygiene.

Results: The mentor’s practice of hand hygiene was the strongest predictor of the student’s rate of hand hygiene for both observational periods (P < .01). Furthermore, students without prior medical experience had a significant increase in hand hygiene rates when comparing observational period 1 to observational period 2 (P < .01). Glove usage was associated with increased hand hygiene rates by 50% during observational period 1 (P = .01) and 44% during observational period 2 (P < .01). Male students during observational period 1 practiced hand hygiene 30% less often than female students (P < .01); however, during observational period 2, there was no significant difference between hand hygiene rates for males and females (P = .82). Questionnaires were completed by 47 students, who reported a strong commitment to hand hygiene, belief in its necessity, and ability to perform hand hygiene (with scores in the high 90s on a 10 to 100 rating scale).

Conclusion: Mentor’s use of hand hygiene and glove usage was associated with increased hand hygiene among students. Even though students reported strongly positive attitudes toward hand hygiene, students had a low overall rate of hand hygiene.

Health care provider (HCP) hand hygiene (HH) rates have long been a focus of research. Studies implementing direct observation have reported HCP HH rates ranging from 5% to 81%.1 Questioning why HCP HH rates are outside of recommended guide lines, researchers have studied a multitude of factors influencing HH. Those studied include contact dermatitis, infection control programs, role model utilization, limited number and poor placement of hand hygiene facilities, automated hand hygiene facilities, and time constraints.2-25

HCP have stated that a deterrent to hand hygiene is excessive dryness and cracking of the skin caused by the usage of soaps and repetitive handwashing required by facility protocols. The drying effects of soaps and repetitive handwashing produces skin changes that can exacerbate contact dermatitis. The addition of emollients and humectants to hand soaps have significantly reduced these adverse effects.4-10

Infection control programs, including frequent education, performance feedback, posters, memos, and direct observation, have made only a transient improvement in HCP rates of HH.13,16-22-27 Infection control programs utilizing role models have had mixed findings with regards to HH practices among HCP. When a peer or a high-ranking physician practiced HH per facility protocol, the subordinates followed suit, suggesting that HH behavior among HCP can be learned and influenced by other team member’s HH practices. Unfortunately, when peers and high-ranking team members fail to practice HH, subordinates are negatively influenced, and the frequency of HH decreases.11-15

Some researchers have speculated that the reason HCP are not practicing good HH is that there are insufficient HH facilities for the patient-staff ratio or possibly that the locations of the HH facilities were not convenient for the HCP after rendering patient care. Surprisingly, when one hospital increased the number of sinks in its facility, the rate of HH actually decreased.12-15,27-29 However, in 2 hospital studies, Pittet
et al was able to demonstrate a sustainable increase in HCP HH rates when bedside dispensers and personal pocket dispensers of alcohol sanitizers were made available to staff.\textsuperscript{3,16}

HCP have stated that there is not enough time to perform patient care and perform HH per facility protocol.\textsuperscript{2,14,16-19,26,30,31} The time that it takes for a HCP to adjust the water, apply and lather soap, dry hands with a towel, and return to the patient takes over a minute. Boyce calculated that handwashing would require 16 hours of nursing time per shift for 12 ICU nurses (assuming 100\% compliance with recommended handwashing practices).\textsuperscript{19}

Alcohol sanitizers are an effective and time-sparing alternative to soap and water. The time that it takes for an HCP to utilize an alcohol sanitizer has been documented at 25 seconds per usage.\textsuperscript{19} Boyce further calculated, when using an alcohol hand disinfectant from a bedside dispenser and 15 seconds is required for drying, 100\% compliance would require only 20 minutes per nurse per shift.\textsuperscript{19} In addition to saving time and decreasing the incidence of contact dermatitis among HCP, alcohol hand sanitizers are the preferred HH method for HCP when HCP are given an HH choice.\textsuperscript{6,7,20} Alcohol sanitizers have also been shown to produce a sustainable increase in rates of HH for HCP.\textsuperscript{7,16,18,20}

Extensive research has been conducted on HH rates, methods, deterrents, and programs; however, the authors of this paper were unable to identify peer-reviewed research comparing HH rates of students entering the health care profession and after their immersion in the health care environment. The purposes of this study were (1) to determine the effect of mentor’s hand hygiene practices on student’s hand hygiene rates during clinical rotations; (2) to assess the difference in hand hygiene rates for students with and without prior medical experience; and (3) to assess the student’s opinion and beliefs regarding hand hygiene.

METHODS

Cohort definition

This was a prospective quasiexperimental study with single blinding of the participants. There were 2 study groups. Study group 1 consisted of 30 student nursing assistants, of which 22 were females, and 8 were males between the ages of 18 and 44 years, without prior medical employment, medical volunteer service, or medical education. Study group 2 consisted of 30 student nursing assistants consisting of 24 females and 6 males between the ages of 19 and 42, with prior medical employment, medical volunteer service, or medical education.

Procedure and definitions

Students who passed the school’s infection control and HH module with an 80\% or higher score were eligible to proceed to clinical rotations and to participate in the study. The infection control module consisted of lectures, videos, and written tests covering the topics of Centers for Disease Control and Prevention (CDC) infection control guidelines, standard precautions, transmission-based precautions, personal protective equipment, and hand hygiene. Once the students were selected for the study, they were assigned to a facility certified nursing assistant (CNA) mentor independent of the study protocol. For CNAs to be considered as a mentor for the study, they must have completed the facility’s infection control program and have been employed at least 3 months. There were 2 observational periods. The first was day 1 of clinical rotation. The second was day 30 of clinical rotation. Students were assigned to different mentors for each observational period.

The observer tallied student and mentor HH opportunities, attempts, and failures. An HH opportunity was defined as the points in time prior to or after making contact with the patient or patient’s personal items or equipment and prior to or after performing a procedure and after removing gloves. An HH attempt was defined as any action to cleanse the hands with soap and water or an alcohol hand-sanitizing solution. An HH failure was defined as not performing HH prior to or after making contact with the patient or patient’s personal items or equipment and prior to or after performing a procedure and after removing gloves. The observer did not evaluate the student’s or the mentor’s HH chosen method or technique. Sinks were located in each patient’s room and alcohol hand-sanitizing dispensers were located at each nurse’s station and on the nurse’s medicine cart. The observer was the same individual for both observational periods.

Each student was observed during a weekday for 3 hours for both observational periods. The observers were the student’s instructors. Subjects were not aware of the instructor’s observation activities during the observation periods.

After completion of the second observational period, students were asked to complete a brief questionnaire. The questionnaire consisted of 5 sections. Each section contained 4 questions. The first section focused on student commitment to practice HH. The second section focused on student perception regarding the convenience of HH. The third section focused on student belief of the necessity for HH. The fourth section concentrated on student opinion of medical staff’s HH practices. The last section of the questionnaire concentrated on student ability to perform HH. A Likert scale
of 10 (never) to 100 (always) was used to score student opinions for each question. The observer instructed the students that completion of the questionnaire was optional and did not affect their grade. The University of Utah institutional review board study approval number was 12895, and a waiver of subject consent was also obtained for the study.

Data analysis

The null hypotheses were tested as follows:

Hypothesis 1: There is no difference between the rates of student HH compliance for observational period 1 and observational period 2. A 2-tailed paired t test was used to compare student HH rates between observational periods.

Hypothesis 2: There is no difference between HH rates for students without prior medical experience (study group 1) and students with prior medical experience (study group 2). A 2-tailed independent t test was used to compare HH frequencies between study group 1 and study group 2.

Hypothesis 3: There is no difference in the relationship between student HH rates and the independent variables age, sex, wearing gloves, past medical experience, and HH rate of the mentor. Multiple regression analysis was used to determine whether a relationship existed between the independent variables and the dependent variable student HH rates for each observational period.

The data were analyzed for each hypothesis using an $\alpha = 0.05$. All statistical calculations were performed using Stata software 8.0, 2003 (College Station, Texas).

RESULTS

During observational period 1, student HH opportunities were 391, with 192 HH attempts and 199 HH failures. Mentor HH opportunities were 483, with 214 attempts and 269 failures. During observational period 2, student HH opportunities were 420, with 222 HH attempts and 198 HH failures. Mentor HH opportunities were 415, with 221 HH attempts and 194 HH failures (See Table 1).

Table 1. HH occurring during each 3-hour observational period for mentors and students with and without medical experience*

<table>
<thead>
<tr>
<th></th>
<th>Ob. period 1</th>
<th>Ob. period 2</th>
<th>Differential</th>
<th>t</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mentor HH rate</td>
<td>214/483 $^\dagger$ (0.43)$^\ddagger$</td>
<td>221/415 $^\dagger$ (0.44)$^\ddagger$</td>
<td>$-0.01$</td>
<td>$-0.14$</td>
<td>.89 $^\ddagger$</td>
</tr>
<tr>
<td>All students HH rate</td>
<td>192/391 $^\dagger$ (0.43)$^\ddagger$</td>
<td>222/420 $^\dagger$ (0.41)$^\ddagger$</td>
<td>$-0.11$</td>
<td>$-2.19$</td>
<td>.03 $^\ddagger$</td>
</tr>
<tr>
<td>No medical experience HH rate</td>
<td>43/88 $^\dagger$ (0.36)$^\ddagger$</td>
<td>77/144 $^\dagger$ (0.34)$^\ddagger$</td>
<td>$-0.24$</td>
<td>$-0.34$</td>
<td>.002 $^\ddagger$</td>
</tr>
<tr>
<td>Medical experience HH rate</td>
<td>149/303 $^\dagger$ (0.42)$^\ddagger$</td>
<td>145/276 $^\dagger$ (0.45)$^\ddagger$</td>
<td>$0.02$</td>
<td>$0.30$</td>
<td>.77 $^\ddagger$</td>
</tr>
</tbody>
</table>

HH, Hand hygiene.

*Observational period 1 vs observational period 2. Paired t test.
$^\dagger$Number of HH attempts/number of HH opportunities.
$^\ddagger$Standard deviation.
$^\ddagger$Two-tailed paired t test.

Two observers completed tallies of student HH attempts for each observational period. The results for the combined study groups 1 and 2 demonstrated evidence of a difference between the rates of student HH compliance for observational periods ($P = .03$, see Table 1) with a higher HH rate in observational period 2 than observational period 1.

Hypothesis 1

Two observers completed tallies of student HH attempts for each observational period. The results for the combined study groups 1 and 2 demonstrated evidence of a difference between the rates of student HH compliance for observational periods ($P = .03$, see Table 1) with a higher HH rate in observational period 2 than observational period 1.

Hypothesis 2

Students without medical experience had a higher rate of HH in observational period 2 when compared with observational period 1. Students with prior medical experience did not demonstrate a significant difference in rates of HH for observational periods 1 or 2 ($P = .77$) (See Table 1).

Hypothesis 3

In multiple logistic regression of data from observational period 1, all of the independent variables were statistically significant ($P < .05$) with the exception of age (See Table 2). The relationship of significant variables to student HH rates was as follows: If a mentor attempts HH, the student, regardless of student sex, will attempt HH 71% of the time. Students who gloved were...
50% more likely to practice hand hygiene. Female students demonstrated an increase in HH rates 30% over male students (See Fig 1), and students with medical experience practiced HH 13% more often than those students without medical experience (See Fig 2).

Observational period 2

During observational period 2, mentor HH rates and student donning gloves were statistically significant ($P < .05$) (See Table 3). The relationship of mentor HH rate to student HH rate was as follows: If the mentor attempted HH, then the student was 70% more likely to attempt HH (See Fig 3), and students who donned gloves were 44% more likely to practice some form of HH.

Questionnaire

Forty-seven students completed the questionnaires after observational period 2. Table 4 summarizes the mean scores (10 = Never to 100 = Always) for each question of the questionnaire. Students reported a commitment to handwashing with a mean score of 92.98 before patient contact, 95.53 for commitment to handwashing after patient contact, 84.89 before donning gloves, and 95.11 after removal of gloves. The students reported a perceived inconvenience of handwashing with a mean of 32.34 before patient contact, 23.40 after patient contact, 31.70 before donning gloves, and 22.77 after removal of gloves.

The students reported a belief in the necessity for handwashing with a mean score of 92.98 before patient contact, 95.53 for commitment to handwashing after patient contact, 84.89 before donning gloves, and 95.11 after removal of gloves. The calculated mean for student’s opinion of medical staffs’ handwashing practices was 58.94 before patient care, 67.02 after patient care, 48.94 before donning gloves, and 95.96 after removal of gloves. Last, the calculated mean for the student’ perceived ability to perform handwashing was 95.74 before patient care, 97.02 after patient care, 91.28 before donning gloves, and 95.96 after removing gloves.

DISCUSSION

Observation and handwashing practices of Ignaz Semmelweis and Oliver Wendell Holmes historically aided in establishing HH as one of the key elements for reducing nosocomial infection rates. Gallo reports that CNAs provide more of the hands-on direct patient care than any other HCP. HH is a critical behavior in preventing nosocomial infections for all HCP and especially for CNAs because of their staffing numbers, the large number of patients cared for, and their job tasks requiring extensive patient contact. Past studies have reported CNAs having some of the lowest HH rates among HCP. Therefore, improving CNA HH practices may assist in decreasing nosocomial rates of infection.
Over the years, researchers and health care facilities have pursued HH protocols and have instituted a multitude of HH programs in hopes of increasing the HH rate of HCP. Unfortunately, HCP HH rates rarely exceed 40% compliance prior to program implementation and even after HH compliance has increased through program interventions, the gains are, at best, minimally sustained.\(^2,3,36-40\)

As found in a previous study by Pittet,\(^35\) males had lower rates of HH than female subjects but only during observational period 1 of this study (\(P = .01\)). During the second observational period, sex of the subject was not statistically significant in describing the rate of HH of students (\(P = .82\)). It should be noted that, by chance, during observational period 1, there were some male CNA mentors, and, for observational period 2, there were no male CNA mentors. This initial sex difference might be attributed to the sex of the mentor that the students were paired with for the observational period, coupled with the HH practices of the mentor.

Past studies have documented a decrease in HH rates when care providers wore gloves\(^35\); however, our study findings demonstrated an increase in HH rates of 50% during observational period 1 and 44% during observational period 2 when students donned gloves. Perhaps the increased HH rates could be attributed to a difference in HCP job tasks and HCP perceiving an increased risk of hand contamination through the gloves by the task. Most job tasks for the CNA involve activities of daily living (ADL). ADL includes feeding, toileting, bathing, and exercising the patient. The excretions associated with ADL often produce strong odors and are visually unpleasant as well. The threat of hand contamination through gloves might be perceived to be higher for a CNA who has just changed a brief soiled with feces than it would be for a nurse who started an intravenous line and did not soil her gloves with blood. Further research needs to be conducted to determine whether specific HCP job tasks and the perceived threat of hand contamination influence HCP HH practices.

Of the 47 students who completed the postobservation questionnaire, students reported a high belief in the importance of HH, as well as high personal commitment to HH. The students also stated that they had the ability to perform HH in the workplace and perceived HH not to be an inconvenient aspect of patient care. In addition, students rated their HH practices at higher levels than were actually demonstrated during the study, and, not surprisingly, students more accurately reported the HH practices of other medical staff. Past research studies have reported similar opinions when medical staff were interviewed or completed questionnaires.\(^25,41,42\)

HH modeling of peer and superior’s HH practices have been reported in multiple studies to have a positive impact on staff HH rates.\(^14,21-24\) This study found mentor’s HH practices as the strongest predictor of

### Table 4. Student opinion and beliefs regarding HH behavior

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>I will wash my hands (Scale: Not true = 10; Exactly true = 100)</td>
<td></td>
</tr>
<tr>
<td>Before all patient contact</td>
<td>92.98</td>
</tr>
<tr>
<td>After all patient contact</td>
<td>95.53</td>
</tr>
<tr>
<td>Before wearing gloves</td>
<td>84.89</td>
</tr>
<tr>
<td>After removing my gloves</td>
<td>95.11</td>
</tr>
<tr>
<td>For me, washing hands (Scale: Never inconvenient = 10; Always inconvenient = 100)</td>
<td></td>
</tr>
<tr>
<td>Before all patient contact is inconvenient</td>
<td>32.34</td>
</tr>
<tr>
<td>After all patient contact is inconvenient</td>
<td>23.40</td>
</tr>
<tr>
<td>Before wearing gloves is inconvenient</td>
<td>31.70</td>
</tr>
<tr>
<td>After wearing gloves is inconvenient</td>
<td>22.77</td>
</tr>
<tr>
<td>Medical professionals I work with wash their hands  (Scale: Never = 10; Always = 100)</td>
<td></td>
</tr>
<tr>
<td>Before all patient care</td>
<td>83.40</td>
</tr>
<tr>
<td>After all patient care</td>
<td>95.32</td>
</tr>
<tr>
<td>Before wearing gloves</td>
<td>80.42</td>
</tr>
<tr>
<td>After removing gloves</td>
<td>91.48</td>
</tr>
<tr>
<td>I can wash my hands (Scale: Never = 10; Always = 100)</td>
<td></td>
</tr>
<tr>
<td>Before all patient care</td>
<td>95.74</td>
</tr>
<tr>
<td>After all patient care</td>
<td>97.02</td>
</tr>
<tr>
<td>Before wearing gloves</td>
<td>91.28</td>
</tr>
<tr>
<td>After removing gloves</td>
<td>95.96</td>
</tr>
</tbody>
</table>

Fig 3. Observational period 2: The influence of mentor HH practices on student HH practices.
student HH for both observational period 1 ($P < .01$) and observational period 2 ($P < .01$). One must ask the following question: Whom does the CNA mentor view worthy of patterning their HH practices after? If the answer is the nurse, does the nurse understand that his/her HH practices are a cue to action for CNA HH practices? Will the nurses recognize their role in CNA HH behavioral patterning and accept accountability for the exponential effects of not practicing HH? Clearly, further research is needed on this topic.

Also of interest in this study was the reported difference between HH rates of students during observational period 1 and observational period 2 for students without prior medical experience ($P < .01$). Possibly, students without prior medical experience had developed a stronger commitment to the principles of infection control and of HH because of repeat exposure to mentors and the medical setting. One should also consider the possibility that the students were less inclined to simply parrot poor HH behavior because of feeling more comfortable in a medical work setting during observational period 2.

In conclusion, this study found the CNA mentor’s HH practices as the strongest predictor of student HH rates for both observational periods (observational periods 1, $P < .01$; observational period 2, $P < .01$). Clearly, role models are important in forming positive HH compliance. It is important to note that mentors were assigned independently on a day-to-day basis to the students; therefore, for this study, the effects of the mentor’s HH practices in relationship to the student’s HH are short-term effects.

The difficulty in understanding health care provider’s low HH rates is in defining what the cultural expectations are for HH rates in the health care industry and ensuring a positive or negative consequence for the noncompliant HCP. A dynamic change must occur in which the health care providers collectively decide that the present rate of HH is no longer acceptable. However, how does the collective mind-set change and behavioral modifications occur for HH rates to increase?

Future research questions should include the following: Could the medical unit’s HH behavior be tied to a cultural expectation that is redefined by key employees on a daily basis? To what degree are CNAs influenced by superiors HH practices? What causes the behavioral disconnect to occur between HH knowledge and HH behavior? What is an effective negative consequence for a HCP not following HH protocol? How can the negative consequence of not practicing HH occur consistently for every missed HH opportunity? Do all classifications of HCP perceive HH social pressure differently? How much time must pass before a new HH standard is adopted by the medical unit? How many employees must adopt the HH behavior before others follow suit? Who are the key formal and informal HCP that lead the HH behavior of the unit members? How is the medical unit’s accepted minimum HH standard maintained as new members are added to the workforce? These questions are but a few of many that need to be explored before a complete understanding of HH compliance may be obtained.

References


