A novel educational programme to improve knowledge regarding health care-associated infection and hand hygiene

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Lack of hand hygiene by health-care workers is the most significant cause of health-care-associated infection. This programme was designed to make health-care workers want to wash their hands, to change their knowledge regarding hand hygiene and health-care-associated infection, and influence practice. Improvement between pre- and post-test scores was statistically significant. Compliance is a multifactorial problem that involves knowledge and behaviour. Educational awareness and frequent reminders are critical to maintain high rates of hand hygiene compliance.

Key words: hand washing, infections, in service training, nurses, protective gloves.

INTRODUCTION
Health care-associated infections (HAI) are a medical crisis that affects patients, health-care workers (HCWs) and the entire health-care system. It has been estimated that nearly 2 million patients in the USA alone become victims of HAI each year, and that those infections result in > 98 987 preventable deaths, with costs estimated as high as $5.7 billion annually. Despite various efforts, low rates of hand hygiene compliance of HCWs continue, and are the single most significant cause of HAI.

Recent studies have reported that the hand hygiene practices of HCWs might be related to workload, stress and the physical environment, including location of sinks. However, it has also been suggested that poor hand hygiene compliance is related to bad habits and can be controlled with the combination of education and training.

To improve compliance among physicians and nurses and thus reduce HAI, hand hygiene policies need to be introduced and enforced. An increased effort to promote didactic training in conjunction with aggressive education programmes might improve hand hygiene compliance, but the improvement might not be permanent. We used a new approach that included a training video produced by an award-winning documentary filmmaker specifically designed to convince physicians and nurses to want to comply with the CDC hand hygiene guideline. The novel programme also incorporated introductory messages from the hospital president and the medical school dean, to provide familiarity as well as to promote staff buy-in.

METHODS
A hand hygiene web-based educational programme was conducted in an intensive care unit (ICU) at a large tertiary-care hospital. It consisted of: (i) a 20-question pretest to measure baseline knowledge regarding hand hygiene and HAI; (ii) a 10-min video that shows how suboptimal hand hygiene compliance increases the risk of HAI and kills patients; and (iii) a PowerPoint presentation documenting how HAI occur, the magnitude of the problem and prevention strategies. The programme concluded with a post-test and programme evaluation.

In addition to the web-based version, the programme was also given at various times on the nursing unit. A computer program randomized the order of the questions for each individual taking the test. To complete the programme successfully, the participant had to answer a minimum of 18 out of 20 post-test questions correctly. If the post-test score was < 18, the participant was required to retake the programme. A comparison between the pretest results and the first post-test results (thus excluding the retake exams) was used to assess knowledge improvement regarding HAI and hand hygiene compliance.

To evaluate the hand hygiene training programme, participants completed a seven-item survey to determine programme satisfaction using a five-point Likert scale. Exemption status for the study was obtained from the university’s Institutional Review Board. All participants gave informed consent to participate in the study.

The programme’s primary outcomes were to change participants’ knowledge regarding HAI and hand hygiene and to positively influence their practice. Comparison of pre- and post-test scores was made by paired t-test and the significance level (P-value) was set at 0.001.

RESULTS
The programme was completed by 244 HCWs, all of whom have contact with patients in the ICU. The group included 80 physicians (attendings, fellows and residents), 88 nurses and 76 fourth-year medical students on subinternships.

A comparison of pre- and post-test results showed a statistically significant improvement in the overall performance in medical students and physicians (Table 1).
There was a statistically significant improvement in the passing scores (≥ 18 correct) between pre- and post-tests for physicians using paired t-tests (Table 2). However, despite our programme, the post-test scores for passing (≥ 18 questions correct) remained low at 48% for physicians and 42% for medical students and nurses. The overall percentage of participants in each group who achieved a perfect score of 20 on the pre- and post-test is shown in Table 3.

Item analysis (Table 4) showed that almost all participants correctly identified the following on the pretest in descending order of percentage: Q13 the necessity of hand hygiene before feeding a patient; Q16 fatigue or workload are acceptable reasons to ignore hand hygiene (false); Q6 brief random contact with patient linen does not contaminate hands; Q20 it is okay to remind a colleague or a superior to clean their hands before patient contact; and Q11 not maintaining proper hand hygiene impacts your family.

The statement that most participants selected incorrectly on the pretest (35%) and improved the most on the post-test (76%) was Q10 ‘one should use either sterile gloves or alcohol-based hand rub to prevent HAI’ (false). A statement that received less correct answers after the intervention was Q9, ‘alcohol-based gel should immediately be used to remove visible dirt’. Q14 ‘using alcohol-
based hand rub before touching door knobs prevents hand contamination’ (which is a false statement) had low pretest scores (58.6% correct), and even fewer participants answered it correctly on the post-test (45.1%).

Two hundred and nineteen participants (89.7%) completed forms to evaluate the programme. Scores were reported as percentage of the potential maximum score (Table 5).

The programme evaluation questions were worded such that a high percentage represents a desirable or positive response for questions, with the exception of question number 6, in which a desirable response would be ‘strongly disagree’ or ‘disagree’. In order to compare the questions, number 6 has been ‘reverse scored’ for consistency. The majority of the items showed positive responses, nearly 90%.

**DISCUSSION**

The programme focused on educating and training current and future health-care providers on preventing HAI by increasing their awareness of established habits as well as their knowledge regarding hand hygiene compliance. Specifically, the programme addressed the need to improve education and training of health-care providers concerning hand hygiene and HAI. This new approach used a combination of tests, video and a PowerPoint presentation to provide additional instructions on how to prevent HAI, especially against highly resistant organisms such as methicillin-resistant *Staphylococcus aureus*.

The programme results produced a statistically significant improvement in the overall passing score rates between pre- and post-tests among medical students and attending physicians. As this was a knowledge-based exam, the results suggest that medical students might not have had sufficient formal knowledge of HAI before the programme; therefore, medical schools might need to re-evaluate the way they teach hand hygiene and the placement of the course in the curriculum. Attending physician scores showed a statistically significant improvement, suggesting that educational programmes have a positive effect. Nurses did not show a statistically significant improvement in scores as their mean pretest scores were higher than the other two groups. However, the nurses mean post-test scores were lower than the other two groups. Thus, it might imply that an increase or constant HAI rate could be related to health-care providers’ attitudes and established behaviours rather than lack of formal knowledge or education.

The percentage of physician participants who achieved passing scores of ≥ 18 questions in the post-tests was statistically significant (from 22% to 48%). However, the percentage of licensed health-care professionals
(physicians and nurses) who achieved passing scores, even after the intervention, is still low (48% and 42%, respectively). The percentage of participants who achieved post-test perfect scores of 20 correct questions on what we considered a very straightforward exam is also dismally low, with physicians (6%) and nurses (7%) achieving virtually the same rate as medical students (7%).

An item analysis showed an overall improvement in the scores of 14 of the questions between the pre- and post-tests. Virtually every participant correctly identified the importance of hand hygiene before feeding a patient, as well as acknowledging that fatigue or workload are not acceptable reasons to ignore hand hygiene. In addition, participants recognized that brief random contact with patient linen does contaminate hands.

The statement (Q10) that most participants selected incorrectly on the pretest (35%), and improved the most on the post-test (76%), was that ‘one should use either sterile gloves or alcohol-based hand rub to prevent HAI’. Perhaps this is the single most important concept in the programme, that is, we need to teach health-care professionals that hand hygiene must be performed before and after glove usage. It has been clearly shown that gloves do not provide an impenetrable barrier for health-care providers and patients, as gloves might have imperfections in their surfaces that allow bidirectional passage of organisms. Using an alcohol-based hand rub before and after using examination gloves is part of the process of proper hand hygiene, as well as hand hygiene after removing sterile gloves after procedures.

Another teaching point was made with the pretest statement from Q14 ‘using alcohol-based hand rub before touching door knobs prevents hand contamination’ (a statement we deemed as false). Participants might have felt the meaning was to perform hand hygiene before touching door knobs in order for the participant not to contaminate the door knob surface if their hands are ‘dirty’. More participants answered this incorrectly in the post-test, which leads us to believe the education programme did not clearly convey this concept to the participants. As this is ambiguous, it has been reworded for use in future exams.

The questionnaire to assess programme satisfaction showed that the majority of items were scored at nearly 90%, suggesting that individuals thought the programme improved their knowledge and skills related to hand hygiene and HAI. In a follow-up survey performed ≈1 year after the programme given to the nurses in the ICU, 43% stated that our hand hygiene programme made them want to wash their hands more and 65% remembered the video. One nurse stated that she is now more aware of using alcohol-based hand rub on non-visibly soiled hands, potentially increasing her compliance with hand hygiene.

In conclusion, this study is limited to the educational aspect of HAI and therefore does not address compliance or infection rates. Recent global increases in HAI rates suggest that there is a critical need for improved periodic education and training of HCWs concerning hand hygiene. Our programme, using a new approach to improve hand hygiene compliance, produced an improvement in general knowledge, skills and awareness of HAI. Further study, however, is necessary to determine if this improvement will be sustained for a significant amount of time.

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