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Major Article

An automated hand hygiene compliance system is associated with improved monitoring of hand hygiene

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Key Words:
Central-line associated bloodstream infections
Catheter-associated urinary tract infections
Multidrug-resistant organisms

Background: Consistent hand hygiene is key to reducing health care-associated infections (HAIs) and assessing compliance with hand hygiene protocols is vital for hospital infection control staff. A new automated hand hygiene compliance system (HHCS) was trialed as an alternative to human observers in an intensive care unit and an intensive care stepdown unit at a hospital facility in the northeastern United States.

Methods: Using a retrospective cohort design, researchers investigated whether implementation of the HHCS resulted in improved hand hygiene compliance and a reduction in common HAI rates. Pearson χ^2 tests were used to assess changes in compliance, and incidence rate ratios were used to test for significant differences in infection rates.

Results: During the study period, the HHCS collected many more hand hygiene events compared with human observers (632,404 vs 480) and ensured that the hospital met its compliance goals (95%+). Although decreases in multidrug-resistant organisms, central line-associated bloodstream infections, and catheter-associated urinary tract infection rates were observed, they represented nonsignificant differences.

Discussion and conclusions: Human hand hygiene observers may not report accurate measures of compliance. The HHCS is a promising new tool for fine-grained assessment of hand hygiene compliance. Further study is needed to examine the association between the HHCS and HAI rate reduction.

Health care-associated infections (HAIs) are a substantial concern in U.S. hospitals. Progress has been made in reducing most categories of HAIs over the years.[1] But roughly 1 in 25 patients in the United States has at least 1 HAI during a hospital stay. An estimated 80,000 people die annually in the United States from an HAI.[2,3] Infections caused by multidrug-resistant organisms (MDROs) are of special concern as hospitals develop antimicrobial stewardship programs. Patients in intensive care units (ICUs) are known to be highly susceptible to infections.

HAIs add substantially to health care costs. The total cost for the 5 major HAIs—central line-associated bloodstream infections (CLABSIs), ventilator-associated pneumonia, surgical site infections, *Clostridium difficile* infection, and catheter-associated urinary tract infections (CAUTIs)—is roughly $10 billion per year.[4]

Many infections are preventable through good hand hygiene, defined as using a disinfecting agent such as alcohol-based hand sanitizers or soap and water to kill microorganisms on the hands. Failure to adhere to proper hand hygiene practice is thought to be the leading cause of HAIs.[5] The Centers for Disease Control and Prevention, The Joint Commission, and the World Health Organization support good hand hygiene to reduce HAIs. Compliance is believed to be low globally and has been notably difficult to measure.[3]

There is a widely recognized need for caregivers to be conscientious about disinfecting their hands at every hand hygiene opportunity (HHO); that is, when hand hygiene is indicated by guidelines or institution protocol. There is also a need for a reliable means of assessing compliance, which would allow facilities to measure their progress and move toward 100% compliance.

Caregivers in ICUs are reported to be less compliant than caregivers in other units. Wearing gowns and/or gloves is associated with lower compliance. Factors contributing to lower compliance include poor knowledge of guidelines and protocols, and circumstances where hand hygiene is a lower priority than the urgent needs of the patient (eg, emergency cases).[5]

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To improve compliance, a hospital must be able to improve reinforcement of the desired behavior. It must also be able to measure compliance accurately. The conventional approach is to employ a team of observers who can record HHOs and the number of times caregivers comply with protocol. The World Health Organization considers observation the gold standard for measuring compliance.[6]

However, relying on human observation has limitations. Observers must have received thorough, similar training. Being observed can change a caregiver's behavior. Workers are more likely to be compliant when they know they are being watched (the so-called Hawthorne effect). Therefore, it may be impossible to obtain a true measure of compliance through human observation. Observation alone does not provide a real-time reminder when the caregiver is in a patient room that it is important to practice good hand hygiene. Because observers are unlikely to be utilized during the hospital's full hours of operation, no institution can determine whether results from limited human observation will accurately reflect actual handwashing compliance in the 24 h/d, 7 d/wk health care setting.[6]

Background on study site

In recent years, a community hospital in the northeastern United States believed it had a strong hand hygiene program to combat MDROs and other sources of infection. The hospital, a nursing Magnet facility, is located in a suburban area close to a large metropolitan area and is the tertiary hub for a large health care system. In 2010 and 2011, hand hygiene compliance rates were 84% and 91%, respectively. Although these rates are better than some reported national averages, rates were below the hospital's goal of 95% compliance.

To improve compliance, the hospital undertook re-education of staff about hand hygiene, had staff members sign pledges to comply, empowered staff to intervene when they observed others not complying, increased the availability of hand sanitizer and moisturizer dispensers, and subjected noncompliant staff to the institution's disciplinary process.

Measurement of compliance was performed in 2014 on a part-time basis by human observers. The observers were local college students in a work–study program who were trained to conduct observations and to intervene if they saw clinicians not being compliant. The compliance rate was measured by this limited human observation. Infection control staff members were concerned about how accurate the reports of human observations were. Student observers were only able to cover a small number of clinicians over a relatively few hours each month. The work–study program at the college was also influenced by budget cuts. Turnover among student observers made it difficult to maintain a fully staffed and trained observer team. The hospital had a goal of 40 observations per month per unit, but often could not meet that standard. Moreover, the hospital continued to experience a higher-than-desirable rate of patient infections, despite a purportedly high rate of hand hygiene compliance.

There has to date been limited published data about the effectiveness of one alternative: automated hand hygiene systems intended to improve compliance and reduce MDROs.[7] Related data have been promising. A level-1 trauma center in India improved hand hygiene compliance and infection rates for CLABSIs, CAUTIs, and ventilator-associated pneumonia after implementing a hand hygiene compliance system (HHCS).[8]

METHODS

This study did not meet requirements for institutional review board application and approval, and was thus exempt from institutional review board review and informed consent protocols.

Study design and setting

The present study was a single-site, observational, retrospective cohort study of hand hygiene and HAIs in a 292-bed community hospital in the northeastern United States. The study goals were to determine whether implementation of the automated HHCS is associated with improved hand hygiene compliance and a significant reduction in MDROs, CLABSIs, and CAUTIs in the hospital's ICU and ICU stepdown unit compared with the use of human observers. The study was conducted using data from the HHCS, human hand hygiene observer records, routine hospital infection surveillance data, and de-identified electronic medical records over a 2-year period. Data were collected during the full calendar year 2014, when human hand hygiene observers were deployed, and partial year 2015 when the HHCS was in-use (February 16-December 31). The hospital implemented the HHCS in its 8-bed ICU and 25-bed ICU stepdown unit.

Participants

During the first study period in 2014, ICU and ICU stepdown unit caregivers and their compliance with hand hygiene protocols were assessed when human observers were present. During the second study period in 2015, all ICU and ICU stepdown unit caregivers with direct patient contact (nurses, nurse technicians, respiratory therapists, care managers, dietary aides, and housekeeping staff) were required to participate in the HHCS implementation. No caregivers were excluded from the handwashing observations during the first study period, except for those not directly observed by the student workers, and only those caregivers without direct patient contact were excluded from the HHCS implementation during the second study period.

For the purposes of calculating infection rates and rate ratios, all patients in the hospital's ICU and ICU stepdown unit during the data collection periods were included in the study. This consisted of 2,174 patients in 2014 and 1,896 patients in 2015, for a total of 4,070 patients across the full study period.

Data collection and measurement

Hand hygiene compliance

During the 2014 study period, hand hygiene compliance was recorded manually by human observers on a sporadic, part-time basis. A hand hygiene monitoring protocol was developed by hospital infection control staff, and observers, students in a local work–study program, were recruited. Observers received a brief training and were then asked to demonstrate adherence to the protocol with infection control staff. New observers participated in weekly debriefings for the first month and then monthly debriefings thereafter. During observation sessions, student workers were required to record the hand hygiene compliance of all health care personnel within the observed unit, including foodservice and housekeeping staff. Hand hygiene compliance was evaluated on the following activities: upon entering and exiting patient rooms, before patient content, after patient contact, before donning and after removing gloves, and after touching equipment or elements in the environment. Compliance or noncompliance was only recorded on complete patient or health care worker encounters.

Evaluation of hand hygiene compliance was recorded on paper survey forms that included the date, time, location, and job classification of observed health care workers, and compliance or noncompliance of the hand hygiene opportunity. Data from the paper forms were entered into the Midas + electronic hospital quality reporting database (Midas + Solutions, Franklin, TN) and compliance reports were generated quarterly.