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Major Article

Utility of electronic hand hygiene counting devices for measuring physicians' hand hygiene adherence applied to outpatient settings

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Background: Our objectives were to evaluate the utility of electronic hand hygiene counting devices in outpatient settings and the impact of results feedback on physicians' hand hygiene behaviors.

Methods: We installed 130 electronic hand hygiene counting devices in our redesigned outpatient department. We remotely monitored physicians' hand hygiene practices during outpatient examinations and calculated the adherence rate as follows: number of hand hygiene counts divided by the number of outpatients examined multiplied by 100. Physician individual adherence rates were also classified into 4 categories.

Results: Two hundred and eighty physicians from 28 clinical departments were monitored for 3 months. The overall hand hygiene adherence rate was 10.7% at baseline, which improved significantly after feedback to 18.2% in the third month. Of the clinical departments, 78.6% demonstrated significant improvement in hand hygiene compliance. The change in the percentage of physicians in each category before and after feedback were as follows: very low (84.3% to 72.1%), low (8.6% to 14.3%), moderate (2.9% to 8.9%), and high (4.3% to 4.6%), from the first to third month, respectively. Based on category assessment, 17.1% of physicians were classified as responders.

Conclusions: Physicians' adherence to hand hygiene practices during outpatient examinations was successfully monitored remotely using electronic counting devices. Audit and feedback of adherence data may have a positive impact on physicians' hand hygiene compliance.

Good hand hygiene practice is recognized as one of the most important ways to reduce pathogen transmission and prevent health care–associated infection (HCAI).[1-3] Despite the relative simplicity of this procedure, adherence to hand hygiene recommendations has remained low in most hospitals, with physicians being poorly compliant.[4-6]

Systematic literature reviews have shown that audits (periodic performance measurements) followed by comparative feedback on performance are generally effective for stimulating improvement at both the provider and organization levels, particularly when baseline performance levels are low.[7,8] Three main methods for measuring hand hygiene compliance include direct observation, measuring product use, and conducting surveys, each of which has associated advantages and disadvantages.[1,2,9]

Assessment of hand hygiene compliance by a validated observer (direct observation) is currently considered the gold standard in hand hygiene compliance monitoring. It is the only method available to detect all occurring hand hygiene opportunities and actions and to assess the number of times and appropriate timings when hand hygiene action would be required in the sequence of care. However, direct observation is labor intensive and expensive, requiring the careful selection and training of the observers, and can also influence the behavior of those aware of being observed (Hawthorne effect).

Measuring the amount of alcohol-based handrub is an indirect way of estimating the adherence of health care workers (HCWs) to

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hand hygiene guidelines. The advantages of this method are that it is simple to execute, it can be continuously monitored, and it can provide an overall picture that remains unaffected by observer bias. However, measuring product use does not reveal whether HCWs are performing hand hygiene actions when it is indicated or whether they are performing it correctly.

An alternative to measuring the amount of hand hygiene product used is to use automated tools, including electronic counting devices or electronic monitoring systems. Wireless devices placed inside handrub dispensers can provide useful information regarding frequency patterns of hand hygiene actions. These methods allow precise quantitative results on hand hygiene activity to be obtained, with the only costs being the installation and maintenance of the system.[1,2] Some studies have attempted to measure hand hygiene compliance using such electronic counting devices installed in patient rooms and in corridors.[10,11] Although an automated system can electronically calculate alcohol-based handrub use by detecting when and which dispenser lever is pressed, the system does not yield contextual information about the user and the circumstances (timing) of hand hygiene activity. In contrast, electronic counting devices installed in outpatient settings can estimate hand hygiene compliance among physicians based on the number of outpatients and the physicians using the examination rooms.

Accordingly, our objectives were to evaluate the utility of electronic counting devices in assessing physicians' hand hygiene compliance in outpatient settings and the impact of performance feedback on physicians' hand hygiene behaviors.

METHODS

This study was conducted at the Mie University Hospital, a 685-bed educational hospital, in Japan. There were 1,300-1,650 outpatient visits per day. We have routinely measured the amount of alcohol-based handrubs and soaps used in the hospital wards; however, we have not monitored hand hygiene performance in outpatient settings. When our outpatient department was redesigned in May 2015, a total of 130 electronic counting devices (Hand Hygiene Monitoring System Compleo-IO; Saraya, Osaka, Japan) were installed, one on each of the desks in the examination rooms on 3 different floors. In our hospital, physicians examine patients by themselves in the outpatient examination rooms without the assistance of other staff, such as medical assistants and nurses. Because the counting devices were installed on a desk on the opposite side of the patient's chair, the hand hygiene dispenser was not accessible to patients. Therefore, only physicians examining a patient in the room could use the hand hygiene dispenser. However, physicians' hand hygiene via soap and water, or hand hygiene conducted via a handrub dispenser located outside of the examination room, could not be captured using these devices.

Study design

Hand hygiene monitoring using electronic counting devices in outpatient settings was started from September 2015. Baseline data were collected for 1 month (September 2015) before notice was given. Monthly hand hygiene adherence rates of each clinical department were calculated and reported at the monthly directors' meeting. The information was shared with colleagues in the clinical department by each director. In this study, data from the first 3 months (September-November 2015) of monitoring were analyzed, and the initial effect of audit and feedback on physician hand hygiene compliance using electronic counting devices was evaluated.

Overall hand hygiene compliance in outpatient settings was analyzed at the hospital and clinical department levels. Individual physician hand hygiene compliance was also analyzed before and after feedback. We assumed that each room was used by one individual physician, even if multiple physicians shared the room in a day. Physicians examining <10 patients in 1 month, and physicians who were transferred to another hospital during the study period, were excluded.

The study was approved by the Institutional Ethical Committee of Mie University Graduate School of Medicine (no. 1624).

Electronic counting devices and calculation of adherence rates

The electronic counting device, Hand Hygiene Monitoring System Compleo-IO, places a wireless device under a handrub dispenser and transmits information wirelessly about the dispenser lever pressed to a nearby computer, which then automatically sums the amount of alcohol-based handrub used in that room.

Hand hygiene adherence rates in this study were calculated by modifying an "all-or-none adherence measurement."[1] In most cases in our outpatient setting, a physician examines patients sequentially, and the opportunity for a hand hygiene action after patient contact and before patient contact may refer to the same time frame. Therefore, it was assumed that for each outpatient examination, at least one hand hygiene action should be performed during the examination. Hand hygiene counts per room in a day were collected by the electronic counting devices, and the number of patients examined in a room on each day was obtained from visit records. Therefore, hand hygiene adherence rates were calculated as follows: the number of hand hygiene counts divided by the number of outpatients examined multiplied by 100. Individual physician adherence rates were also assessed by classification into 4 categories: very low (0% to <25%), low (25% to <50%), moderate (50% to <75%), and high (75%-100%).

Statistical analysis

Statistical analyses were performed using SPSS version 22 (SPSS Benelux, Gorinchem, The Netherlands). Categorical variables were compared by Pearson χ^2 test. $P < .05$ was considered statistically significant.

RESULTS

Characteristics of the study population

Two hundred and eighty physicians were monitored and evaluated for their hand hygiene compliance for 3 months across 28 clinical departments (15 nonsurgical departments, including cardiology, gastroenterology and hepatology, pulmonology, nephrology, hematology, oncology, diabetes and endocrinology, family medicine, neurology, pediatrics, psychiatry, diagnostic radiology, radiation therapy, anesthesiology and pain clinic, and interventional radiology, and 13 surgical departments, including gastroenterologic surgery, hepatobiliary pancreatic transplant surgery, respiratory surgery, cardiovascular surgery, breast center, pediatric surgery, orthopedic surgery, obstetrics and gynecology, dermatology, nephrourologic surgery, ophthalmology, otorhinolaryngology head and neck surgery, and neurosurgery).

Baseline data were obtained through monitoring without prior notice for 1 month, and hand hygiene adherence rates of each clinical department were reported at the monthly directors' meeting, and monitoring was then continued.

Overall hand hygiene compliance before and after feedback

The overall hand hygiene adherence rate in outpatient settings in our hospital was 10.7% at baseline, which improved significantly