Positive deviance: Using a nurse call system to evaluate hand hygiene practices

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Key Words:
- Step-down unit
- Sustained results
- Alcohol hand rub
- Observational study
- Epidemiology

**Background:** Many approaches have been taken to increase compliance with hand hygiene by health care professionals. We evaluated a nurse call system used as a tool in a positive deviance (PD) approach to improving compliance.

**Methods:** We conducted a quasi-experimental study between September 2008 and December 2010 in 2 step-down units (SDUs). The consumption of alcohol-based sanitizers for hand hygiene was monitored by electronic handwash counters installed in each room as of January 2009. The number of nurse visits to patient rooms was measured by the nurse call system, which provides information on each instance of nursing care provided to the patients.

**Results:** The use of alcohol hand rubs was increased in both units after implementation of the PD approach, with higher rates sustained for more than 2 years. The rate of device-related infections showed a decreasing trend, especially for catheter-associated urinary infection in the east SDU. In both units, the ratio of alcohol hand rub uses to nurse visits was >2.5, indicating increased use of alcohol rubs, especially in the east SDU, which had a ratio of 3 for 2010.

**Conclusions:** The PD approach to hand hygiene produced increased compliance, as measured by increased consumption of alcohol hand sanitizer, an improved ratio of alcohol hand rub uses to nurse visits, and a reduced rate of device-related infections, with results sustained over 2 years.

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resources, and actions; and searches for the best solutions using unique strategies.

In our institution, among other resources, we have electronic handwash counters inside all alcohol-based hand rub dispensers installed in patients’ rooms, allowing us to measure the number of times our staff members use the sanitizing product. We also have a manual nurse calling system which allows us to account for and report each time a nurse enters and exits a patient room.

The present study investigated the application of PD in 2 step-down units (SDUs), and evaluated the adherence of the nursing staff to hand hygiene practices based on the ratio between the number of uses of alcohol-based hand rub (using the electronic counters) and the number of nurse visits to patient rooms (using the nurse call system).

MATERIALS AND METHODS

This quasi-experimental study was conducted in 2 SDUs of Albert Einstein Hospital in São Paulo, Brazil, between September 2008 and December 2010. The east SDU is a 22-bed unit for patients with mixed clinical conditions; the west SDU is another 22-bed unit for patients with cardiovascular conditions. Both units include private patient rooms only. The study was approved by Albert Einstein Hospital’s Ethics Committee.

The study began with a survey of cases of health care–associated infections, which were identified through active epidemiologic surveillance by trained infection preventionists using the methodology of the Centers for Disease Control and Prevention.

In December 2008, electronic handwash counters were installed in all patient rooms, and in January 2009, we began to monitor the use of alcohol-based hand rubs inside the rooms. The consumption of alcohol-based rub (62% ethyl alcohol plus 4% isopropyl alcohol) during the hand hygiene procedure was measured by the electronic handwash counters. Each hand-rub dispenser records only one event every 2 seconds, even if multiple aliquots of the product are dispensed during this period. Chlorhexidine dispensers (2% chlorhexidine) are also available, but do not have electronic handwash counters. All in-room dispensers release the same amount of product per use (~1.3 mL). With the counters, we were able to determine both the total number of hand rub aliquots dispensed and the total volume of alcohol rub used (expressed in liters per 1,000 patient-days).

The number of nurse visits to patient rooms was measured using the nurse call system, which was installed in the east SDU in June 2009 and in the west SDU in March 2010. As a nurse enters a patient room, she pushes a button that registers her presence. As she exits the room, she pushes another button to deactivate the system. The system reports provide follow-up information on each instance of nursing care provided to patients.

PD implementation

The PD project was implemented in the west SDU (cardiology unit) in February 2009 and in the east SDU (general unit) in August 2009. The PD approach was reinforced at bimonthly meetings with the participation of the entire staff from these units: nurses, physical therapists, dietitians, physicians, psychologists, cleaning and food service staff, radiology technicians, and volunteers. During these meetings, the group discussed the importance of hand hygiene, with focus on the WHO’s “My 5 Moments for Hand Hygiene” approach and its applications to patient care, and suggested possible approaches to increasing compliance with hand hygiene practices. The participants (positive deviants) were encouraged to spread the ideas to other staff members, and hospital management committed to implementing the proposed solutions and publishing monthly reports on infection rates and hand sanitizer consumption.

Solutions suggested by the positive deviants included changing the locations of the alcohol rub dispensers to allow easier access and use, providing a daily supply of liquid alcohol for concurrent surface cleaning in the rooms, and changing the procedure for monitoring the consumption of alcohol rubs. This procedure was initially performed by a single staff member every 48 hours, but gradually evolved to become the responsibility of every professional involved with patient care, at the end of shifts.

The additional metric of compliance with the use of alcohol-based hand rubs by the nursing staff (ie, the relationship between the nurse call system reports and the use of hand sanitizer inside the rooms) was initially proposed in one of the PD meetings. Based on this suggestion, we began to provide monthly reports on the ratio of hand sanitizer consumption to nurse visits to patient rooms as the number of alcohol rub aliquots dispensed divided by the number of nurse visits.

Statistical analysis

Statistical analyses were performed using SPSS version 13.0. Differences in proportions between baseline data (September to December 2008) and the study period (2009 and 2010) were analyzed using the $\chi^2$ test or the Fisher exact test as appropriate. All tests for statistical significance were 2-sided tests, with the significance level set at $P < .05$.

RESULTS

As shown in Table 1 and Figures 1 and 2, there were no significant changes in the number of patients per day, nurse–patient ratio, or occupancy rate in either SDU from 2009 to 2010. The rate of invasive device use differed in the 2 SDUs; however, the differences within a given unit over time were not marked. In the east SDU, patient length of stay increased in both 2009 and 2010 ($P = .001$). The ratio of alcohol hand rub uses to nurse visits was $>2.5$ in both SDUs.

With respect to infection rates, in 2009, the east SDU had a reduction in the number invasive device–associated infections compared with the fourth quarter of 2008 ($P = .021$), but this trend was not seen in 2010. The rates of catheter-associated urinary tract infection also were statistically significantly reduced in both 2009 ($P = .018$) and 2010 ($P = .008$) compared with 2008. The west SDU also had a reduced rate of catheter-related urinary tract infections over the study period, although the differences were not statistically significant ($P > .05$).

The incidence density of all nosocomial infections (device-associated and non–device-associated) and the incidence density of infections associated with devices showed an overall trend toward reduction, but the changes were not statistically significant.

DISCUSSION

Appropriate hand hygiene in health care settings is a priority for both professionals and organizations concerned with patient safety. Hands are contaminated during contact with people, the environment, or objects, and appropriate hand hygiene prevents cross-contamination and dissemination of hospital-acquired infections.

Health care–associated infections represent a major challenge, and actions must be taken to prevent and control these conditions. The WHO adopted the “My 5 Moments for Hand Hygiene” approach to alert health care professionals to always sanitize their hands. These “5 moments” are before contact with patients, before
Understand how health care professionals perform hand sanitation is essential to planning appropriate interventions. Promoting and improving hand hygiene practices can reduce infection rates in health care services. Guidelines in this area encourage health care institutions to develop initiatives that foster hand hygiene practices and strategies to monitor compliance of the staff with such practices. Some studies, however, have shown that compliance with hand hygiene practices varies considerably, and in some cases is below 50%.3,12,13

The difficulties in assessment are related to the metrics of compliance. Direct observation is considered the most effective approach, because the observer is able to account for every opportunity of performing hand hygiene and to report on the quality of the procedure. This approach is not unbiased, however; in SDUs, patients stay in private rooms, and the conspicuous presence of the observer tends to artificially improve staff behavior (Hawthorne effect).4 With this in mind, we chose to use an electronic handwash counter, which records the actual number of alcohol rub aliquots dispensed over a 24-hour period. The major drawback of this method is its inability to qualitatively assess the hand hygiene procedure.

According to the latest Cochrane review of studies assessing adherence to hand hygiene practices (2009), there remains insufficient evidence to support any given strategy to ensure better compliance and maintenance of compliance with hand hygiene practices. The mere introduction of alcohol hand rubs followed by education and training is not sufficient. The use of multiple strategies, such as involving the staff members themselves in the planning of initiatives or incentive strategies, seems to produce better results.12

We previously showed that the PD approach to hand hygiene increased the frequency of hand sanitation and led to a decreased rate of nosocomial infection,4 while ensuring sustainable results.5 These findings are confirmed by our present results, which show increased use of alcohol hand rubs since February 2009, when the PD approach was implemented in the west SDU. Regarding the reported correlation between the use of alcohol hand rubs and nurse visits to patient rooms, as well as the rates of device-related infections in the east SDU in 2009 versus 2008, the lack of statistical significance in the infection rate comparison might be related to the low incidence of nosocomial infections observed during the pre-intervention period.

Compliance with hand hygiene practices may vary depending on occupational category. The literature shows that physicians are less compliant than other health care professionals.3,13,14 However, nurses are numerically more representative and have more repeated contact with the patients, which creates more frequent opportunities for hand hygiene and, in its absence, a greater risk of cross-contamination.3 Along with nursing staff, participants in our PD meetings include physical therapists, pharmacists, dietitian, physicians, and cleaning and food service staff. During one of these meetings, the idea was raised of using an indirect metric to assess staff adherence to hand hygiene practices, that is, the ratio between the number of alcohol rub aliquots dispensed (registered on the electronic counters) and the number of nurse visits to patient rooms (obtained from the manual nurse calling system reports). The proposal was brought up during a discussion about the value of the month-by-month comparison of the alcohol hand rubs use, considering the possible changes in occupancy rates and workload in the SDUs.

Table 1

<table>
<thead>
<tr>
<th>Unit demographics</th>
<th>East SDU (general unit)</th>
<th>West SDU (cardiology unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>September-December 2008</td>
<td>2009</td>
</tr>
<tr>
<td>Patient-days</td>
<td>1,737</td>
<td>7,515</td>
</tr>
<tr>
<td>Occupancy rate per month, %</td>
<td>94.9</td>
<td>94.9</td>
</tr>
<tr>
<td>Length of stay, days, mean ± SD</td>
<td>5.8</td>
<td>9.5*</td>
</tr>
<tr>
<td>Nursing workload</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse/patient ratio in SDU</td>
<td>1:2.5</td>
<td>1:2.5</td>
</tr>
<tr>
<td>Number of nurse visits to patient rooms (mean number per month)</td>
<td>-</td>
<td>16,146</td>
</tr>
<tr>
<td>Hand hygiene</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of alcohol rub aliquots dispensed in patient rooms</td>
<td>-</td>
<td>304,540</td>
</tr>
<tr>
<td>Ratio of alcohol rub aliquots dispensed and visits to patient rooms</td>
<td>-</td>
<td>2.7</td>
</tr>
<tr>
<td>Device utilization rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bladder catheter</td>
<td>0.10</td>
<td>0.08</td>
</tr>
<tr>
<td>Central venous line</td>
<td>0.42</td>
<td>0.48</td>
</tr>
<tr>
<td>Tracheostomy</td>
<td>0.17</td>
<td>0.17</td>
</tr>
<tr>
<td>Device-associated infections, n</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Bloodstream infections/1,000 catheter-days</td>
<td>2.7</td>
<td>0.6</td>
</tr>
<tr>
<td>Urinary tract infections/1,000 catheter-days</td>
<td>16.6</td>
<td>4.8****</td>
</tr>
<tr>
<td>Pneumonia/1,000 tracheostomy-days</td>
<td>3.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Incidence density of device-associated infections/1,000 patient-days</td>
<td>1.2</td>
<td>0.2***</td>
</tr>
<tr>
<td>Incidence density of hospital-acquired infections/1,000 patient-days</td>
<td>9.8</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Device utilization rates = device-days/patient-days.  
*P < .001; **P < .004; ***P < .021; ****P < .018; *****P < .008.
1Periods March-September and November-December 2010. (October data are missing due to call system maintenance stop.)
2Period June-December 2009.
3Periods January-September and November-December 2010. (October data are missing due to call system maintenance stop.)
4Period February-December 2009.
We had no target volume in mind, given that other staff members as well as patients, family members, and companions also use the alcohol hand rubs in the rooms without activating the call system. However, intuitively we assumed that there should be no fewer than 2 moments for hand hygiene per nurse visit, because health care professionals should sanitize their hands at least twice, on entering and before leaving the room. The actual ratio stabilized at around 3 in the east SDU and at 2.7 in the west SDU (both in 2010).

In our opinion, this method is also valid for assessing sustained results of the PD approach on our floor; the presentation of these data to the whole team encourages a permanent discussion about the “5 Moments” and serves as an incentive for those teams who seek to exceed their own performance indicators on a monthly basis. This method reinforces the feedback loop in this process related to hand hygiene.

The protocol design (quasi-experimental) may be a limitation of this study. The inclusion of a control group was not considered, however, given that the PD approach to hand hygiene had already proven successful in our institution. It is worth mentioning that our hospital has other strategies and care practices in place for the prevention of device-related infections, but the PD approach has had a clear influence on local outcomes.

We conclude that the PD approach to hand hygiene produced positive results in terms of compliance to this practice, with increased consumption of alcohol hand rubs, improved ratio of alcohol rub use to nurse visits to patient rooms in the east SDU, and a >2 ratio in both the east and west SDUs. In addition, the use of
this approach led to a reduction in the rate of device-related infections in both units, with sustained results over 2 years.

References