ORIGINAL ARTICLE

Positive Deviance: A New Strategy for Improving Hand Hygiene Compliance

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OBJECTIVE. To evaluate the effectiveness of a positive deviance strategy for the improvement of hand hygiene compliance in 2 adult step-down units.

DESIGN. A 9-month, controlled trial comparing the effect of positive deviance on compliance with hand hygiene.

SETTING. Two 20-bed step-down units at a tertiary care private hospital.

METHODS. The first phase of our study was a 3-month baseline period (from April to June 2008) in which hand hygiene episodes were counted by use of electronic handwashing counters. From July to September 2008 (ie, the second phase), a positive deviance strategy was implemented in the east unit; the west unit was the control unit. During the period from October to December 2008 (ie, the third phase), positive deviance was applied in both units.

RESULTS. During the first phase, there was no statistically significant difference between the 2 step-down units in the number of episodes of hand hygiene per 1,000 patient-days or in the incidence density of healthcare-associated infections (HAIs) per 1,000 patient-days. During the second phase, there were 62,000 hand hygiene episodes per 1,000 patient-days in the east unit and 33,570 hand hygiene episodes per 1,000 patient-days in the west unit ($P < .01$). The incidence density of HAIs per 1,000 patient-days was 6.5 in the east unit and 12.7 in the west unit ($P = .04$). During the third phase, there was no statistically significant difference in hand hygiene episodes per 1,000 patient-days ($P = .16$) or in incidence density of HAIs per 1,000 patient-days.

CONCLUSION. A positive deviance strategy yielded a significant improvement in hand hygiene, which was associated with a decrease in the overall incidence of HAIs.

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Although hand hygiene is widely regarded as the most effective preventive measure for healthcare-associated infection (HAI),[1] there is little robust evidence about the best interventions to improve hand hygiene compliance or to determine whether a sustained increase in compliance can reduce rates of HAI.[2] Alcohol-based products, compared with other commonly used products, have been shown to reduce the time spent on hand hygiene while achieving even higher rates of hand decontamination.[3] Many hospitals have reported a higher use of alcohol gel preparations than of chlorhexidine.[4,5] In a previous study, we demonstrated that feedback of product use resulted in no significant improvement in hand hygiene.[6] Other measures, including positive deviance[7] for developing accountability among healthcare workers (HCWs), should be considered to increase and sustain hand hygiene compliance.

According to the Positive Deviance Initiative,[8] "[p]ositive [d]eviance is based on the observation that in every community there are certain individuals or groups whose uncommon behaviors and strategies enable them to find better solutions to problems than their peers, while having access to the same resources and facing similar or worse challenges."[9] Positive deviance, pioneered by Jerry and Monique Sternin of the Positive Deviance Initiative,[8] has been used worldwide to combat such intractable problems as childhood malnutrition, sex trafficking of girls, and poor infant health and

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has more recently been applied to the serious problem of HAIs, specifically those due to methicillin-resistant *Staphylococcus aureus*.[10]

Improving hand hygiene compliance is one of the performance improvement objectives of our institution, especially in hospital units serving critically ill patients. In our intensive care unit (ICU), we have personnel who observe the performance of hand hygiene by HCWs; however, because the rooms in a step-down unit (SDU) are private, it is impossible to observe hand hygiene compliance by HCWs in an SDU. The purpose of our study was to prospectively evaluate compliance with hand hygiene in 2 similar adult SDUs using electronic counting devices for hand washing (hereafter referred to as electronic handwashing counters) while also applying a positive deviance strategy.

METHODS

From April to June 2008, the baseline rates of hand hygiene episodes and HAIs were established prior to the introduction of a positive deviance strategy in the east SDU (ie, the intervention unit); the west SDU served as the control unit from July to September 2008. Because of the success of the positive deviance strategy in the intervention unit, we decided to extend the positive deviance strategy to the control unit (ie, the west SDU) in the final 3 months (from October to December 2008). Then a 9-month controlled trial was conducted in 2 adult, 20-bed SDUs with the same physical layout during the period from April 1, 2008, to December 31, 2008. All the rooms in these SDUs are single-bed rooms. Our study was approved by the facility's institutional review board.

Hand hygiene episodes were recorded by electronic handwashing counters for alcohol gel (ie, 62% ethyl alcohol and 4% isopropyl alcohol in a 1-L bag of Purell Hand Instant Sanitizer; Gojo Industries). The alcohol gel dispenser (Gojo NXT 1-L dispenser; Gojo Industries) records only 1 episode in any 2-second period, even if more than 1 aliquot of alcohol is dispensed. Chlorhexidine dispensers (chlorhexidine 2%) were also available for use, but these dispensers did not have electronic handwashing counters. Both dispensers dispensed the same volume of product per use (approximately 1.3 mL) and are located inside the patient rooms. The total volume of product used and the number of aliquots of alcohol gel per 1,000 patient-days dispensed, as well as the total use of alcohol gel and chlorhexidine (in units of liter per 1,000 patient-days), were determined.

A positive deviance strategy was first introduced in the intervention unit (ie, the east SDU). Positive deviance in hand hygiene links what HCWs know to what they really do during work shifts. The positive deviance approach focuses on promoting compliance with hand hygiene at all opportunities by everyone who comes in contact with patients and their environment. Every frontline HCW has countless opportunities for hand hygiene when caring for patients. They also are the very best on-site experts on what is needed in their workplace to improve hand hygiene compliance (eg, changing the position of the alcohol gel dispenser in the patient room or saying that it is necessary to control the pressure of the tap water). A meeting of all SDU HCWs was convened to discuss positive deviance twice monthly. This meeting included HCWs from all shifts and gave these HCWs opportunities to express their feelings about hand hygiene, to discuss what needs to be improved, and to note good examples. Monthly HAI rates were shown to the HCWs who worked in the intervention unit.

We applied the experience of HCWs at Albert Einstein Medical Center in Philadelphia, Pennsylvania, who implemented a positive deviance strategy to reduce infections due to methicillin-resistant *S. aureus*.[11] The process of positive deviance for hand hygiene was as follows: changing experiences, showing how to improve hand hygiene practices, and discussing the best way to perform hand hygiene in the hospital unit.

The HCWs who exhibited positive deviance early on (hereafter referred to as positive deviants) were discovered by the 2 SDU nurse managers, but after several weeks of implementation of the positive deviance strategy, these positive deviants identified other SDU HCWs who were also good at performing hand hygiene. The positive deviants were those HCWs who wanted to change and develop new ideas for improving hand hygiene and who stimulated other HCWs (including doctors) to use the alcohol gel product. The positive deviants spontaneously decided to count hand hygiene episodes during their shifts to assess the performance of their colleagues. They also created and edited videos that were shown during positive deviance meetings. To be considered a positive deviant was a great source of pride.

The total number of hand hygiene episodes recorded from the electronic handwashing counters from each patient room in which an HCW worked was shown by the positive deviants and discussed during the meetings so that HCWs could review them and improve their performance. They could also view the total number of hand hygiene episodes of other HCWs, promoting a comparison of hand hygiene compliance among them. We provided positive deviance training for all SDU HCWs (including nurses, physicians, physical therapists, speech pathologists, and nutritionists) who used the dispensers. For both SDUs (ie, the intervention unit and the control unit), we maintained the same HCW team during the entire period of the study, with the intention of avoiding crossover of nursing staff during the shifts.

HAI surveillance was performed by trained infection control practitioners using the Centers for Disease Control and Prevention definitions[12] in both SDUs during the study. Mean length of stay, occupancy rate, nurse-to-patient ratio, antibiotic use, and invasive-device use ratio were calculated for the duration of the study. In addition, we analyzed the nurses' workload using the median nursing activities score.[13]

Statistical analyses were performed using SPSS, version 13.0 (SPSS). Comparisons between SDUs during the study periods were performed using the Fisher exact test, the χ^2 statistic test, and the *t* test for equal variances. The Mann-Whitney *U* test was performed for nonnormally distributed continuous variables. All tests of statistical significance were 2-sided, with a significance level set at .05.

RESULTS

Study Sample, Compliance, and Characteristics of Patients and Nurses

During the first 3 months of our study (ie, the preintervention phase), there were 1,492 patient-days and 69,959 hand hygiene episodes counted by use of electronic handwashing counters in the east SDU. In the west SDU (ie, the control unit), there were 1,794 patient-days and 79,761 hand hygiene episodes counted by use of electronic handwashing counters (Tables 1 and 2). There was no statistically significant difference between the 2 SDUs in the number of hand hygiene episodes per 1,000 patient-days (Table 2).

No statistically significant differences were found in the mean length of stay or occupancy rate of patients, in the nurse-to-patient ratio, or in the use of urinary catheters, central venous catheters, and/or tracheostomy between the 2 SDUs (Table 1). There was a higher consumption of antibiotics in the west SDU than in the east SDU ($P < .01$) (Table 1). The median nursing activities score was 48.0 in the east SDU and 49.3 in the west SDU ($P < .01$) (Table 1).

During the second 3-month phase of our study (ie, the positive deviance phase) in the intervention unit (ie, the east SDU), there were 1,769 patient-days and 109,683 hand hygiene episodes counted by use of electronic handwashing counters. In the control unit (ie, the west SDU), there were 1,852 patient-days and 62,178 hand hygiene episodes counted by use of electronic handwashing counters (Tables 1 and 2). There was nearly a 2-fold difference in the amount of alcohol gel dispensed between the intervention unit and the control unit (62,000 vs 33,570 aliquots per 1,000 patient-days; $P < .01$). There was also a statistically significant difference in the number of liters of alcohol gel used between the intervention unit and the control unit (249.5 vs 126.1 L per 1,000-patient days; $P < .01$). However, there was no statistically significant difference in the number of liters of chlorhexidine used between the intervention unit and the control unit (63.5 vs 49.9 L per 1,000-patient days; $P = .18$) (Table 2).

No statistically significant differences were found in the mean length of stay and occupancy rate of patients, in the nurse-to-patient ratio, or in the use of urinary catheters, central venous catheters, and/or tracheostomy between the 2 SDUs in our study (Table 1). There was a higher consumption of antibiotics in the intervention unit than in the control unit ($P < .01$) (Table 1). There was no statistically significant difference in median nursing activities scores between the intervention unit and the control unit (46.7 vs 46.3; $P = .10$) (Table 1).

In the third phase of our study (positive deviance in both SDUs), there were 1,771 patient-days and 102,602 hand hygiene episodes counted by use of electronic handwashing counters in the east SDU, and there were 1,863 patient-days and 81,928 hand hygiene episodes counted by use of electronic handwashing counters in the west SDU (Tables 1 and 2). There was no statistically significant difference in hand hygiene episodes per 1,000 patient days ($P = .16$) (Table 2).

No statistically significant differences were found in the mean length of stay and mean occupancy rate of patients, in the nurse-to-patient ratio, or in the use of urinary catheters, central venous catheters, and/or tracheostomy between the 2 SDUs in our study (Table 1). There was a higher consumption of antibiotics in the east SDU than in the west SDU ($P < .01$) (Table 1). There was also a statistically significant difference in median nursing activities scores between the east SDU and the west SDU (51.1 vs 43.7; $P < .01$) (Table 1).

Infection Rates and Organisms Involved

During the first phase of our study, there was no statistically significant difference between the 2 SDUs in the incidence density of HAIs per 1,000 patient-days (Table 2). Device-associated infections by type of infection and by organism(s) are described in Table 3.

HAI rates during the positive deviance phase in the east and west SDUs, respectively, were as follows: 1.5 and 0 bloodstream infections per 1,000 device-days; 15.5 and 25.8 urinary tract infections per 1,000 device-days; 0 and 1.8 cases of pneumonia per 1,000 device-days; and 0 and 1.8 cases of tracheobronchitis per 1,000 device-days (Table 2). The incidence densities of device-associated infections during the positive deviance phase were 2.4 device-associated infections per 1,000 patient-days in the east SDU and 3.3 device-associated infections per 1,000 patient-days in the west SDU ($P = .65$). The incidences of all HAIs were 6.5 HAIs per 1,000 patient-days in the east SDU and 12.7 HAIs per 1,000 patient-days in the west SDU ($P = .04$).

During the third phase of our study, there was no statistically significant difference in incidence density of HAIs between the east SDU and the west SDU (7.3 vs 5.4 HAIs per 1,000 patient-days) (Table 2). A relationship between the incidence density of HAIs per 1,000 patient-days and the the number of aliquots of alcohol gel dispensed per 1,000 patient-days in each SDU during the 3 study phases is shown in the Figure.

DISCUSSION

The strongly positive and consistent results from previous studies of positive deviance suggested that the positive deviance approach could be successful; however, their relatively weak study designs limited the ability to attribute causality

TABLE 1. Characteristics of the Patients and Nurses in the 2 Step-Down Units (SDUs) during the 3 Study Phases

	Preintervention phase (April–June 2008)			Positive deviance phase in east SDU (July–September 2008)			Positive deviance phase in both SDUs (October–December 2008)		
Characteristic	East SDU	West SDU	*P*	East SDU	West SDU	*P*	East SDU	West SDU	*P*
Patient data									
No. of patient-days	1,492	1,794		1,769	1,852		1,771	1,863	
Occupancy rate per month, %	82.3	98.6		96.1	98.9		96.3	96.4	
Length of stay, mean ± SD, days	14.6 ± 5.42	14.3 ± 1.47	.92	11.5 ± 0.97	10.8 ± 1.34	.47	11.4 ± 1.60	13.1 ± 3.40	.48
Nursing workload									
Nurse-to-patient ratio in SDU	1 : 2.3	1 : 2.3		1 : 2.3	1 : 2.3		1 : 2.3	1 : 2.3	
Median nursing activities score	48.0	49.3	<.01	46.7	46.3	.10	51.1	43.7	<.01
Device use rates, device-days per patient-days									
Urinary catheter	0.20	0.12	.28	0.11	0.09	.21	0.06	0.07	.42
Central venous line	0.40	0.39	.87	0.38	0.35	.52	0.39	0.36	.66
Tracheostomy	0.46	0.36	.18	0.40	0.31	.18	0.33	0.38	.46
Antimicrobial consumption, DDD per 1,000 patient-days[a]									
β-lactams	875.7	894.6	.62	1298.8	1150.9	<.01	1,516.2	1,154.7	<.01
β-lactams/inhibitor	83.2	153.4	<.01	323.2	230.4	<.01	181.8	316.8	<.01
Aminoglycosides	19.5	16.3	.61	77.4	26.1	<.01	4.2	47.6	<.01
Vancomycin	87.5	120.9	.01	201.3	123.8	<.01	132.3	64.9	<.01
Metronidazole	117.7	167.1	<.01	117.5	127.7	.45	135.3	131.7	.79
Quinolones	441.3	392.5	.03	523.7	572.1	.03	323.4	380.4	<.01
Total	1,668.4	2,329.3	<.01	2,541.9	2,230.9	<.01	2,293.2	2,096.1	<.01

NOTE. SD, standard deviation.

[a] The defined daily dose (DDD) is the assumed average maintenance dose per day for a drug used for its main indication for adults. For example, the DDD of levofloxacin is 0.5 g; if 200 g were dispensed in a period with 4,500 patient-days, then (200 g/0.5 g)/4,500 patient-days × 1,000 = 89 DDDs per 1,000 patient-days.

TABLE 2. Results of 9-Month, Controlled Trial Comparing the Effect of Positive Deviance on Compliance with Hand Hygiene in 2 Step-Down Units (SDUs), during 3 Study Phases

	Preintervention phase (April–June 2008)			Positive deviance phase in east SDU (July–September 2008)			Positive deviance phase in both SDUs (October–December 2008)		
Value	East SDU	West SDU	*P*	East SDU	West SDU	*P*	East SDU	West SDU	*P*
Hand hygiene									
Total no. of aliquots of alcohol gel dispensed	69,959	79,761		109,683	62,178		102,602	81,928	
No. of aliquots of alcohol gel dispensed per 1,000 patient-days	46,890	44,460	.75	62,000	33,570	<.01	57,930	43,980	.16
Alcohol gel used, L per 1,000 patient-days	136.0	115.1	.16	249.5	126.1	<.01	238.8	204.8	.07
Chlorhexidine used, L per 1,000 patient-days	60.9	50.2	.28	63.5	49.9	.18	42.3	40.2	.82
No. of device-associated infections	6	8		4	6		5	4	
Bloodstream infections per 1,000 catheter-days	3.3	0		1.5	0		0	0	
Urinary tract infections per 1,000 catheter-days	13.2	31.8		15.5	25.8		27.3	23.3	
Cases of pneumonia per 1,000 device-days	0	1.6		0	1.8		0	0	
Cases of tracheobronchitis per 1,000 device-days	0	0		0	1.8		3.4	1.4	
Incidence density of device-associated infections per 1,000 patient-days	4.0	4.5	.74	2.4	3.3	.65	2.8	2.1	.65
Incidence density of HAIs per 1,000 patient-days	9.4	8.9	.60	6.5	12.7	.04	7.3	5.4	.81

NOTE. HAIs, healthcare-associated infections.

TABLE 3. Device-Associated Infections in 2 Step-Down Units (SDUs) during 3 Study Phases, by Type of Infection and by Organism(s)

Type of device-associated infection	Preintervention phase (April–June 2008)				Positive deviance phase in east SDU (July–September 2008)				Positive deviance phase in both SDUs (October–December 2008)			
	East SDU		West SDU		East SDU		West SDU		East SDU		West SDU	
	No. of cases[a]	Attributable organism(s)	No. of cases[a]	Attributable organism(s)	No. of cases[a]	Attributable organism(s)	No. of cases[a]	Attributable organism(s)	No. of cases[a]	Attributable organism(s)	No. of cases[a]	Attributable organism(s)
Bloodstream infection	2	*S. epidermidis; E. faecalis*	0	…	1	*C. albicans*	0	…	0	…	0	…
Urinary tract infection	4	*P. aeruginosa; P. aeruginosa* and *K. pneumoniae; E. cloacae; E. faecalis*	7	*K. pneumoniae; K. pneumoniae; K. pneumoniae; K. pneumoniae* and *E. coli; E. faecalis; P. aeruginosa; C. tropicalis*	3	*P. aeruginosa; K. pneumoniae; C. freundii*	4	*P. aeruginosa; K. pneumoniae; B. cepacia; C. albicans*	3	*P. aeruginosa; P. aeruginosa; S. capitis*	3	*K. pneumoniae; M. morganii; C. albicans*
Pneumonia	0	…	1	*P. aeruginosa*	0	…	1	Not identified	0	…	0	…
Tracheobronchitis	0	…	0	…	0	…	1	*P. aeruginosa*	2	*K. pneumoniae* and *P. aeruginosa; A. xylosoxidans*	1	*P. aeruginosa*

NOTE. *A. xylosoxidans, Achromobacter xylosoxidans; B. cepacia, Burkholderia cepacia; C. albicans, Candida albicans; C. freundii, Citrobacter freundii; C. tropicalis, Candida tropicalis; E. cloacae, Enterobacter cloacae; E. coli, Escherichia coli; E. faecalis, Enterococcus faecalis; K. pneumoniae, Klebsiella pneumoniae; M. morganii, Morganella morganii; P. aeruginosa, Pseudomonas aeruginosa; S. capitis, Staphylococcus capitis; S. epidermidis, Staphylococcus epidermidis.*

[a] Per 1,000 device-days.

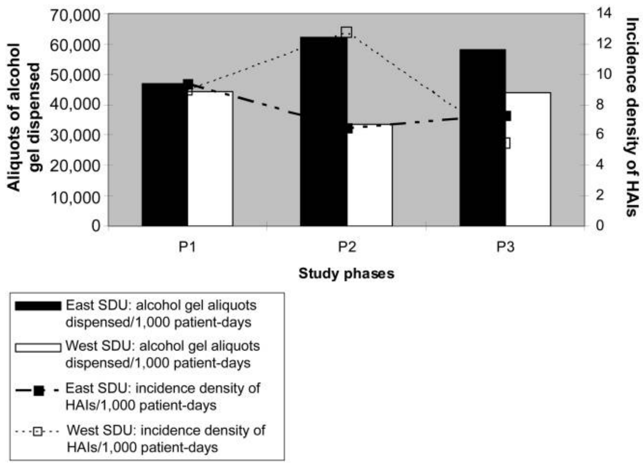

figure Relationship between the incidence density of healthcare-associated infections (HAIs) per 1,000 patient-days and the number of aliquots of alcohol gel dispensed per 1,000 patient-days in each step-down unit (SDU) during the 3 study phases. P1, preintervention (April–June 2008); P2, positive deviance in the east SDU (July–September 2008); P3, positive deviance in both SDUs (October–December 2008).

to the interventions.[9] However, we felt that the positive deviance approach for improving hand hygiene compliance deserved further evaluation.

There is a need for improving study designs in reports of hand hygiene interventions. The great majority of hand hygiene studies involve uncontrolled before-and-after study designs[2] or controlled before-and-after study designs with a nonequivalent control group.[14] These designs do not have a standard nomenclature and are hampered by confounding and regression to the mean.[15] These quasi-experimental study designs are frequently used when it is not logistically feasible to conduct a controlled trial.[16] In our study, we had 2 similar adult SDUs (the east and west units) that permitted us to develop an ethical, controlled trial for evaluating a positive deviance strategy with HCWs using electronic handwashing counters to improve hand hygiene compliance.

To our knowledge, the present study is the first to include a controlled clinical trial with a positive deviance approach to increase hand hygiene compliance in a medical-surgical SDU that showed a significant reduction in HAIs. The 2 SDUs have no distinction between patients. The SDU patients are transferred from the medical-surgical ICU of this hospital and from wards or from the emergency department. Importantly, no differences in potential confounders were observed between the intervention unit and the control unit, including mean length of stay, nurse-to-patient ratio, nursing activities score, and invasive-device use ratio during the positive deviance phase (from July to September 2008). The difference in total antibiotic consumption does not reflect a difference between the patient populations. The median nursing activities score between these populations was very similar (46.7 for the intervention unit and 46.3 for the control unit).

Rupp et al[17] developed a prospective, controlled, crossover trial of alcohol-based hand gel in 2 critical care units, showing that the introduction of alcohol-based gel resulted in a significant and sustained improvement in the rate of hand hygiene adherence. However, they did not detect changes in the incidence of HAIs. Although the newly developed "My five moments for hand hygiene" tool has emerged from the World Health Organization guidelines on hand hygiene in health care to add value to any hand hygiene improvement strategy,[18] in many medical centers where alcohol gel has been implemented, hand hygiene compliance rates are only approximately 50%.[19,20]

The introduction of alcohol gel products without an associated behavioral modification program has proved to be ineffective.[20,21] We believe that positive deviance can offer an alternative way to produce change. Exchanging experiences and reading articles, as we do in our regular staff meetings, are ways to exhibit positive deviance that need to be encouraged so that all doctors improve hand hygiene compliance. Telling your peers how often you succeed (as our positive result) and how often you fail can be a good beginning.[21] Using this method, all the HCWs were motivated to find other ways to improve hand hygiene compliance and to encourage their colleagues on the shift to use the alcohol gel product. HCWs also believe that infection control can become a reality when they observe that improving their hand hygiene compliance results in a decrease in the rate of HAIs in the SDUs.

Some infection rates are more likely than others to be sensitive to changes in hand hygiene; for example, bloodstream infections and urinary tract infections are associated with invasive devices that are inserted by staff and manipulated periodically while the line or catheter is in place. Surgical site infections may be less sensitive to the care process because they are more likely to be associated with practices in the surgical suite.[22] However, dressings are changed every day by HCWs (and also other procedures are performed by HCWs as well), and it is difficult not to consider surgical site infections as originating in SDUs. As a result, we decided to show the rates of device-associated infections and all HAI rates per 1,000 patient-days in the SDUs during each period of the study, because there is no sensitive method for distinguishing which type of infection can be avoided by hand hygiene.

It is important to point out that the increase in the rate of urinary tract infection during the third phase in the east SDU represents only 3 cases of infection. The invasive-device use ratio in the east SDU during the third phase was 0.06, compared with the higher ratios during the first and second phases (0.20 and 0.11, respectively). However, it is difficult to compare our infection rates with those in other studies, because the Centers for Disease Control and Prevention's National Healthcare Safety Network (formerly the National

Nosocomial Infections Surveillance system) emphasizes intensive care settings.[23] In addition, hospitals have increased the sizes and the numbers of their ICUs,[24] adding SDUs to provide appropriate care for patients whose acuity of illness falls between that of ICU patients and that of ward patients. Weber et al[25] demonstrated that the infection rate provides a better delineation of the impact of HAIs across different types of adult units (ICU, SDU, or ward) and that the infection rate in the SDU is more similar to the infection rate in the ward setting.

There are several limitations to our study. First, we did not visually assess hand hygiene compliance before and after patient contacts, nor did we evaluate the handwashing technique. However, the Hawthorne effect might have an influence on an observational study in which hand washing is being documented.[26] Second, we have monitored only the use of alcohol gel with electronic handwashing counters, but we had the consumption data for chlorhexidine and alcohol gel in liters per 1,000 patient-days, which corroborated the HCWs' preference for the alcohol gel product. Third, because this intervention was performed at a single medical center, these results may not be generalizable to other hospitals. Fourth, HCWs (eg, nurses) were independent in our study, but hand hygiene episodes were not (because nurses have multiple hand hygiene episodes). Our study did not collect data on individual nurse's performance of hand hygiene. The positive deviance hypothesis was based on this positive influence lasting over a very long period of time and influencing these decisions. It is also true that because of the magnitude of the differences between the groups during the second phase of our study, there may be statistical differences even if our study were properly adjusted for the lack of independence. We assume independence even though the data do not support this assumption, and thus standard errors and *P* values are overstated. Finally, communication between nurses from both SDUs may have occurred; however, the examples of positive deviance certainly did not.

In conclusion, compliance with use of alcohol gel preparations was higher than it was with use of chlorhexidine. Positive deviance resulted in a significant improvement in hand hygiene, which was associated with a decrease in the incidence of HAI.

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