Effect of education and performance feedback on handwashing: The benefit of administrative support in Argentinean hospitals

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Background: Patients admitted to hospitals are at risk of acquiring nosocomial infections. Many peer-reviewed studies show that handwashing (HW) significantly reduces hospital infections and mortality. Our objective was to evaluate the effects of HW by health care workers (HCW) before contact with patients in 3 Argentinean hospitals. We performed an observational study of HCW to measure the effect of 2 interventions: education alone and education plus performance feedback.

Methods: A total of 3 hospitals were studied for adherence to a HW protocol. The observed HCW included physicians, nursing personnel, and ancillary staff. After initial observations to establish baseline rates of HW (phase 1), we evaluated the effect of education alone (phase 2), followed by education plus performance feedback (phase 3). We also evaluated the relationship between the administrative support and HW adherence.

Results: We observed 15,531 patient contacts in 3 hospitals. The baseline rate of HW before contact with patients was 17%. With education, HW before contact with the patients increased to 44% (relative risk 2.65; 95% confidence interval 2.33-3.02; $P < .001$). Using education and performance feedback HW further increased to 58% (relative risk 1.86; 95% confidence interval 1.38-2.51; $P < .001$). In the private hospitals where administrative support for the HW program was significantly greater, HW compliance was significantly higher (logistic regression analysis: odds ratio 5.57; 95% confidence interval 5.25-6.31; $P < .001$).

Conclusions: In this study, HW policies and education of HCW significantly improved HCW adherence to the HW protocol, however, when performance feedback was incorporated, the HW compliance increased to a greater degree. We identified that administrative support provides a positive influence in efforts to improve HW adherence. (Am J Infect Control 2003;31:85-92.)

Patients who are hospitalized are at risk of acquiring nosocomial infections, resulting in increased morbidity and mortality, extended lengths of stay, and increased health care costs. The importance of hand hygiene (HH) before contact with each patient was demonstrated 150 years ago when, in 1847, Ignaz Semmelweis studied the relation between puerperal sepsis and HH.[1] Since that time many studies have been published demonstrating that appropriate handwashing (HW), HH, or both reduces hospital infection rates[1-11] and mortality.

Health care workers (HCW) commonly carry nosocomial bacteria on their hands, and the number of organisms is higher when HW compliance is low.[4,7,12-36] Many of the pathogens responsible for nosocomial infections are transmitted from patient to patient by the hands of HCW. Although improved

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Table 1. Features of the participating hospitals

Hospital	Type of facility	Training activities	Administrative support* (compliance/criteria)	Total beds	ICU beds	Initial ratio sink:beds	Final ratio sink:beds
A	Public	Yes	0/9	250	20	1:10	1:10
B	Private	No	9/9	150	32	1:10	1:2
C	Private	Yes	7/9	180	20	1:2	1:2

ICU, Intensive care department.
*(1) Participation in infection control committee, (2) willingness to meet with infection control representative, (3) support for installation of additional sinks as needed, (4) evaluation and approval of submitted infection control policies in timely manner, (5) provision of appropriate hand hygiene supplies, (6) active participation in performance feedback process, (7) admonishment of suboptimal performance when indicated, (8) willingness to pay for services of hospital epidemiologist activities, and (9) willingness to share activities and success of the infection control efforts in other meetings.

invasive devices and other infection control practices aid in the prevention of nosocomial infections, HH remains the cornerstone in the prevention of cross-infection among patients.

Despite great efforts to improve this practice in the past 2 decades, HH compliance remains poor among HCW.[37-39] Risk of hand irritation,[40] distance to the sinks,[17] and lack of time[39] are some of the reasons cited for poor compliance. Effective strategies to improve and maintain compliance continue to be elusive.

Argentina does not yet have a mandatory requirement for a hospital infection control program or a national hospital infections surveillance system, however, there is a growing awareness that infection surveillance is an effective measure of an institution's commitment to an infection control program, and that HH plays an important role in infection prevention. Our hope is that this HW study, the first of its kind performed in Argentina, showing the baseline rates and subsequent improvement, will be a model for continuing improvement in the quality of health care throughout the country.

Several researchers have reported low adherence to HW. Studies show HW rates range from 4% to 52% with a mean of 33%.[2,3,7,16-36,39,41-44] Wurtz et al[20] found in his observational study that with the installation of an automated sink, HW compliance increased from 22% to 38%. In a multifaceted study that combined group sessions, installation of automated sinks, and performance feedback, Larson et al[43] demonstrated that HW adherence increased from 56% to 76%. Avila-Aguero et al[44] showed that the baseline prevalence of HH was 52%, that with performance feedback HH increased to 56%, and with additional motivation (movies, brochures, posters) HH reached 74%. Watanakunakorn et al[42] found differences in HH compliance rates in different work categories: resident physicians (59%), staff physician (37%), nurses (33%), and others (4%). They found no differences between work shifts; however, there were striking differences by unit, with compliance being 56% in the intensive care unit (ICU), compared with 23% in non-ICUs. Avila-Aguero et al[44] found modest differences between the nurses (67%) and ancillary staff (62%); whereas Wurtz et al[20] found 33% compliance with nurses, 35% for physicians, 25% for physiotherapists, and between 0% and 20% among technicians.

The purpose of our study was to establish a baseline compliance rate of HW by physicians, nursing personnel, and ancillary staff before patient contacts (phase 1), determine impact of the education (phase 2), and determine the reinforcing effect of performance feedback (phase 3). One of the goals of our research was to evaluate the application of the published guidelines by the Association for Professionals in Infection Control and Epidemiology, Inc. (APIC) and a multifaceted approach to improve HW in hospitals in Argentina. An additional objective of this study was to assess the role of administrative support and improved HW behavior among HCW in a Latin American country.

METHODS

Staff and settings

This study was conducted in 3 hospitals in Buenos Aires, Argentina. Each hospital has an infection control team comprised of a medical doctor (with formal education and background in internal medicine, infectious diseases, and hospital epidemiology), an infection control nurse, and a program assistant. All 3 teams have informatic and microbiologic support within their respective institutions. Two hospitals (B and C) were private facilities and the remaining hospital (A) was public (Table 1).

Each participating hospital was successively incorporated into the study during a period of 49 months. The infection control practitioner observed HH practices by physicians, nursing staff, and ancillary staff primarily in the ICUs of each facility before patient contacts.

HH compliance was observed simultaneously along with multiple other infection control responsibilities in the ICU. The infection control practitioner was well known by the ICU staff, and although the HCW were informed that their HH practices were being monitored, the staff was not aware of precisely when these observations were being made. The principal investigator periodically validated observations. To ensure high interrater reliability, each data collector was trained by conducting a series of observations (≥15) simultaneously with the trainer, until a high level of agreement (85%) was attained. The comparison of observation between observers and trainer were very similar (relative risk 0.67; 95% confidence interval 0.17–2.70; $P = .5721$).

Variables

Variables measured in association with the HW observation included sex, job classification, type of care unit, work shift, weekend versus weekday, degree of cross-transmission (minor contact [eg, vital signs] vs invasive procedures [eg, insertion of intravascular catheter]), and degree of administrative support.

The degree of the administrative support was assessed using the following criteria: (1) participation in infection control committee, (2) willingness to meet with infection control representative, (3) support for installation of additional sinks as needed, (4) evaluation and approval of submitted infection control policies in timely manner, (5) provision of appropriate HH supplies, (6) active participation in performance feedback process, (7) admonishment of suboptimal performance when indicated, (8) willingness to pay for services of the hospital epidemiologist's activities, and (9) willingness to share activities and successes of the infection control efforts in other meetings.

Protocol development and approval

After reviewing the pertinent literature we defined HH as "cleaning the hands with antiseptic soap before contact with the patient without the use of brushes."[45] The protocol was on the basis of the HW and hand antisepsis guidelines developed by APIC.[45]

Table 2. Duration of the phases of each hospital

Hospital	Phase 1, mo/y	Phase 2, mo/y	Phase 3, mo/y
A	8/98-9/98 (2)	10/98 (1)	11/98-4/99 (5)
B	4/99-5/99 (2)	6/99-7/99 (2)	8/99-7/02 (24)
C	9/00-12/00 (4)	1/01-4/01 (4)	5/01-7/02 (15)

The study proposal was submitted to the infection control committee, which included representative leadership of each hospital and ICU personnel. The institutional review board at each center approved the study protocol and all the participants of the infection control committee endorsed the research project.

A comprehensive infection control manual was distributed to all HCW, and the HH section was used as an educational tool for this study.

The study was carried out in 3 phases during 49 months from July 1998 to July 2002 (Table 2). The first phase of the study consisted of baseline data collection in which the HW of HCW before contact with patients was observed.

Procedure

During each phase of the study, trained staff observed the HW technique of physicians, nursing staff, and technicians for 30-minutes intervals at random times that included all work shifts.

The contacts were monitored with direct observation and the infection control practitioners recorded the HW processes before contact with each patient. One nurse per hospital was trained to detect the HW compliance and to record it on a form designed for the study. To provide feedback, bar charts of HW rates were displayed at monthly meetings and posted each month in the ICUs.

Phases

The objective of phase 1 of the study was to establish a baseline rate of HW compliance.

The second phase required HH education of all HCW. Educational classes were given in group sessions. These 1-hour sessions with physicians, nursing staff, and ancillary staff were scheduled for all shifts every day for 1 week. Each participant was given the infection control manual, and the HH section was used as an educational tool to reinforce classroom teaching. Attendance was voluntary, supported by the admin-

Table 3. Handwashing compliance according to intervention phase

	% (No. handwashing/No. opportunities)			Univariate analysis	
				Phase 2 vs 1	Phase 3 vs 2
Institution	Phase 1	Phase 2	Phase 3	RR; (95% CI); *P* value	RR; (95% CI); *P* value
A	5.0 (41/827)	14.8 (46/310)	27.6 (791/2861)	2.99; (1.96-4.56); .0000	1.86; (1.38-2.51); .0000
B	24.0 (63/262)	36.6 (193/528)	67.1 (4265/6353)	1.52; (1.14-2.02); .003	1.84; (1.59-2.12); .0000
C	23.1 (268/1160)	50.1 (428/854)	69.4 (1831/2640)	2.17; (1.86-2.53); .0000	1.38; (1.25-1.54); .0000
Pooled mean	16.5 (371/2249)	43.8 (625/1428)	58.1 (6887/11,854)	2.65; (2.33-3.02); .0000	1.33; (1.22-1.44); .0000

CI, Confidence interval; *RR*, relative risk.

istrator, and monitored. The HCW could reattend the course as many times as desired. Theoretic and practical indications were reviewed. The guidelines were also posted at a strategic location in each unit. The primary investigator routinely held infection control review classes to provide an opportunity for infection control questions and to share surveillance data. During phase 2, hospital B installed 2 additional sinks. Throughout the study, antiseptic HW agents (povidone iodine or chlorhexidine gluconate) were available in all hospitals.

Phase 3 consisted of HH performance feedback in addition to educational classes. Performance feedback and surveillance data were provided each month and were available to all HCW. Written reports were sent to the unit manager and to the administrator. Bar charts of HH rates were displayed in the meetings and posted in the units.

Statistical analysis

EPI Info v. 6.04 b (CDC, Atlanta, Ga) was used as database and data was analyzed with Stata (1984-2000 Statistics/Data Analysis, Stata Corp, College Station, Tex). In each phase, HCW HW rates were calculated as the proportion of the observed HW over the indicated HW before contact with patients. In addition to univariate analysis we also performed logistic regression analyses to identify independent variables associated with noncompliance of HW. In the case of univariate analysis we report relative risk, 95% confidence interval, and *P* value, and in the case of logistic regression, odds ratios, 95% confidence interval, and *P* values were calculated. A *P* value $< .05$ was considered statistically significant.

RESULTS

A total of 4 observers completed 807 hours of observation. In 1610 observation periods of 30 minutes, 15,531 HW processes were observed; 2249 in phase 1; 1428 in phase 2; and 11,854 in phase 3. Throughout the study period, the nurse/patient ratio ranged between 1:2 and 1:10 in the 3 hospitals. We observed 3998 HW processes in hospital A, 6879 in hospital B, and 4654 in hospital C.

There were differences among the 3 hospitals that may have influenced some of the infection control practices and outcomes. As shown in Table 1, the sizes of the hospitals varied from 150 beds to 250 beds, however, the number of ICUs was similar.

With respect to sex, we observed 4350 procedures in males, and 11,181 in females. We observed 1665 opportunities during the weekend and 13,866 during the week. Of 15,531 observations, 10,609 were before superficial procedures, and 4922 before invasive procedures. We observed 5757 procedures in coronary ICUs, 7709 in medical surgical ICUs, and 2065 in non-ICUs. The number of HW procedures during the morning, evening, and night shifts were 6790, 5926, and 2815, respectively. We observed 12,385 HW events in nurses, 1708 in physicians, and 1438 in ancillary staff.

The rate of HW varied significantly depending on the phase of the study. On average, the 3 hospitals had a HW compliance rate of 16.5% in phase 1, 43.8% in phase 2, and 58.1% in phase 3 (Table 3).

Using univariate analysis we found a statistically significant association of HW compliance and administrative support, sex, days of week, type of procedure, type of unit, work shifts, and the HCW (Table 4). With logistic regression the differences between weekdays and weekends, and between work shifts disappeared (Table 4).

We observed striking differences in the degree of administrative support among the 3 hospitals. In 2 of

Table 4. Handwashing compliance according to each institutional variable. Univariate analysis

	Variable	% (No. handwashing/No. opportunities)	RR; (95% CI); *P* value
Administrative support	Absent vs present	22% (878/3998) vs 61% (7006/11,533)	2.7; (2.58-2.97); .0000
Sex	Male vs female	46% (1989/4350) vs 53% (5895/11,181)	1.15; (1.10-1.21); .0000
Days	Weekends vs weekdays	44% (740/1665) vs 52% (7144/13,866)	1.16; (1.07-1.25); .0000
Procedure	Superficial vs invasive	49% (5147/10,609) vs 56% (2737/4922)	1.15; (1.09-1.20); .0000
Unit	M/S vs Cor	47% (3599/7709) vs 54% (3123/5757)	1.16; (1.11-1.22); .0000
	M/S vs non-ICU	47% (3599/7709) vs 56% (1162/2065)	1.21; (1.13-1.29); .0000
	Cor vs non-ICU	54% (3123/5757) vs 56% (1162/2065)	1.04; (0.97-1.11); .2863
Work shift	Morning vs afternoon	47% (3170/6790) vs 49% (2909/5926)	1.05; (1.00-1.11); .0506
	Morning vs night	47% (3170/6790) vs 64% (1805/2815)	1.37; (1.30-1.46); .0000
	Afternoon vs night	49% (2909/5926) vs 64% (1805/2815)	1.31; (1.23-1.39); .0000
HCW	Physicians vs nurses	37% (638/1708) vs 55% (6773/12,385)	1.46; (1.35-1.59); .0000
	Ancillary staff vs physicians	33% (472/1438) vs 37% (638/1708)	1.14; (1.01-1.28); .0340
	Ancillary staff vs nurses	33% (472/1438) vs 55% (6773/12,385)	1.66; (1.52-1.83); .0000

CI, Confidence interval; *COR*, coronary care unit; *HCW*, health care workers; ICU, intensive care units; M/S, medical/surgical ICU; *RR*, relative risk.

the hospitals administrators took an active role in the HH program and this participation appeared to play an important role. Comparing the overall HW compliance in hospitals with and without administrative support, independent of the study phase and using logistic regression analysis, we observed greater compliance in hospitals with administrative support.

Table 5. Handwashing compliance according to each institutional variable. Logistic regression analysis

Variable	OR	(95% CI)	*P* value
Administrative support	5.57	(5.25-6.31)	.0000
Sex	0.79	(0.73-0.86)	.0000
Days	0.89	(0.79-1.00)	.058
Procedure	0.84	(0.78-0.90)	.0000
Unit	1.43	(1.30-1.59)	.0000
Work shift	0.98	(0.93-1.03)	.519
HCW	0.66	(0.63-0.70)	.000

CI, Confidence interval; *HCW*, health care workers; *OR*, odds ratio.

DISCUSSION

To our knowledge this is the first research project published that evaluates the application of the published APIC guidelines[45] using a multifaceted approach[43] to improve, and to evaluate the influence of administrative support on, HW compliance in Argentina.

Previous studies of HW programs have been presented at a number of scientific meetings in Latin American countries since 1996,[46-48] one of which showed a reduction of nosocomial infections through improvement in HW compliance.[49]

Performance feedback[11,16,18,24,25,27,31,43,44,50-52] has been studied by other authors in multiple countries as an intervention to improve HW compliance. In Argentina, the lack of a national, mandatory, health care infection control program; nosocomial infections surveillance system; and health care facilities accreditation process stimulated us to develop a continuous intervention to maintain optimal compliance of infection control measures such as HW. Because we do not have the aforementioned processes to facilitate infection control quality improvement, we have used observation and performance feedback on a continuous basis and have not observed the short-lived improvement seen by others when feedback was discontinued.[44] Some may argue that the implementation of sustained HW observation and performance feedback is labor intensive and expensive. Given the relatively low salaries of HCW in Latin American countries, this expense may be cost-effective as compared with the cost of treating patients with nosocomial infections, the associated morbidity and mortality, and the risk of the development of multiple resistant organisms as a result of antibiotic pressure.

HW adherence among HCW is frequently suboptimal and resistant to improvement as shown by Larson et al.[6] Baseline HH compliance (16.5%) of HCW in Argentina is similar to that shown in the medical literature (4%–54%) by multiple authors.[2,3,7,16-36,39,41-44]

The role of education and performance feedback in our study increased the HCW HW compliance in medical surgical ICU, coronary ICUs, and non-ICUs

studied. Authors Larson et al,[43] Pittet et al,[11] Dubbert et al,[25] Tibballs,[31] and Aspock and Koller[52] found education to be of similar value. Larson et al,[43] Mayer et al,[16] Dubbert et al,[25] Lohr et al,[27] Raju,[50] Pittet et al,[11] Bischoff et al,[18] Tiballs,[31] Avila-Aguero et al,[44] Berg et al,[51] Graham,[24] and Aspock and Koller[52] also found increased compliance when performance feedback was provided to HCW.

Administrative support resulted in a statistically significant improvement in HW compliance. Administrative support was measured by the criteria shown in Table 1. In private hospitals the administrators typically have different attitudes, motivation, expectations, and priorities and often place more emphasis on fiscal issues and cost savings. These individuals understand both the importance of preventing hospital infections and the significant extra costs that nosocomial infections generate for the hospital. Private hospitals are more likely to regard infection control as a program to reduce costs and improve the cost-effectiveness of hospitalization. These factors may provide tacit motivation to HCW in private hospitals. In general, HCW pay attention to what is deemed important by upper-level management.

At the beginning of the study the sink/bed ratio was similar but suboptimal in hospital A (public) and hospital B (private). Additional sinks were requested of the director in each hospital. Priority for the installation of the needed sinks was given in hospital B only, despite the fact that refurbishment of hospital A was in progress and additional sinks could readily have been added to the hospitalwide project. This is but one example of differences in administrative support and appropriate prioritization of infection control needs. It appears that the motivation to prevent nosocomial infections does not get the same priority in public hospitals as that seen in private hospitals. The observations of the primary investigator is that typically public hospitals are also more likely to lack supplies or experience interruption in the availability of supplies for HCW. Although that was not an issue during this particular study it illustrates some of the differences between private and public facilities.

The value of active participation at the institutional level has also been demonstrated in other studies by Larson et al,[6] Pittet et al,[11] and Kretzer and Larson.[53] Kretzer and Larson,[53] and Boyce[54] have also addressed the issue of administrative sanctions. Investigators in these studies believe that active administrative support is an especially important issue. This belief may also be important in Argentina because we do not have the benefit of a national hospital infection surveillance mandate or a system for accreditation of health care facilities.

HCW categories appear to influence compliance. We found greater compliance among nurses, as demonstrated in other studies.[20,42,44] Performance was considerably lower in physician and ancillary staff compared with nurses. One possible explanation for the contrast may be that more emphasis is placed in prevention of infection in the nursing school curriculum whereas diagnosis and therapy is of primary importance in medical school education. It is difficult to measure and report to administrators what has been prevented, eg, the success in preventing an untoward outcome such as a nosocomial infection, however, it is quite easy for physicians to measure the successes in treatment. In short, prevention is a hard sell to physicians in particular.

We also found a statistically significant association between HW compliance and sex. There was greater compliance in females, as demonstrated by Van de Mortel et al,[55] and by Sharir et al.[56] Women usually wash their hands more frequently than men, but this difference remains without satisfactory explanation, aside from the fact that in many countries females are the predominant sex in nursing and in some countries male physicians predominate. Differences in HH compliance by sex has also been identified in individuals unrelated to health care. Guinan et al[57] observed greater compliance by females in middle- and high-school students. Little research has been done regarding the role, if any, that feminine-hygiene needs play in the development of HW practices. Further research is needed to elucidate these observations.

HCW behavior may change when they are aware of an infection control professional observing them and is an example of the Hawthorne effect. This phenomenon has the potential to add bias to an outcome and could have been avoided if the HCW behaviors had been monitored without a professional presence, for example by using video cameras. The Hawthorne effect is often temporary and has also been called the "somebody upstairs cares syndrome." Although it is not possible to readily measure this effect or its duration we believe the sustained support by hospital administration may have provided a beneficial Hawthorne effect resulting in improved compliance. We are pleased that

the health institution authorities supported us in improving the behavior of our HCW.

In this setting, we predict that the intervention program described will continue to increase the HCW HW compliance. This may be one of the most demonstrable measures to help in keeping hospital infection rates, bacterial resistance, and attributable costs within acceptable limits.

This first HW study performed in Argentina showing the baseline rates, interventions, and subsequent improvements is one example of a model for continuing improvement in the quality of health care throughout the country.

Study limitations

One limitation of this study is that the only hospital without administrative support was the single public hospital of the study; it is possible that other features of the public hospital impede HW compliance, for example public hospitals are more likely to lack supplies or experienced interruption in the HCW availability of supplies. However, this was not observed during this study.

A second limitation is that the study design did not allow us to measure differences in HW compliance in relation to the nurse/patient staffing ratios as there were significant differences in the number of patients assigned to a single nurse and this may have influenced the time available for HW.

CONCLUSION

The education and performance feedback of our hospital staff in Argentina improved HW compliance. We believe that it is important to support methods and programs that make optimal HW a habit, as compliance remains a significant problem in a large number of hospitals. Administrative support was also found to play an important role in the improvement of HW compliance.

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