

Hand hygiene compliance by physicians: Marked heterogeneity due to local culture?

Dror Cantrell, MD,^a Oded Shamriz, MD,^a Matan J. Cohen, MD, MPH,^a Zvi Stern, MD,^b Colin Block, MBBCh, PhD,^c and Mayer Brezis, MD, MPH^{a,d}
Jerusalem, Israel, and Boston, Massachusetts

Background: Physician compliance with hand hygiene guidelines often has been reported as insufficient.

Methods: The study was conducted in 2 hospitals (Hadassah Ein Kerem [EK] and Mt Scopus [MS]) in Jerusalem, Israel. Covert observations were conducted during morning rounds by trained observers. The data were recorded as the percentage of times that hand hygiene was applied out of the total contacts with patients. After the observational step, an intervention—providing an alcohol gel and encouraging its use—was instituted in several wards.

Results: Physicians' compliance with hand hygiene averaged 77% at MS and 33% at EK ($P < .001$), and was characterized by a marked additional heterogeneity among wards. Rates of adherence ranged from as low as 4% in a gynecology ward to as high as 96% in a neonatal unit. Availability of a handwashing basin in the room and seniority status of the physician were associated with higher compliance rates but explained only a small part of the variation. Compliance improved significantly in 2 wards exposed to the intervention.

Conclusion: The remarkable heterogeneity in physicians' hand hygiene compliance among sites within the same institution is consistent with an important role of the local ward culture.

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Nosocomial infections and multidrug-resistant pathogens affect 5% to 10% of hospitalized patients,¹⁻⁹ which translates to 2 million patients, 90,000 deaths, and a preventable cost estimated as high as \$5 billion per year in the United States alone.^{4,5,8,9} Although hand hygiene is one of the leading means of preventing transmission of infectious organisms among caregivers and patients,^{1-4,10-15} the rate of physician compliance with infection control guidelines is only 20% to 50%.^{1,10,12,13,16-23} Previous studies have found that physicians have lower hand hygiene compliance than other health care workers.^{18,24} Because physicians, as role models, may influence others' behavior,^{13,15,23,25} their hand hygiene compliance is of special interest.

Our goals in this study were to assess hand hygiene compliance among physicians at a large general

hospital, to identify potential factors that may affect adherence (eg, hospital site, ward, physician seniority, proximity of a basin), and to attempt to improve compliance by introducing alcohol gel in selected wards.

METHODS

Setting

The study was conducted in 2 Hadassah-Hebrew University Medical Center hospitals, the Ein Kerem (EK) campus and Mt Scopus (MS) campus, both located in Jerusalem, Israel. Hadassah EK (700 beds), open since 1961, serves mostly the population of Jerusalem as a general and specialty hospital and as a referral center for the entire region. Hadassah MS (300 beds), reopened and renovated in 1975, is primarily a community hospital that serves the Jewish and Arab populations of northern and eastern Jerusalem, referring to EK the more complex cases in need of specialty care (eg, transplantation, oncology, cardiovascular procedures, neurosurgery). At both Hadassah hospitals, hand hygiene protocol requires that every caregiver wash his or her hands with soap and water before and after each physical contact with a patient. At the time of the survey, there was no formal infection control education for interns and residents, which often rotate between the 2 Hadassah hospitals.

The observations were conducted in the medical, general surgery, and pediatric wards in both centers and in the obstetrics and gynecology ward in EK and

From the Center for Clinical Quality and Safety,^a Central Management, Mount Scopus Campus,^b and Department of Clinical Microbiology & Infectious Diseases,^c Hadassah-Hebrew University Medical Center, Jerusalem, Israel, and Center for Bioethics, Brigham & Women's Hospital and Harvard Medical School, Boston, MA.^d

Address correspondence to Oded Shamriz, MD, Center for Clinical Quality & Safety, Box 53, Ein Kerem Campus, Hadassah-Hebrew University Medical Center, PO Box 12000, Jerusalem 91120, Israel. E-mail: oded.shamriz@mail.huji.ac.il.

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the neonatal intensive care unit at MS. These wards were selected because they are key wards for the hospitals' clinical, teaching, and training activities.

Ethical review of the study

All of the work for this study was performed as a quality improvement initiative and was approved by Hadassah's Institutional Review Board. At Hadassah, the Institutional Review Board provides review and approval for quality improvement projects on the condition that such a project imposes a minimal burden on patients, carries minimal risk of breaches of confidentiality, and has the approval of department heads. In the present study, the Associate Director General of Hadassah informed the department heads in advance that a survey would be conducted in their units on compliance with daily routine work guidelines, without specifying the nature of these guidelines.

Study design

The study comprised 2 steps.

Step 1. The purpose of the first step, conducted between August 2003 and August 2004, was to gather and generate baseline data on physician hand hygiene compliance rates. Observations were made during morning rounds by 1 of the authors (D.C.), who joined the rounds as a medical student and recorded physicians' compliance with hand hygiene guidelines between physical contacts with patients. The physicians were unaware that this student participating in the rounds was observing their hand hygiene behavior. Before the start of the survey, techniques for data recording and correct hand hygiene practice in the literature were reviewed, and an infectious control practitioner provided practical advice from previous experience in such schemes. Most of the observations (>80%) were recorded by D.C., with the remainder recorded by 2 other medical and nursing students following the same technique. Although not evaluated, interobserver difference was not considered a significant problem, because most observations were made by a single observer.

During a given round, the number of times that the physician performed hand hygiene (by washing or disinfection) out of the total number of physical contacts with patients was calculated as percent adherence. As the physician moved between patients during the round, opportunities for hand hygiene were counted as the number of intervals between patients with physical contacts. Only those opportunities in which the physician was observed before and after touching a patient were counted; patient contacts that took place during nonobservation times or for which data were incomplete were not counted. Information on physician

status (senior vs resident) and the presence of a hand-washing basin in the patient's room was noted. The physicians' names and the quality of their handwashing technique were not documented.

Step 2. The second step involved an intervention in selected wards, making alcohol gel available (June 2005) and encouraging its use by holding discussions regarding nosocomial infections at staff meetings (July to September 2005). Step 1 identified 2 wards with low hand hygiene compliance: internal medicine C and surgery A, both at EK. These 2 wards were the targets of the intervention program.

This step included an educational meeting with physicians in each ward, during which trained infection control nurses discussed the theory and practice of hand hygiene, promoted the use of the alcohol gel, and provided data regarding rates of nosocomial infections in Hadassah. Several months later, repeated pre-intervention observations confirmed the low rates of adherence in these 2 wards. During the exposure to the intervention and for several months thereafter, compliance with hand hygiene was observed using the same technique by a hidden observer.

Materials

The alcohol gel used for the intervention was MANUGEL 85 (Anios, Lilles, France), an antiseptic hydroalcoholic gel provided free to us for the study period by the manufacturer. Its composition was alcohol (2-propanol in 60% concentration), aqua (water), glycerin, diethyl phthalate, acrylates/C10-30 alkyl acrylate cross-polymer, ethoxydiglycol oleate, bisabolol, PEG-4 caprylic/capric glycerides, aminomethylpropanol, and phenoxyethanol. Alcohol gel dispensers were mounted on file carts and equipment carts that follow physicians on their morning rounds and also inside patient rooms.

Statistical analysis

Our results are presented as percent compliance of handwashing or disinfection. The χ^2 test was used to evaluate associations between categorical variables. Linear associations were evaluated using Pearson's r coefficient. The percentage of explained variance was derived from the power of the correlation coefficient; 95% confidence intervals (CI) were used, and a P value < .05 was considered statistically significant.

RESULTS

The physician's rates of adherence to hand hygiene requirements are given in Table 1. These rates varied significantly by both site and ward. Mean adherence rates were 77% (95% CI = 71% to 83%) at the MS campus and 33% (95% CI = 28% to 39%) at the EK campus

Table 1. Hand hygiene compliance among physicians, % (n/N)*

Ward	MS	EK
Internal medicine A	82 (18/22)	47 (20/43)
Internal medicine B	69 (11/16)	50 (25/50)
Internal medicine C		57 (27/47)
All internal medicine	76 (29/38)	51 (72/140) [†]
Pediatrics A	85 (22/26)	91 (10/11)
Pediatrics B	78 (14/18)	
All Pediatrics	81 (36/44)	91 (10/11)
Neonatal intensive care unit	96 (24/25)	
Surgery A	78 (35/45)	13 (6/47)
Surgery B	60 (21/35)	16 (7/43)
All surgery	70 (56/80)	14 (13/90) [‡]
Obstetrics		14 (5/35)
Gynecology		4 (1/25)
Total	77 (145/187)	33 (101/301)
Total for comparable wards [§]	74 (121/162)	39 (95/241) [¶]

*n = number of handwashing/disinfection events; N = total opportunities.

[†]P < .01 versus MS.

[‡]P < .001 versus MS.

[§]Excluding neonatal intensive care unit and obstetrics and gynecology ward.

[¶]P < .001 versus MS.

($P < .001$ for comparison between these 2 sites) and were markedly higher in some wards than in others. Adherence rates were highest in pediatric wards (91% in the EK pediatrics ward and 96% in the MS neonatal intensive care unit) and lowest in the EK gynecology (4%) and obstetrics (14%) wards.

Residency status was associated with lower rates of hygiene adherence at EK (residents, 31%; senior physicians, 50%; $P = .005$) but not at MS. The seniority of the physician explained 4% of the overall variance in adherence. The presence of a handwashing basin in the patient's room was associated with higher compliance rates in internal medicine wards at MS (basin present, 81%; basin absent, 43%; $P = .035$) and at EK (basin present, 61%; basin absent, 28%; $P < .0001$) and explained 10% of the overall variance in adherence.

In the 2 intervention wards, compliance increased over the 3-month follow-up period, from 13% to 43% ($P < .001$) in the surgical ward and from 57% to 79% ($P = .039$) in the medical ward. In both wards, alcohol gel became the preferred mode of hand hygiene, being used in 80% of hand hygiene actions. Of note, during 1 week of the observation period, the alcohol gel supply ran out and was inadvertently replaced with a chlorhexidine-in-alcohol solution; during that week, adherence rates dropped back to baseline while physicians complained about the lack of alcohol gel.

DISCUSSION

Our data indicate suboptimal hand hygiene compliance among the physicians at MS and EK, at about

nearly 50% of physical encounters overall—not far from compliance rates reported in the literature of 20% to 50%.^{10,12,13,16-19,21-23,26} Compliance was variable between the hospital sites (77% at MS vs 33% at EK), with marked additional heterogeneity among wards, ranging from as low as 4% in a gynecology ward to as high as 96% in a neonatal intensive care unit.

Various factors may contribute to the variable compliance with hand hygiene guidelines. Compared with MS, EK is an older hospital, with no handwashing basins in patient rooms in several wards. In addition, EK physicians commonly perceive their workload to be greater than that of physicians at MS, perhaps because of the more complex cases referred to EK from MS. Physicians' workload at the 2 hospitals was not quantified for this study, however. Compliance rates differed between residents and senior physicians; residency status was associated with lower rates of hand hygiene adherence in 1 of the hospitals. Previous studies have found that adherence was lower in specialists than in residents^{13,21,26} or that differences varied in the same direction, in accordance with role modeling or socialization among the team.^{13,15,23,25} Our data suggest that the accessibility of a handwashing basin had a significant affect on compliance. Previous studies have shown inconsistent findings, with some finding increased adherence with more handwashing basins²⁷ and others finding no association between the number of basins and adherence.^{13,28,29} Accessibility of a handwashing basin likely is only one of many factors contributing to increased adherence. At any rate, in the present study, residency status and availability of handwashing basins in patient rooms explained only a small part of the large variation between sites and among wards.

Previous studies have suggested varying rates of compliance with hand hygiene practices by specialty; for example, Pittet et al²² reported higher adherence rates in internal and pediatric medicine compared with surgery. Our study confirms and extends this finding, with the highest rate seen in a neonatal intensive care unit and the lowest rate seen in obstetrics and gynecology. This is likely due to multiple factors, as discussed by Pittet et al,²² including differences in local culture and role modeling by senior physicians in different sites. Recent unpublished independent surveys of hand hygiene practices among nursing staff at both Hadassah hospitals have shown heterogeneity in adherence similar to our current observations, with higher rates in pediatric and neonatal wards and lower rates in medical and surgical units (N. Minster, V. Roval, and B. BarCohen, personal communication). Moreover, an independent study of safety culture in different wards also revealed heterogeneity consistent with our

present data.^{30,51} Taken together, these findings support the idea that the local ward culture may affect the degree of compliance with hand hygiene guidelines.

The wards with the highest rates of compliance merit some attention. The pediatric ward in EK, where the chief of service is a infectious disease specialist, exhibited an adherence rate of 91%. Neonatologists also had a high rate of adherence (96%), perhaps due to their awareness of their patients' high vulnerability to nosocomial infections. Yet in recent years, the MS neonatal intensive care unit has been affected by outbreaks of resistant organisms. For a patient in this ward, the likelihood of being touched at least once by an unclean hand increases with each contact, being, after n contacts, $1 - (0.96)^n$, for an adherence rate of 96%. A neonate with 10 physical contacts per day would have a > 90% chance of exposure to at least 1 unclean hand in less than 1 week. According to this estimate, effective prevention of nosocomial transmission requires an adherence rate of 100%. The local culture of hand hygiene may reflect perceived vulnerability of patients, role modeling, and other factors, but as a rule appears to miss the desired target of adherence.

In the present study, a limited pilot intervention was undertaken to improve adherence. In 2 wards, compliance significantly improved with preferential use of an alcohol gel over a short-term observation period of 3 months. Improvement in hand hygiene compliance often is not long-lasting.^{1,7,8,10,13,16,17,19,20,32-34} Biscoff et al²¹ found that introduction of an alternative hand hygiene product, such as alcohol gel, was sufficient to improve compliance. Most studies have shown that educational and informative intervention programs are needed to achieve long-lasting results.^{4,10,15,16,33-35}

Study limitations

Our study has several important limitations. The observations did not include information on the quality of the hand hygiene technique. This omission was made to help keep observation and recording easy and unnoticed by the staff. Also, the study did not directly assess the local culture with regard to hand hygiene by other workers, the infection control setting, and executive management; thus, it relates only to the culture of physicians vis-à-vis hand hygiene practice. Moreover, the intervention using alcohol gel did not include contemporary repeated observations in control wards. The survey often included repeated visits in the same ward, conducted several weeks apart, to collect sufficient observations (often on different physicians). Comparison of rates from different visits sometimes showed fluctuations but not a consistent increase as was observed in the wards exposed to the intervention. Of note, this intervention was short-term, designed as a

pilot for a more sustained project including hospital-wide introduction of an alcohol-based solution. Preliminary observations have confirmed successful use of this modality in several other wards with low baseline adherence rates, but little improvement in wards with high baseline adherence rates. Repeated long-term surveys are needed to determine the overall efficacy of this intervention.

In conclusion, we have found substantial heterogeneity in hand hygiene practices among physicians in a large medical center, possibly related to local ward culture. Accessibility of handwashing basins and physician workload and residency status also may contribute to this heterogeneity. The introduction of an alcohol gel along with educational meetings was found to improve hand hygiene adherence. Systemic changes, along with personal accountability and leadership for change at the local level, with periodic observations and feedback, may be needed to achieve lasting improvements in hand hygiene adherence.³⁶

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