

ORIGINAL ARTICLE

Handwashing and gloving practice among health care workers in medical and surgical wards in a tertiary care centre in Riyadh, Saudi Arabia

MONA M. BASURRAH¹ & TARIQ A. MADANI²

From the ¹Shobra Primary Health Care Centre, Ministry of Health, The Department of Internal Medicine, King Abdulaziz University, Jeddah, and ²The Riyadh Medical Complex, Ministry of Health, Riyadh, Saudi Arabia

Abstract

We evaluated the adherence to handwashing and gloving practice among health care workers (HCWs) in 5 medical and 5 surgical wards of a 1250-bed hospital in Riyadh. Nurses, consultants, residents, interns, and medical students attending these wards were each unobtrusively observed for handwashing and gloving practice. Each HCW was observed only once for all handwashing and gloving opportunities during a single patient encounter. 312 handwashing opportunities for 230 HCWs were observed. The study population comprised 110 nurses, 76 residents, 23 medical students, 11 interns, and 10 consultants. Female subjects constituted 56.1% of the population. The ratio of handwashing sinks to beds was 1:6–7. The overall frequency of handwashing was 6.7% before patient contact and 23.7% after patient contact. Adherence to handwashing was 70.0% among medical students, 69.2% among interns, 18.8% among nurses, 12.5% among residents, and 9.1% among consultants. The duration of handwashing was suboptimal for all HCWs (average of 4.7 s). Adherence to wearing gloves for performing procedures was on average 75.5%. Poor adherence to handwashing is a worldwide problem. Strategies to improve hand hygiene practice should be multifaceted and should include increasing the availability and accessibility of handwashing sinks and alcohol-based hand rubs.

Introduction

Hands of health care workers (HCWs) are the main vehicle of transmission of microorganisms that cause health care-associated infections (HAIs). Handwashing is known to be the single most important means of preventing the spread of microorganisms in the health care setting. Observational studies indicated that adherence of HCWs to handwashing practice is low. Most of these studies were conducted in intensive-care units in western countries. The objective of the present study was to evaluate the adherence to handwashing and gloving practice among HCWs in the medical and surgical wards of a large Ministry of Health tertiary care centre in Saudi Arabia, the Riyadh Medical Complex.

Material and methods

Design and study population

This was an unobtrusive observational descriptive cross-sectional study conducted over a 4-week period from 26 April to 24 May 2003. The study population included a sample of HCWs from both the medical and surgical wards.

Institution

The Riyadh Medical Complex is a 1250-bed tertiary care facility established by the Ministry of Health in the capital city, Riyadh, in 1956. It comprises a general hospital (731 beds), a paediatric hospital (292 beds), and an obstetrics and gynaecology

hospital (227 beds). The average annual number of admissions to the general hospital is 17,350 patients. This study was conducted in 5 medical (total of 88 beds) and 5 general surgery (total of 117 beds) wards located in the general hospital. Each ward consisted of 5–7 rooms, 3–4 beds each. Apart from routine orientation on standard infection control practice for all new HCWs in the hospital, there were no special campaigns undertaken to promote handwashing among HCWs before this study was conducted.

Definitions

For the purpose of this study, handwashing was defined as any duration of handwashing with plain or antiseptic soap and water. A handwashing opportunity included any contact with a patient's skin, mucous membranes, blood, or body fluids, wound care, placement of an intravascular device or urinary catheter, visible soiling of hands, contact with body fluids, glove removal, or contact with a likely contaminated inanimate object or environmental surface. Inanimate objects considered likely to be contaminated included tracheostomy tubes, suction equipment, urinary collection devices, rectal tubes, thermometers, bed linens, and biohazardous waste containers. Failure to wash hands immediately before any patient's contact was counted as non-adherence unless the hands were just washed after contact with a preceding patient.

Data collection

Structured observation sessions were performed by the first author (M.M.B.) at random during day shifts from 7:00 am to 3:00 pm on weekdays (Saturday to Thursday in Saudi Arabia) for 4 consecutive weeks. Nurses, consultants, residents, interns, and medical students attending the 5 medical and the 5 surgical wards were each unobtrusively observed for handwashing and gloving practice. Each HCW was observed only once for all handwashing and gloving opportunities during a single patient encounter. HCWs were not informed regarding the purpose of the study. If questioned during observations, the observer replied that infection control measures were being monitored. No immediate feedback was provided to the HCWs regarding hand hygiene behavior. Data collected included profession of the HCW (nurses, consultants, residents, interns, and medical students), adherence to handwashing practice, the duration of handwashing in seconds, use of gloves, and procedures performed. Data were collected on a standard data collection form.

Data analysis

Epi Info version 6.04d was used for data entry and analysis. χ^2 test was used for comparison of proportions. Analysis of variance (ANOVA) was used for comparison of means. A *p* value of less than 0.05 denoted statistical significance.

Results

312 handwashing opportunities for 230 HCWs were observed; 163 opportunities in the medical wards, and 149 opportunities in the surgical wards. The study population comprised 110 nurses (52 in the medical, and 58 in the surgical wards), 76 residents (42 in the medical, and 34 in the surgical wards), 23 medical students (23 in the medical, and none in the surgical wards), 11 interns (4 in the medical, and 7 in the surgical wards), and 10 consultants (6 in the medical, and 4 in the surgical wards). Female subjects constituted 56.1% (129 HCWs) of the study population. 118 (51.3%) HCWs were Saudi citizens. The number of handwashing sinks for HCWs was limited, with 1 sink each located in the nursing station, the treatment room, and the doctors' room in each ward. No handwashing sinks were available inside patients' rooms. Sink-to-bed ratio was approximately 1:7 in the medical wards and 1:6 in the surgical wards. Antiseptic hand rub gel or solution for waterless hand hygiene was not available during the study. Plain liquid soap was used for routine handwashing. An antiseptic liquid agent (chlorhexidine gluconate 4%) was used for handwashing after contact with patients under contact precautions. Paper towels were used to dry the hands.

Table I shows the frequency of handwashing among HCWs before and after contact with patients according to the HCWs' professions. The overall frequency of handwashing was 6.7% before patient contact and 23.7% after patient contact. Adherence to handwashing before patient contact was 53.3% among interns, 43.3% among medical students, 0.6% among nurses, and nil among residents and consultants ($p < 0.001$). Similarly, adherence to handwashing after patient contact was highest among medical students (70.0%) and interns (69.2%), followed, in descending order, by nurses (18.8%), residents (12.5%), and consultants (9.1%) ($p < 0.001$). The mean duration (\pm standard deviation) of handwashing was 6.1 ± 1.8 s for medical students, 5.4 ± 2.1 s for interns, 4.1 ± 1.9 s for nurses, 3.1 ± 1.6 s for residents, and 3.0 ± 0.0 s for the 1 consultant who washed his hands ($p < 0.001$). The frequency of handwashing after patient contact

Table I. Frequency and duration of handwashing among health care workers in the medical and surgical wards of the Riyadh Medical Complex.

Occupation	No. of health care workers	No. of handwashing opportunities before or after patient contact	Frequency of handwashing before patient contact (%) ¹	Frequency of handwashing after patient contact (%) ²	Average (\pm standard deviation) duration of handwashing in s ³
Nurses	110	170	1 (0.6)	32 (18.8)	4.1 \pm 1.9
Medical students	23	30	13 (43.3)	21 (70.0)	6.1 \pm 1.8
Interns	11	13	7 (53.8)	9 (69.2)	5.4 \pm 2.1
Residents	76	88	0	11 (12.5)	3.1 \pm 1.6
Consultants	10	11	0	1 (9.1)	3.0 \pm 0.0
Total	230	312	21 (6.7)	74 (23.7)	4.7 \pm 1.8

¹The difference between the categories is statistically significant ($\chi^2 = 119.2$, p value <0.001).

²The difference between the categories is statistically significant ($\chi^2 = 62.9$, p value <0.001).

³The difference in the mean duration between the categories is statistically significant (F statistic = 5.70, p value <0.001).

was 26.4% (43/163) in the medical wards and 20.8% (31/149) in the surgical wards ($p=0.24$).

Adherence to handwashing was 52.4% (22/42) after wound care, 40% (14/35), after inserting peripheral intravenous catheters, 31.6% (65/206) after examining patients, and 21.4% (6/28) after emptying urinary bags. In the remaining one opportunity (suctioning of secretions), the HCW washed his hands after removing the gloves.

Adherence to wearing gloves was on average 75.5% (80/106); it was 95.2% (40/42) for wound care, 82.1% (23/28) for emptying urinary bags, and 45.7% (16/35) for inserting peripheral intravenous catheters. In the remaining 1 opportunity (suctioning), the HCW wore gloves. Adherence to handwashing after removing gloves was 48.8% (39/80).

Discussion

Between 1975 and 2002, a series of contemporary revised recommendations and guidelines on handwashing and hand antisepsis, collectively referred to as hand hygiene, were published [1–7]. Although these guidelines have been adopted by hospitals worldwide, studies indicated that adherence of HCWs to recommended hand hygiene procedures was poor, with mean baseline rates of 5%–81%, and an overall average of 40% [7]. In the present study, the overall frequency of handwashing after patient activity was 23.7%. Adherence to handwashing varied significantly according to the HCWs' profession. Adherence to handwashing before patient contact was highest among interns (53.3%) and medical students (43.3%) and poor among nurses (0.6%), residents (nil), and consultants (nil). Adherence to handwashing after patient contact was also highest among medical students (70.0%) and interns (69.2%), followed, in descending order, by nurses (18.8%), residents (12.5%), and consultants (9.1%). The better adherence to hand hygiene

observed among the medical students and interns and its noticeable decline as the HCWs become more senior needs further study to define the possible explanations. Possibilities include limited patients' responsibilities and better undergraduate education and motivation of the junior staff on infection control issues and decreasing awareness or conviction and increasing schedules and patients' responsibilities as HCWs become more senior. Adherence to handwashing varied also according to the type of procedure performed. It was highest (52.4%) after wound care, and lowest (21.4%) after emptying urinary bags.

Observational studies indicated that the duration of handwashing episodes by HCWs was on average 6.6–24.0 s [7]. In the present study, the duration of handwashing was suboptimal for all HCWs with an overall average duration of 4.7 s. The duration of handwashing varied significantly by profession. It was longest among medical students (6.1 s), followed, in descending order, by interns (5.4 s), nurses (4.1 s), residents (3.1 s), and consultants (3 s).

Many risk factors for poor adherence to recommended hand hygiene practices were reported [7,8]. In the present study, one obvious deterring factor for handwashing was the scarcity of handwashing sinks in the general hospital. Further, the available sinks were located far away from the door of the rooms housing the patients.

The time required for nurses to leave a patient's bedside, go to a sink, and wash and dry their hands before attending the next patient is a deterrent to frequent handwashing or hand antisepsis [9,10]. One study conducted in an intensive care unit demonstrated that it took nurses an average of 62 s to leave a patient's bedside, walk to a sink, wash their hands, and return to patient care [10]. In contrast, an estimated one-quarter as much time is required when using alcohol-based hand rub placed at each patient's bedside. In contrast to sinks used for

handwashing or antiseptic handwash, dispensers for alcohol-based hand rubs do not require plumbing and can be made available adjacent to each patient's bed and at many other locations in patient care areas. Further, using alcohol-based hand rubs may be a better option than traditional handwashing with plain or antiseptic soap and water because they require less time, act faster, and irritate hands less often [10–14]. Additionally, their use was shown to lead to a sustained improvement in hand hygiene adherence and decreased infection rates and to be cost effective [15–17]. For instance, in a recent Australian study evaluating the effect of a multifaceted hand hygiene programme on health care workers behaviour, the compliance to hand hygiene improved from a pre-intervention mean of 21% to 42% 12 months post-intervention [17]. The acceptability of alcohol-based hand rub in Islamic communities, where intake of alcohol is prohibited by the Islamic religion, is not expected to be a problem, as most Islamic scholars allow the use of alcohol on the skin as, for instance, the case with alcohol-containing perfumes. However, the potential to abuse alcohol-based medical solutions in Saudi Arabia and other Islamic communities where alcoholic drinks are not legally available needs further studies.

Wearing gloves is recommended to reduce the risk of HCWs acquiring infections from patients, to prevent HCWs' flora from being transmitted to patients, and to reduce transient contamination of the hands of HCWs by flora that can be transmitted from one patient to another [18]. Gloves should be worn during all patient-care activities that may involve exposure to blood or body fluids. The effectiveness of gloves in preventing contamination of HCWs' hands has been confirmed in several clinical studies [19–21]. However, gloves do not provide complete protection against hand contamination. In such instances, pathogens presumably gain access to the HCWs' hands via small defects in gloves or by contamination of the hands during glove removal [22]. Therefore, hands should be washed or disinfected with alcohol-based hand rub after removal of gloves. In the present study, adherence to wearing gloves for performing procedures and adherence to handwashing after removing gloves were suboptimal (75.5% and 48.8%, respectively).

In addition to making sinks for handwashing available and easily accessible, and making alcohol-based hand rub available at least in high-demand situations, strategies for successful promotion of hand hygiene in hospitals also include education, routine observation of HCWs and feedback, posting reminders in the workplace, administrative sanction/rewarding, promotion of skin care for HCWs' hands, improving institutional safety climate, and avoidance

of overcrowding, understaffing, and excessive workload [7]. These strategies have been adopted by the Riyadh Medical Complex and other Ministry of Health hospitals in Saudi Arabia with strong commitments from the highest authorities in the Ministry of Health after knowing the results of this study. A re-evaluation study will be conducted at the end of y 2006 to assess the impact of these strategies on adherence of HCWs to hand hygiene.

In conclusion, poor adherence to handwashing is a worldwide problem. Factors deterrent to hand hygiene are many and intermingled. Efforts to improve hand hygiene practice should be multifaceted and should involve both medical and administrative staff and the institution at large.

References

- [1] Steere AC, Mallison GF. Handwashing practices for the prevention of nosocomial infections. *Ann Intern Med* 1975; 83:683–90.
- [2] Garner JS, Favero MS. CDC guideline for handwashing and hospital environmental control, 1985. *Infect Control* 1986;7: 231–43.
- [3] Larson E. Guideline for use of topical antimicrobial agents. *Am J Infect Control* 1988;16:253–66.
- [4] Larson EL, APIC Guidelines Committee. APIC guideline for handwashing and hand antisepsis in health care settings. *Am J Infect Control* 1995;23:251–69.
- [5] Hospital Infection Control Practices Advisory Committee (HICPAC). Recommendations for preventing the spread of vancomycin resistance. *Infect Control Hosp Epidemiol* 1995;16:105–13.
- [6] Garner JS, Hospital Infection Control Practices Advisory Committee. Guideline for isolation precautions in hospitals. *Infect Control Hosp Epidemiol* 1996;17:53–80.
- [7] Boyce JM, Pittet D, Healthcare Infection Control Practices Advisory Committee, HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Guideline for Hand Hygiene in Health Care Settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Society for Healthcare Epidemiology of America/Association for Professionals in Infection Control/Infectious Diseases Society of America. *MMWR Recomm Rep* 2002;51(RR-16):1–45.
- [8] Pittet D. Improving compliance with hand hygiene in hospitals. *Infect Control Hosp Epidemiol* 2000;21:381–6.
- [9] Pittet D, Mourouga P, Perneger TV, Members of the Infection Control Program. Compliance with handwashing in a teaching hospital. *Ann Intern Med* 1999;130:126–30.
- [10] Voss A, Widmer AF. No time for handwashing! Handwashing versus alcoholic rub: can we afford 100% compliance? *Infect Control Hosp Epidemiol* 1997;18:205–8.
- [11] Larson E. Skin hygiene and infection prevention: more of the same or different approaches? *Clin Infect Dis* 1999;29: 1287–94.
- [12] Boyce JM, Kelliher S, Vallande N. Skin irritation and dryness associated with 2 hand-hygiene regimens: soap-and-water handwashing versus hand antisepsis with an alcoholic hand gel. *Infect Control Hosp Epidemiol* 2000; 21:442–8.
- [13] Winnefeld M, Richard MA, Drancourt M, Grobb JJ. Skin tolerance and effectiveness of 2 hand decontamination

- procedures in everyday hospital use. *Br J Dermatol* 2000; 143:546–50.
- [14] Larson EL, Aiello AE, Bastyr J, Lyle C, Stahl J, Cronquist A, et al. Assessment of 2 hand hygiene regimens for intensive care unit personnel. *Crit Care Med* 2001;29:944–51.
- [15] Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauvan V, Touveneau S. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. *Lancet* 2000;356: 1307–12.
- [16] Boyce JM. Antiseptic technology: access, affordability, and acceptance. *Emerg Infect Diseases* 2001;7:231–3.
- [17] Johnson PD, Martin R, Burrell LJ, Grabsch EA, Kirsa SW, O’Keeffe J, et al. Efficacy of an alcohol/chlorhexidine hand hygiene programme in a hospital with high rates of nosocomial methicillin-resistant *Staphylococcus aureus* (MRSA) infection. *Med J Aust* 2005;183:509–14.
- [18] Garner JS, Simmons BP. Guideline for isolation precautions in hospitals. *Infect Control* 1983;4(Suppl 4):245–325.
- [19] McFarland LV, Mulligan ME, Kwok RYY, Stamm WE. Nosocomial acquisition of *Clostridium difficile* infection. *N Engl J Med* 1989;320:204–10.
- [20] Pittet D, Dharan S, Touveneau S, Sauvan V, Perneger TV. Bacterial contamination of the hands of hospital staff during routine patient care. *Arch Intern Med* 1999;159:821–6.
- [21] Tenorio AR, Badri SM, Sahgal NB, Hota B, Matushek M, Hayden MK, et al. Effectiveness of gloves in the prevention of hand carriage of vancomycin-resistant *Enterococcus* species by health care workers after patient care. *Clin Infect Dis* 2001;32:826–9.
- [22] Olsen RJ, Lynch P, Coyle MB, Cummings J, Bokete T, Stamm WE. Examination gloves as barriers to hand contamination in clinical practice. *JAMA* 1993;270:350–3.