

Improvement of hand hygiene compliance among health care workers in intensive care units

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Keywords

Compliance • Hand hygiene • HCWs

Summary

Aim. Hand hygiene (HH) is an essential component in preventing healthcare associated infections. The purpose of this study was to evaluate HH compliance among health care workers (HCWs) in intensive care units at Beni-Suef university hospital, Egypt before and after an intervention educational program.

Methods. Data were collected by using the standardized WHO method for direct observation "Five moments for HH" approach. Observations were conducted in six ICUs before intervention (March to April 2017) and after the intervention (July to August 2017). The study included 608 opportunities (observations) among 177 HCWs collected before and 673 opportunities among 163 HCWs collected after the intervention.

Results. Overall HH compliance increased significantly from 30.9 (95% CI: 27.2-34.6%) before intervention to 69.5 (95% CI: 65.2-72.6%) post intervention; with the highest HH compliance rate

among nurses compared to physicians and workers ($P = 0.001$). Significantly higher HH compliance rates were observed after body fluid exposure, before aseptic procedures, and after patient contact compared to before patient contact and after patient surrounding contact ($P = 0.001$). In binary logistic regression analyses a statistically significant difference was shown ($P = 0.047$) for HH compliance among events before and after patient contact ($OR = 1.399$, 95% CI: 1.004-1.948).

Conclusions. The interventional educational program improved the HH compliance among ICUs-HCWs at Beni-Suef university hospital. The hospital should conduct monthly observational monitoring for the ICUs units sharing the findings to spread best practices. Provision of sustained training programs to help efficient and effective HH for care delivery is mandatory.

Introduction

Hand hygiene (HH) is the easiest, most influential, and economical method in reducing Hospital acquired infections (HAIs) [1, 2] which results in increased healthcare costs, length of hospitalization, use of drugs, and unnecessary laboratory investigations both in developed and developing countries, resulting in [3, 4] health care associated infections (HCAIs); HAIs known as nosocomial infections accounts for 5-10% and >15% in developed and developing countries respectively [5]. Knowing that, compliance with HH alone essentially enhances patient safety; the reported compliance levels among healthcare workers (HCWs) remains suboptimal, with compliance rates being 30-75% [6-8].

In order to improve health care worker practices; the World Health Organization (WHO) standardized hand hygiene practice and recommended 100% compliance [5]. Effective measurement of HH adherence involves three concepts: indication, opportunity, and action; with Indications being the principal rationale for performing HH [9]. Both WHO and CDC guidelines recommend HCWs with a hand wash using soap and water when there is visible dirt. Alcohol-based hand hygiene is recommended for all other opportunities using Alcohol containing hand disinfection (AHD) which is an effective alternative to soap and water [5, 10].

Non compliance with HH protocols in hospitals, especially in ICUs, is a serious contributing yet preventable cause of HAIs. Most ICU endemic infections result from HCWs hands contamination with micro-organisms with frequent outbreaks due to cross transmission due to frequent invasive procedures for ICU patients [11-13]. The purpose of the current study is to measure the compliance with HH practices among HCWs in ICUs at Beni-Suef university hospital before and after an intervention program for HH based on WHO strategies.

Materials and methods

This study was conducted among 177 HCWs working in six different ICUs - Beni-Suef university hospitals, Egypt; between March and August 2017.

ICUs included in the study were: six ICUs were included in the study. The Critical Intensive Care Unit (CICU): 19 beds; the Surgery Care Unit (SCU): 12 beds; the Cardiothoracic Care Unit (CCU): 6 beds; Chest Care Unit: 8 beds; Neonatal Intensive Care Unit (NICU): 10 beds; and the Pediatric Care Unit (PICU): 10 beds. All of the ICUs followed local infection control policies and procedures. Alcohol-based hand rub dispensers are available for each ICU, and one dispenser per every two ICU beds within each unit.

DESIGN

This is a prospective, Interventional study divided into three phases:

Phase 1: pre-intervention; from March to April 2017; 8 weeks. Baseline hand hygiene compliance rate was assessed.

Phase 2: interventional phase, from May to June 2017, 8 weeks. Interventional training and education were carried out by the infection control team for the study participants. The educational programs aimed at raising their awareness at all levels. The training was held at least on three different occasions for each ICU HCWs to ensure their active participation concerning HH knowledge and practice. Workplace posters and explanatory Leaflets depicting the 5 moments for hand hygiene, instructions on the techniques of hand Sanitizers and hand washing were posted to act as a reminder for them. In addition, active presentations, video show and training handouts were given to each participant.

Phase 3: post-intervention, from July to August 2017; 8 weeks. Hand hygiene compliance rate was assessed post-interventional training.

Hand hygiene compliance assessment in phase 1 and 3: An observation record form was used for an unscheduled direct observation by members of the infection control team for the 5 HH opportunities [14] among ICUs HCWs; (1) before patient contact, (2) before an aseptic task, (3) after exposure to bodily fluids, (4) after patient contact and (5) after contact with patient surroundings. The observations were carried out in a 20-30-min periods, several times a week. No more than two patients were observed at a time. HCWs did not know the schedule of the observation periods. The HH compliance rate was calculated. The HH compliance data were discussed regularly during the infection control committee (ICC) meeting and with the ICU staff. The data were reported in a composite unit by job category.

STUDY SUBJECTS

Post intervention observations were done for 163 HCWs; 106 nurses, 34 physicians, and 23 workers (radiographers, laboratory technicians, ECG technicians, physiotherapists and respiratory therapists). Distribution of study subjects shown in Table I revealed that 95%, 89.5% and 85% of nurses, physicians and workers were observed post-intervention.

ETHICAL CONSIDERATIONS

To ensure privacy, dignity, and integrity, the used questionnaire was anonymous. All required permissions were obtained from the hospital administration and from the head of the infection control unit.

STATISTICAL ANALYSIS

Data were analyzed using the software, Statistical Package for Social Science, (SPSS Inc. Released 2009 - PASW Statistics for Windows Version 18.0. Chicago: SPSS Inc.) Frequency distribution, percentage and descriptive statistics including mean and standard deviation were calculated. McNemar test was performed when indicated. A Binary logistic regression model was conducted. Odds ratio (OR) and antecedent 95% confidence intervals were used to identify potential determinants of HH compliance. P-value was considered significant if ≤ 0.05 .

Results

This study involved observing 112 nurses (89% females & 11% males) 67 % of them were staff nurse and 33% were head nurse with a mean age of 32.41 years \pm SD 11.26. Their mean work experience was 9.97 years \pm SD 9.58. 38. Thirty-eight physicians were observed for HH compliance (45.7% males & 54.3% females), 33% were clinical residents, 58% were specialists and 10 % were consultants. Their mean age was 30.74 years \pm SD 6.8 with a mean work experience of 5.74 \pm SD 6.56. Workers constituted 15% of the study group (32% males & 68% females) with a mean age of 32.41 years \pm SD 11.26 and a mean work experience of 9.97 years \pm SD 9.58.

Study observations included 608 ICU opportunities, collected before the intervention program (March to April 2017), and 673 observations collected after the intervention program (July to August 2017).

A statistically significant improvement ($P = 0.01$) in the overall HH compliance rate from 30.9(95% CI: 27.2-34.6%) before the intervention to 69.5(95% CI: 65.2-72.6%) post intervention ($P = 0.001$) is shown in Table II.

Pre-intervention compliance rates were lower for the neonatal and cardiac ICUs. Table II also represents the difference between HCWs HH compliance rate pre and

Tab. I. Distribution of the study group among the 6 ICUs.

Type of ICU		Physician		Nurses		Workers	
		Pre	Post	Pre	Post	Pre	Post
1	Critical Intensive Care Unit	11	9	32	30	8	7
2	Surgery Care Unit	7	6	20	19	4	4
3	Cardiothoracic Care Unit	5	5	11	11	3	3
4	Chest Care Unit	4	4	15	14	5	4
5	Neonatal Intensive Care Unit	6	5	18	17	4	3
6	Pediatric Care Unit	5	5	16	15	3	3
Total		38	34	112	106	27	23

Tab. II. Pre- and post-intervention hand hygiene compliance rates.

Variable*	Compliance rate% (95% CI)	
	Pre-intervention	Post-intervention
ICUs		
Pediatric ICU	37.8 (27.9-47.8)	74.2 (66.5-81.9)
Chest ICU	32.3 (22.7-41.8)	71.1 (63.1-79.1)
Surgery ICU	35.4 (26.5-44.5)	68.8 (59.3-79.2)
Neonatal ICU	25.0 (10.9-39.0)	69 (59.0-79.0)
Critical ICU	30.4 (21.9-39.0)	71.1 (63.1-79.1)
CCU	24.3 (17.4-31.2)	61.0 (51.5-70.04)
Healthcare workers		
Nurses	37.9 (32.8-42.8)	71.7 (67.2-76.2)
Physicians	21.7 (15.8-27.6)	67.5 (61.4-73.6)
Others	17.5 (7.4-27.7)	62.5 (49.4-75.6)
Hand hygiene indication		
Before patient contact (Moment 1)	22.1 (15.8-28.4)	69.0 (61.7-69.2)
Before aseptic procedure (Moment 2)	40.5 (31.3-49.8)	73.3 (66.0-80.5)
After body fluid exposure (Moment 3)	55.4 (43.0-67.8)	75.7 (69.0-82.8)
After patient contact (Moment 4)	35.0 (27.6-42.4)	72.8 (66.6-79.0)
After patient surrounding contact (Moment 5)	12.4 (5.7-19.04)	58.5 (48.5-67.7)
Overall HH compliance rates	30.9 (27.2-34.6)	69.5 (65.2-72.6)
ICU: Intensive care unit; HH: Hand hygiene; Others: Radiographers, laboratory technicians, ECG technicians, physiotherapists and respiratory therapists		

post intervention in the six ICUs for the 5 moments with a significant improvement among all HCWs in the six ICUs (P = 0.001). HH compliance rates were highest among nurses in the pre-intervention phase, which increased for all HCWs after the interventional program (P = 0.001). Moments 1&5 had the lowest HH compliance rates pre-intervention and a significant difference was achieved post the interventional program for all 5 moments (P = 0.001).

Using binary logistic regression analysis model; we use the hand hygiene after the intervention (done or missed) as a dependent factor and HCWs type, Events of HH and ICUs type and predictors or independent variables for hand hygiene improvement after the intervention. It was illustrated that the type of HCWs, type of ICUs didn't not affect the compliance of HCW towards HH and the only positive predictor was the event or the indication for HH after touch patients and after an invasive procedure (OR = 1.399, 95% CI: 1.004–1.948) with P = 0.047 (Tab. III).

Discussion

Hand hygiene is an effective tool in the reduction of health care associated infection (HAIs) in healthcare facilities, especially in intensive care units (ICUs), and poor compliance for hand hygiene is associated with high rates of

HAIs [15]. In the present study, the success of the interventions (educational) program carried out for ICU HCWs showed a significant improvement in the HH compliance rates evidenced by the increase in overall hand hygiene compliance rate in all ICUs from 30.9% before the intervention to 69.5% after the intervention (Tab. I). This finding is in agreement with similar Middle East studies from Saudi Arabia, Kuwait reporting improvement from 43-60.8% before intervention to 61.4-86.4% post-intervention [16, 17], and similar to the reported improvement post intervention from 23.1% to 64.5% in Argentina [18], and from 30.0% to 56.7% in Brazil [19] and from 51.0% to 67.2% in a multi-center Multi-national study including 55 departments in 43 hospitals in Costa Rica, Italy, Mali, Pakistan, and Saudi Arabia [4].

In the current study, HH compliance was highest for moments 2, 3 & 4 and lowest for moments 1&5 (P = 0.001). This observation was constant in the pre and post interventional phases.

Improvement of HH practice was observed among HCWs for the 5 moments post the interventional program. Moment 1 improved from 22.1% to 69% in agreement with similar European and Arabian studies reporting improvement from 35% and 52% [17, 20, 21], reflecting lesser concern of personal HCWs risk of contamination before patient's contact or representing a vector for pathogenic

Tab. III. Factors determining hand hygiene compliance in intensive care units.

Factors	P-value	OR	95% C.I. for OR	
			Lower	Upper
HCWs: nurses vs physicians and other HCWs	0.175	0.794	0.569	1.108
Event: after vs before patient contacts	0.047	1.399	1.004	1.948
ICUs: medical vs surgical	0.626	1.097	0.756	1.591
Constant	0.000	1.992		

CI: Confidant interval; OR: Odds ratio, HCWs: Health care workers; ICU: Intensive care unit

organisms transmission to others [22-24]. Other factors such as work overload and insufficient time could be the cause of this result.

Moment 2 improved from 40.5% to 73.3% similar to the reported improvement from 51.0% to 67.2% in a multi-national study conducted in six pilot sites [20].

As for a Moment 3, an observed higher compliance rate from 55.4% to 75.7%, higher than the reported percentages in an Indonesian study with an improvement from 22.2% to 33.3% [26] and similar to that reported on a Saudi Arabian study from 65.2% to 85.2% [16]. High compliance rate of HCWs is logical when hands are visibly dirty or sticky.

Similarly, results of higher compliance rate for a Moment 4 were observed from 35% to 72.8%, a finding which ranges consistent with similar reported improvement from (20.6-78.6% in pre-intervention to 34.1-89.7% in post-intervention) [16, 26].

Compliance with the WHO recommendation for HH practice after contact with patient surroundings (surfaces and objects) was poorly implemented by HCWs in the current study. This is shown by the lowest compliance rates of Moment 5 in the pre and post intervention phases in spite of the highest improvement rates from 12.4% to 58.5% ($P = 0.001$) yet did not reach a satisfactory percentage. Findings which are similar to the reported improvement percentages for Moment 5 in Indonesia and another study conducted in at six pilot sites [20]. Explanation of which might be due to HCWs belief that patient's surroundings harbor less risk for acquired infections. Therefore, convincing evidence should drive HCWs to practice effective HH to protect themselves [20, 26-28].

Hand hygiene compliance rate among nurses was significantly higher ($P = 0.001$) compared to the compliance of physicians and other HCWs in pre- and post-intervention phases. This is in concordance with other studies [16, 20-22, 24, 29]. In general, physicians were found to be poor compliant with infection control standards [30].

Conclusions

The HH compliance rate among HCWs improved with the Interventional, teaching program in the six ICUs in Beni-Suef university hospital. Nurses were found more compliant with the HH practice compared to physicians and other HCWs. HH compliance rates after Moments 2, 3 and 4 were significantly higher compared with Moments 1 and 5. Continuous professional performance improvement programs should be periodically implemented and audited to maintain an adequate, safe environment for the HCWs and the patients.

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Conflict of interest statement

None declared.

Authors' contributions

The authors have contributed substantially to conception of the study, analysis and interpretation of data, drafting of the article, and critical revision of the article. Both authors have given final approval to the article as submitted.

References

- [1] Boyce JM, Larson EL, Pittet D. Hand hygiene must be enabled and promoted. *Am J Infect Control* 2012;40(Suppl. 1):S2.4.
- [2] Al-Tawfiq JA, Pittet D. Improving hand hygiene compliance in healthcare settings using behavior change theories: reflections. *Teach Learn Med* 2013;25:374-82.
- [3] Derde LP, Cooper BS, Goossens H, Malhotra-Kumar S, Willems RJJ, Gniadkowski M, Hryniewicz W, Empel J, Dautzenberg MJD, Annane D, Aragão I, Chalfine A, Dumpis U, Esteves F, Giamarellou H, Muzlovic I, Nardi G, Petrikos GL, Tomic V, Marti AT, Stammet P, Brun-Buisson C, Bonten MJM; MOSAR WP3 Study Team. Interventions to reduce colonisation and transmission of antimicrobial-resistant bacteria in intensive care units: an interrupted time series study and cluster randomized trial. *Lancet Infect Dis* 2014;14:31-9.
- [4] Allegranzi B, Gayet-Ageron A, Damani N. Global implementation of WHO's multimodal strategy for improvement of hand hygiene: a quasi-experimental study. *Lancet Infect Dis* 2013;13:843-51.
- [5] World Health Organization. WHO Guidelines on hand hygiene in health care: first global patient safety challenge clean care is safer care 2009 [cited 2012 May 15]; available from www.who.int/patientsafety/en/www.who.int/gpsc/en.
- [6] Pittet D, Simon A, Hugonnet S, Pessoa-Silva CL, Sauvan V, Perneger TV. Hand hygiene among physicians: performance, beliefs, and perceptions. *Ann Intern Med* 2004;141:1-8.
- [7] Allegranzi B, Sax H, Pittet D. Hand hygiene and healthcare system change within multi-modal promotion: a narrative review. *J Hosp Infect* 2013;83(Suppl. 1):S3-10.
- [8] Lee A, Chalfine A, Daikos GL, Garilli S, Jovanovic B, Lemmen S, Martínez JA, Masuet Aumatell C, McEwen J, Pittet D, Rubinovitch B, Sax H, Harbarth S; MOSAR-04 Study Team. Hand hygiene practices and adherence determinants in surgical wards across Europe and Israel: a multicenter observational study. *Am J Infect Control* 2011;39:517-20.
- [9] Sax H, Allegranzi B, Chraiti MN, Boyce J, Larson E, Pittet D. The World Health Organization hand hygiene observation method. *American Journal of Infection Control* 2009;37:827-34.
- [10] Boyce JM, Pittet D. Healthcare Infection Control Practices Advisory Committee, and 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 Infec-

- tion Control/Infectious Diseases Society of America. *MMWR Recomm Rep* 2002;51:1-45.
- [11] Pittet D. Hand hygiene: improved standards and practice for hospital care. *Curr Opin Infect Dis* 2003;16:327-35.
- [12] Mahfouz AA, Al Azraki TA, Abag FI, Al Gamal MN, Seef S, Bello CS. Nosocomial infection in a neonatal intensive care unit in Southwestern Saudi Arabia. *East Mediterr Health J* 2010;16:40-4.
- [13] Pittet D. Hand hygiene: it's all about when and how. *Infect Control Hosp Epidemiol* 2008;29:957-9.
- [14] World Health Organization (WHO). *World alliance for patient safety: manual for observers*. Geneva, Switzerland: WHO 2006.
- [15] Haas JP, Larson EL. Measurement of compliance with hand hygiene. *J Hosp Infect* 2007;66:6-14.
- [16] Mahfouz AA, Al-Zaydani IA, Abdelaziz AO, El-Gamal MN, Assiri AM. Changes in hand hygiene compliance after a multimodal intervention among health-care workers from intensive care units in Southwestern Saudi Arabia. *J Epidemiol Glob Health* 2014;4:315-21.
- [17] Salama MF, Jamal WY, Al Mousa H, Al-Abdul Ghania KA, Rotimi VO. The effect of hand hygiene compliance on hospital acquired infections in an ICU setting in a Kuwaiti teaching hospital. *J Infect Public Health* 2013;6:27-34.
- [18] Rosenthal VD, Guzman S, Safdar N. Reduction in nosocomial infection with improved hand hygiene in intensive care units of a tertiary care hospital in Argentina. *Am J Infect Control* 2005;33:392-7.
- [19] dos Santos RP, Konkewicz LR, Nagel FM, Lisboa T, Xavier RC, Jacoby T, Gastal SL, Kuplich NM, Pires MR, Lovatto CG, Deutschendorf C, Kuchenbecker R. Changes in hand hygiene compliance after a multimodal intervention and seasonality variation. *Am J Infect Control* 2013;41(11):1012-6. doi: 10.1016/j.ajic.2013.05.020.
- [20] García-Vázquez EI, Murcia-Payá J, Allegue JM, Canteras M, Gómez J. Influence of a multiple intervention program for hand hygiene compliance in an ICU. *Med Intensiva* 2012;36:69-76.
- [21] Mohidin S, Al-Hazmi A, Al-Tabsh L, Al-Kattan R, Al-Eidarous S. Compliance to hand hygiene among health care workers: observational study at teaching hospital. 2016. Research Available at: https://www.researchgate.net/publication/291831439_Compliance_to_Hand_Hygiene_Among_Health_Care_Workers_Observational_Study_at_Teaching_Hospital. DOI: 10.13140/RG.2.1.4616.2963.
- [22] Sánchez Payá J, Galicia García MD, Gracia Rodríguez RM, García-González C, Fuster-Pérez M, López-Fresneña N, Avendaño-Corcoles F, González-Torga. Evaluation of a program for updating recommendations about hand hygiene. *Enferm Infecc Microbiol Clin* 2007; 25:369-75.
- [23] Palomar M, Rodríguez P, Nieto M, Sancho S. Nosocomial infections in intensive care units. *Med Intensiva* 2010;34:523-33.
- [24] Wendt C, Knantz D, Von Baum H. Differences in hand hygiene behavior related to the contamination risk of healthcare activities in different groups of healthcare workers. *Infect Control Hosp Epidemiol* 2004;25:203-6.
- [25] Santosaningsih D, Erikawati D, Santoso S, Noorhamdani N, Ratridewi I, Candradikusuma D, Chozin IN, Huwae TECJ, van der Donk G, van Boven E, Voor In 't Holt AF, Verbrugh HA, Severin JA. Intervening with healthcare workers' hand hygiene compliance, knowledge, and perception in a limited-resource hospital in Indonesia: a randomized controlled trial study. *Antimicrob Resist Infect Control* 2017;6:23. doi 10.1186/s13756-017-0179-y.
- [26] Pittet D. Improving adherence to hand hygiene practice: a multidisciplinary approach. *Emerg Infect Dis* 2001;7:234-40.
- [27] Teker B, Ogutlu A, Gozdas HT, Ruayercan S, Hacialioglu G, Karabay O. Factors affecting hand hygiene adherence at a private hospital in Turkey. *Eurasian J Med* 2015;47:208-12.
- [28] Randle J, Arthur A, Vaughan N. Twenty-four-hour observational study of hospital hand hygiene compliance. *J Hosp Infect* 2010;76:252-5.
- [29] Martín-Madrado C, Cañada-Dorado A, Salinero-Fort MA, Abanades-Herranz JC, Arnal-Selfa R, García-Ferradal I, Espejo-Matorral F, Carrillo-de Santa-Pau E, Soto-Diaz S. Effectiveness of a training programme to improve hand hygiene compliance in primary healthcare *BMC Public Health* 2009;9:469. doi: 10.1186/1471-2458-9-469.
- [30] Brooks I, Brown RB. The role of the ritualistic ceremonial in removing barriers between 292 subcultures in the National Health Service. *J Adv Nurs* 2002;38:341-52.

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