Assessment of knowledge, attitude and practice of hand washing among healthcare workers in Al-Azhar University hospitals in Cairo

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Abstract: Most nosocomial infections are thought to be transmitted by the hands of healthcare workers. The aim of this work was to assess the knowledge, attitude and practice of hand washing among healthcare workers (HCW) in Al-Azhar University hospitals and to investigate the presence of the necessary facilities and supplies required for hand washing (HW) in ten wards. A cross sectional descriptive and observational study was conducted for six months from June till November 2016. Observation of the HCW for hand washing practice was done at any opportunity of contact with the patients in the different wards by members of the infection control team. Knowledge & attitude of HCW towards hand hygiene was done through self-administered questionnaire to HCW in 10 different departments. The total opportunities observed were 2189 opportunities. Doctors showed a significantly higher compliance (37.5%) than other groups of HCW (P = 0.000), however only 11.6% of the opportunities observed for doctors were done appropriately. The most common type of HW practiced among HCW was the routine HW (64.3%) and the least was the antiseptic HW (3.9%). Having a short contact time and improper drying (23.2%) were the most common errors that lead to inappropriate HW. Most of the wards had available sinks (80%) but none of them had available paper towels. The mean knowledge score was higher in nurses compared to doctors (42.6 ± 11.7 versus 39.1 ± 10.5). Most of the nurses (97.3%) believe that administrative orders and continuous observation can improve hand washing practices. Implementation of multifaceted interventional behavioral hand hygiene program with continuous monitoring and performance feedback, increasing the supplies necessary for HW and institutional support are important for improving the compliance of hand hygiene guidelines.
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Key words: Hand washing • Healthcare workers • Knowledge • Attitude • Practice

1. Introduction

Most nosocomial infections are thought to be transmitted by the hands of healthcare workers. It has long been known that hand hygiene among healthcare workers plays a central role in preventing the transmission of infectious agents. Hand-washing (HW) is the most effective way of preventing the spread of infectious diseases [1]. But despite a Joint Commission requirement that Centers for Disease Control and Prevention hand hygiene guidelines be implemented in hospitals, compliance among healthcareworkers remains low [2]. The reasons for low compliance to hand hygiene have not been defined in developing countries probably due to limited studies on hand hygiene [3]. Factors that contribute to non-compliance to HW among healthcare workers are: lack of awareness and knowledge among healthcare workers as regard the importance, techniques, methods and quality of hand hygiene [4-8]. Moreover, human factors that lead to low compliance to hand hygiene are busyness [6], forgetfulness [9], low staff to patient ratio and attitudes among staff towards bio-safety [4]. Other factors related to low hand washing practices are insufficient supply of equipments, materials and resources for good hand hygiene maintenance [4, 5, 7, 10], skin condition as allergies and irritants to hand washing agents [4, 6, 7]. Attitude is a significant predictor of intention to perform hand hygiene [11]. Improved compliance with hand washing was associated with a significant decrease in overall rates of nosocomial infection and respiratory infections in particular [13]. Hand hygiene technique is seldom incorporated into research studies and audits designed to increase compliance. As a result, numerous unanswered questions remain concerning this aspect of hand hygiene [13]. In order to be effective, efforts to improve compliance with hand washing guidelines must be multifaceted incorporating cognitive, emotional and behavioral aspects and should include increasing the availability and accessibility of hand washing sinks and alcohol-based hand rubs [14, 15].

Aim of the work

1) Assessment of knowledge, attitude and practice of hand washing among healthcare workers (HCW) in Al-Azhar University hospitals.

2) Careful inspection of ten wards in Al-Azhar University hospitals for facilities required for hand washing.

2. Subjects and methods

Design of the Study

A cross sectional study was conducted in Al-Azhar University hospitals from June till November 2016.

Study Observations

This study aimed at checking all opportunities of hand washing practices among HCW in ten wards of Al-Azhar University hospitals. Hand washing opportunities are those where the HCW could do invasive procedures, come into personal contact with the patient, do non-invasive procedures as blood pressure or temperature measurement, body fluid contact, waste disposal or come in contact with contaminated inanimate objects. Multiple opportunities could be observed for a single healthcare worker.

Data Collection

Two infection control nurses from ten departments were trained on observing hand washing opportunities and filling out the forms needed. The trained nurses filled the observational forms which recorded the events in each opportunity observed and in a covert manner. The observational form included a recording if the hand washing was done or not, also if done what was the type of hand washing and what type of errors if the HW was done incorrectly. A ward inspection form was also filled by checking the availability of facilities needed for hand washing in each department, as sinks, soap, drying materials, alcohol-based hand rubs, presence of gloves, hand hygiene guidelines and posters.

Instruments

Three research instruments were used in this study:

a) Hand washing observation form.

b) Ward inspection form.

c) Self-administered questionnaire to assess the knowledge and attitude of healthcare workers towards hand hygiene practice.

Questionnaire of the Study

Knowledge and attitude of HCW towards hand washing practices were assessed by a self administered questionnaire. This questionnaire included 20 questions for doctors or nurses and only 10 questions for workers assessing their knowledge about hand hygiene. It covered many aspects of hand washing practices as indications, techniques; minimum time required for each technique, materials used in hand washing. Three answers were offered after each question as True, false or unsure. Furthermore, the questionnaire included questions on alcohol hand rubbing and using of gloves with hand washing. Attitude questionnaire was distributed to nurses and included four questions based on Likart scale. This questionnaire aimed mainly on studying the attitude of HCW towards methods of improvement of hand washing practice in their workplace. Totally agree and agree answers were considered as a positive attitude. A total score was given to both the knowledge and attitude questionnaire (out of 20). Forms were revised for completeness and consistency. Data entry, data checking and data analysis were done with the program SPSS (Statistical package for social science) version 11.0. The study questionnaire had a score of 0.680 on testing its internal consistency by Alpha Cronbach's reliability analysis test.

Ethical Consideration

Approval of the design and steps of the study were conducted with members of the infection control unit in Al-Azhar University hospitals. Oral consent was taken from doctors and nurses before answering the questionnaires of the study. The observation of the hand washing practices is considered among the routine checking of infection control activities by the infection control nurse.

3. Results

A total of 2189 opportunity among healthcare workers in Al-Azhar University hospitals were observed for compliance to hand Hygiene. Most of the observed opportunities for hand washing were done by nurses (1180) followed by doctors (465).

Collectively doctors (37.5%) showed a significantly higher compliance to hand washing compared to other groups of healthcare workers (P = 0.000), however only 11.6% of the opportunities observed from doctors were done in an appropriate way (Tab. I). The departments included in the observations of opportunities of hand washing were orthopedic, neurosurgery, plastic and general surgery (722 observations), pediatric, gynecology and chest intensive care units (1193 observations) and the hematology departments (Tab. II). The most practiced type of hand washing among HCWs was the routine hand washing (64.3%) and the least was the antiseptic hand wash (3.9%) (Tab. III). The prevalence of hand washing was higher after doing the different procedures or interventions than before doing them, yet hand washing was done in a more appropriate way before doing the different intervention except for the non-invasive procedures where it was nearly similar before and after. The knowledge questionnaire was filled by 152 HCW. The mean knowledge score was higher among nurses compared to doctors (42.6 ± 11.7 versus 39.1 ± 10.5). The assessment of the knowledge of HCWs in different departments showed that the highest mean score was in the Neonatal Intensive Care Unit (NICU) pediatric department. Doctors had high mean score in knowledge in General surgery department 7 (47.5 ± 8.6), nurses (48 ± 2.7) and workers (63.3 ± 1105) in the NICU pediatric

department (Tab. IV). Although the highest mean knowledge of hand washing was among nurses in the NICU pediatric 48.0 ± 2.7 yet the lowest attitude score was found among nurses in the same department 68.0 ± 7.5 (Results are not shown in tables). As regards the attitude of nurses towards hand hygiene, it was found that 96% of nurses believe that hand washing is protective to healthcare personnel against infection. Also, it is noted that 97.3% of the nurses believe that administrative orders and continuous observation can improve hand washing practices. As regards lowering of nosocomial infection rates 92% of the nurses believe that this method (Hand washing) can lower nosocomial infection rates more than any other method of infection control. Only 70.7% of the nurses had positive attitude towards the improvement of hand washing by watching role models do hand washing (Tab. V). The most common form of inappropriate hand washing was in the improper drying and having short contact time (23.2%) (Fig. 1). As regards the wards inspection for HW supplies and facilities, most of the wards had available sinks (80%) but none of them had available paper towels for drying of the hands (Tab. VI).

Tab. I. Compliance to hand hygiene among different groups of healthcare workers in Al-Azhar Universityhospitals

Healthcare workers	Opportunities observed	Hand Washing			
		Done		Appropriate	
	Total	N	(%)	N	(%)
Doctors		174	37.5	54	11.6
Nurses	465	429	36.4	44	3.7
Housekeepers	1180	67	22.6	10.3	
Others*	296	75	30	12 4.8	
Total	248	745	34.0	1115.1	
	2189	$X^2 = 23.9$		$X^2 = 52.5$	
		P = 0.000		P = 0.000	

*Others include waste disposal workers and janitors

Tab. II. Compliance to hand hygiene among different departments and in different procedures in Al-Azhar University hospitals

Variables	Opportunities observed	Hand Washing		
		Done		Appropriate
	Total	N	(%)	N (%)
Departments:				86.9
Orthopedic	115	16	13.9	0 0
Neurosurgery	157	2	1.3	4 1.3
Plastic surgery	294	32	10.9	0 0
General surgery	156	63	40.4	67 13.9
NICU Pediatric	480	300	62.5	29 8.4
NICU Gynecology	345	136	39.4	3 1.1
Hematology	274	73	26.6	0 0
Chest ICU	368	123	33.4	
Procedures:				
Invasive procedures	753	258	34.3	34 4.5
Non-Invasive procedures	501	160	31.9	39 7.7
Personal contact	157	69	43.9	7 4.4
Body fluids contact	191	76	39.8	22 11.5
Contaminated inanimate objects	249	52	20.9	3 1.2
Waste handling	224	60	26.8	3 1.3
After using gloves	114	70	61.4	3 2.6
Total	2189	745	34.0	111 5.1

Table III. Appropriateness of hand washing in different types of hand washing, before and after different procedures among HCW in Al-Azhar University Hospitals.

Variables	Hand Washing		
	Done		Appropriate
	N	(%)	N (%)
Types of Hand Washing (HW)			
Routine	480	64.3	17 3.5
Antiseptic	29	3.9	8 27.6
Alcohol hand rub	236	31.8	86 36.4
Total	745	100	111 14.9
Appropriate HW before and after interventions			
1- Invasive Procedure			
Before	107		22 20.6
After	151		12 7.9
Both	258		34 13.1
2- Non-Invasive Procedure			
Before	67		16 23.9
After	93		23 24.7
Both	160		39 24.4
3- Personal contact			4 18.2
Before	22		3 6.4
After	47		7 10.2
Both	69		
4- Body fluids contact			
Before	19		12 63.2
After	57		10 17.5
Both	76		22 28.9
5- Contaminated inanimate objects			
Before	14		2 14.3
After	38		1 2.6
Both	52		3 5.8
6- Wastes handling			
Before	4		1 25.0
After	56		2 3.6
Both	60		3 5.0
7- Using gloves			
Before	2		1 50
After	68		2 2.9
Both	70		3 4.3

Table IV. Comparison between the mean knowledge scores of HCWs, doctors, nurses and workers in different departments in Al-Azhar University Hospitals

Departments	**HCWs N=**	**Doctors N=**	**Nurses N=**	**Workers N=**
	Mean± SD			
Orthopedic	36.7±15.2	25.8±8.0	44.2±15.3	50.0±0
Neurosurgery	42.9±10.1	33.3±2.8	44.0±10.4	47.5±9.5
Plastic surgery	41.8±11.9	40.0±7.0	37.7±11.9	55.0±5.7
General surgery	42.2±9.5	47.5±8.6	41.4±9.8	40.0±10.0
NICU Pediatric	51.8±9.5	46.6±5.7	48.0±2.7	63.3±11.5
ICU Pediatric	41.2±8.5	41.2±8.5		
NICU Gynecology	41.7±10.4	42.5±9.5	43.3±11.7	37.5±9.5
ICU Gynecology	44.1±14.8	45.0±17.7	45.0±10.0	40.0±28.2
Hematology	44.7±13.4	42.0±2.7	42.7±16.6	52.0±10.9
Chest ICU	36.0±12.8	35.0±9.3	41.5±10.8	26.0±15.1
Collective Mean± SD		39.1±10.5	42.6±11.7	44.2±15.0

Table V. Assessment of attitude towards hand washing of nurses in Al-Azhar University hospitals

Attitude of nurses		N	(%)
1-	HW is protective to healthcare personnel	72	96.0
2-	HW can be improved by administrative orders and continuous observation	73	97.3
3-	HW lowers nosocomial infections more than other methods of IC	69	92.0
4-	HW can be improved by role models	53	70.7

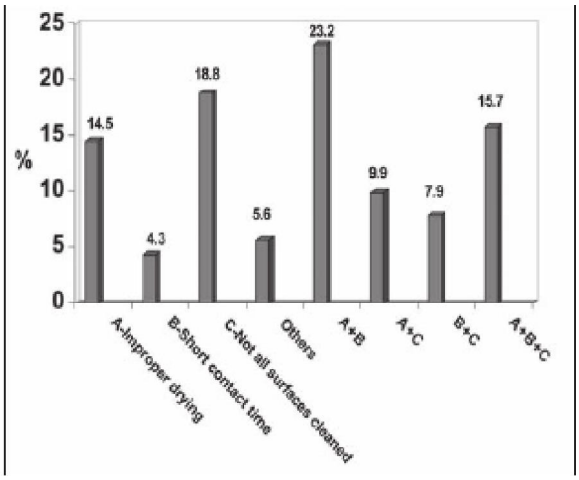

Fig. 1. Forms of inappropriate hand hygiene among observed opportunities

A. Improper drying is any method of dying other than dying in fresh clean towel.

B. Short contact time is below 30 seconds in routine handwashing and alcohol hand rub, or less than 2 minutes in hygiene wash.

C. Not all surfaces cleaned.

D. Others.

Tab. VI. Ward assessment in different departments in Al-Azhar University hospitals

Variables	N	(%)
Number of available sinks		
Number of sinks where soap is available	8	80
Availability of hand drying material	4	40
Availability of paper towel	1	10
Availability of cloth towel	0	0
Availability of alcohol hand rub	1	10
Availability of automatic sinks	4	40
Availability of gloves at point of care	1	10
Written hand hygiene guidelines	7	70
Availability of communication material for hand hygiene (HH)	3	30
Staff formally educated on HH	5	50
A product selection process has been implemented	7	70
Feedback performance provided to staff	1	10
	1	10

4. Discussion

Hand hygiene prevents cross infection in hospitals, however adherence to guidelines is commonly poor. (16) While the techniques involved in hand hygiene are simple, the complex interdependence of factors that determine hand hygiene behavior makes the study of hand hygiene complex [17]. In our study the overall hand hygiene compliance among healthcare workers is 34%, this agrees with Patarakul [9] who reported that hand hygiene among HCWs before patient contact was less than 50%. Also, this compliance rate comes in agreement with Pittet [18] who observed 20000 opportunities for hand hygiene before implementing a hand hygiene campaign during routine patient care in a teaching hospital in Geneva and the compliance to HW was 48%. This gives an idea for our need to such programs in order to raise our compliance to hand hygiene. Our result was much better than Kim [19] who reported overall compliance of hand washing to be 22.1%. As regard compliance to hand hygiene in chest Intensive Care Unit (ICU) was 33.4%, in NICU pediatrics 62.5% & NICU in gynecology department 39.4%. These results were much better than Rosenthal [20] who reported a rate of 23.1% before implementing a hand hygiene education, training and performance feedback program in one medical surgical ICU and one coronary ICU of one hospital in Argentina. Also, our results concur with Lipsett [21] who reported a range of 28%-74% in his study. Our results were comparable with Won [12] study in a level III NICU in a teaching hospital where he found compliance to hand hygiene to be 43%. Doctors showed the highest compliance to HW (37.5%) in comparison to nurses (36.4%) and housekeepers (22.6%) and this disagrees with Lipsett [21] who reported a higher compliance among nurses (50%) compared to doctors (15%) and nursing supporting personnel (37%). Minimizing the gap found between the knowledge and attitude in nurses as found in Pediatric NICU could improve the compliance rates to HW in nurses. Good hand washing technique, ensuring that all surfaces of the hands receive contact with the decontaminating agent, has been accepted for many years [13]. Inappropriate hand washing was observed in 23.2% of the opportunities for hand washing in our study. The causes for

inappropriate hand washing were having a short contact time less than 30 seconds and improper drying. Basurrah [17] found that the duration of hand washing was suboptimal for all HCWs in medical and surgical wards in a tertiary center in Riyadh. Improper drying of hands was found in 14.5% of our opportunities, while in Kuzu [22] study in a university hospital in Turkey 79.8% of HCWs didn't dry their hands. Appropriate health education programs should be implemented to raise the compliance in this issue.

A complex interplay of cognitive, socioeconomic and technical factors may determine hand washing practice among hospital-based health workers especially doctors, regardless of the location of the country or hospital they work in [22]. Administrative support [22] and improved availability of resources [23] provide a positive influence on the efforts made to improve adherence to HW which will eventually advance the infection control in hospitals. Inspection of the wards showed a marked deficiency of supplies and resources necessary for performing hand washing. Only 10% of the wards had available automatic sinks and hand drying material while soap was found in only 40% of the sinks. The study done by Ji [24] revealed that being short of water accounted for 22% of the reasons of noncompliance to hand washing. In our study 20% of the observed wards had no available sinks. Improving the availability of materials and supplies essential for hand hygiene is a basic step in improving the compliance with hand washing. Alcohol based hand rubbing reduces the mean bacterial counts on hands more effectively than hand washing with antimicrobial soaps [25, 26]. In our study HW in 64.3% of the observed opportunities were routine hand washing with soap, in comparison to 99.3% in Kuzu study [22] and alcohol-based hand rubs were recorded for 31.8% of the opportunities which is lower in comparison to Wendt [27] study in Germany whom reported alcohol-based hand rub of (52.2%). To enhance the compliance to alcohol-based hand rubs this necessitates the increase of supplies and continuous education. Whitby [28] found that introduction of alcohol-based hand rub without an associated behavioral modification program proved to be ineffective. In observing the invasive procedures, it was found that HW was done in 20.6% of the opportunities before the procedures while it was done in 7.9% of the opportunities after the procedures. Those rates are compared to 13.8% and 35.6% in Arenas study [29] who conducted his study among HCW in haemodialysis units in Spain. HCW should be keen not to transmit infection to their patients. Raising the awareness of HCW in this issue is very important. Kim [19] found a positive association between glove use and subsequent hand disinfection. In our study HW was reported in 61.4% of the observed opportunities after removal of the gloves.

Our results showed a higher positive attitude among nurses (96.0%) towards HW protection of healthcare personnel in comparison to 86.2% in a study in Italy among HCWS in ICUs [30]. Most of the nurses in our study (97.3%) believe that hand washing practices can be improved by administrative orders and this contradicts Harris [31] who found that healthcare workers are not in favor of interventions involving rewards and punishments, but are more attracted to interventions that make hand-washing easier. Using hand hygiene as a sole measure to reduce infection is unlikely to be successful when other factors in infection control, such as environmental hygiene, crowding, staff levels and education are inadequate [17]. The staff of 7 wards (out of 10) had previously received formal education on hand washing hygiene. All HCW should have continuous education to raise their awareness and compliance towards hand hygiene. Only 30% of the observed wards had written hand hygiene guidelines. These guidelines should be generalized to all wards of the hospital.

5. Recommendations

Implementation of multifaceted interventional behavioral hand hygiene program is important for improving the compliance to hand hygiene guidelines. Implementation of hand washing training programs for undergraduate doctors, house officers and nurses would improve HW practice. Those training programs should be implemented at intervals and assessed for the improvement of hand washing practices in the hospital. Continuous monitoring and performance feedback is beneficial beside the increase in supplies necessary for hand washing and institutional support.

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References

1. Anderson JL, Warren CA, Perez E, Louis RI, Phillips S, Wheeler J, et al. Gender and ethnic differences in hand hygiene practices among college students. Am J Infect Control 2008; 36:361-8.
2. Haas JP, Larson EL. Compliance with hand hygiene guidelines: where are we in 2010? Am J Nurs 2010; 108:40-4; quiz 45.
3. Ansari SK, Gupta P, Jais M, Nangia S, Gogo S, Satia S, et al. Assessment of knowledge, attitude and practices regarding hand hygiene amongst the healthcare workers in a tertiary healthcare

center. Int J Pharm Res Health Sci. 2015;3(3):720-726.
4. Practical guidelines for infection control in healthcare facilities. WHO 2004, Annex1:76-80.
5. Beghdadli B, Belhadj Z, Chabane W, Ghomari O, Kandouci AB, Fanello S. "Standard precautions" practices among nurses in a university hospital in Western Algeria. SantePublique 2008; 20:445-53.
6. Barrett R, Randle J. Hand hygiene practices: nursing students' perceptions. J ClinNurs 2008; 17:1851-7.
7. Abd Elaziz KM, Bakr IM. Assessment of knowledge attitude and practice of hand-washing among healthcare workers in Ain Shams University hospitals Cairo. J PrevMed Hyg. 2009;50(1):19-25.
8. Wisniewski MF, Kim S, Trick WE, Welbel SF, Weinstein RA; Chicago Antimicrobial Resistance Project. Effect of education on hand hygiene beliefs and practices: a 5-year program. Infect Control Hosp Epidemiol 2016; 28:88-91. Epub 2006 Dec 15.
9. Patarakul K, TanKhum A, Kanha S, Pandungpean D, Jaichaiyapum OO. Crosssectional survey of hand-hygiene compliance and attitudes of healthcare workers and isitors in the intensie care units at King Chulalongkorn Memorial Hospital. Med Assoc Thai 2005; Suppl. 4:S287-93.
10. World Health Organization / United Nations' Children's Fund. Water, sanitation and hygiene in healthcare facilities: status in low- and middle income countries and the way forward. Geneva, Switzerland: WHO/UNICEF; 2017. Available:htpps://www.who.int/water_sanitation_health/publications/wash-health- care-facilities/en/.
11. Jenner EA, Fletcher B, Watson P, Jones FA, Miller L, Scott GM. Discrepency between self-reported and observed hand hygiene behaviour in healthcare professionals. J Hosp Inf 2012; 63:418-22.
12. Besha B, Gyche H, Chare D, Amare A, Kassahun A, Kebede E, et al. Assessment of hand washing practices and its associated factors among First Cycle Primary School children in Arba Minch town, Ethiopia, 2015. Epidemiology (Sunnyvale). 2016;6:247.
13. Gould D, Drey N. Hand hygiene technique. Nurs Stand 2008; 22:42-6.
14. Creedon SA. Healthcare workers' hand decontamination practices: compliance with recommended guidelines. J Adv Nur 2005; 3:208-16.
15. Basuurah MM, Madani TA. Hand washing and gloving practice among healthcare workers in medical and surgical wards in a tertiary care center in Riyadh, Saudi Arabia. Scand J Infect Dis 2014; 38:620-4.
16. Chistiaens G, Barbier C, Mutsers J, Warnotte J, De Mol P, Bouffioux C. Hand hygiene: first measure to control nosocomial infection. Rev Med Liege 2006; 61:31-6.
17. Akyol A, Ulusoy H, Ozen I. Hand washing: a simple, economic and effective method for preventing nosocomial infections in intensive care units. J Hosp Infect 2006; 62:395-405.
18. Pittet D, Hugonnet S, Harbarth S, Mourouga P, Sauan, Touveneau S, Perneger TV. Effectiveness of a hospital wide programme to impove compliance with hand hygiene. Infection Control Program. Lancet 2000; 356:1307-12.
19. Kim PW, Roghmann MC, Perencevich EN, Harris AD. Rates of hand disinfection associated with glove use, patient isolation, and changes between exposure to various body sites. Am J Infect Conrol 2003; 31:97-103.
20. Rosenthal VD, Guzman S, Pezzotto SM, Crnich CJ. Effect of an infection control program using education and performance feedback on rates of intravascular device associated bloodstream infections in intensive care units in Argentina. Am J Infect Control 2003; 31:405-9.
21. Lipsett PA, Swoboda SM. Hand washing compliance depends on professional status. Surg Infect (Larchmt) 2001; 2:241-5.
22. Kuzu N, Ozer F, Aydemir S, Yalcin AN, Zencir M. Compliance with hand hygiene and glove use in a university-affiliated hospital. Infect Contol Hosp Epidemiol 2005; 26:312-5.
23. Samuel R, Almedom AM, Hagos G, Mutungi A. Promotion of hand washing as a measure of quality of care and prevention of hospital-acquired infections in Eritea: the Keren study. Afr Health Sci 2005; 5:4-13.
24. Ji G, Yin H, Chen Y. Prevalence of and risk factors for noncompliance with glove utilization and hand hygiene among obstetrics and gynecology workers in rural China. J Hosp Infect 2005; 59:235-41.
25. Karabay O, Sencan I, Sahin I, Alpteker H, Ozcan A, Oksuz S. Compliance and efficacy of hand rubbing during in- hospital practice. Med PrincPract 2005; 14:313-7.
26. Kac G, Podglajen I, Gueneret M, Vaupré S, Bissery A, Meyer G. Microbiological evaluation of two hand hygiene procedures achieved by healthcare workers during routine patient care: a randomized study. J Hosp Infect 2016; 62:129.

27. Wendt C, Knautz 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 2014; 25:203-6.
28. Whitby M, McLaws ML, Slater K, Tong E, Johnson B. Three successful interventions in healthcare workers that improve compliance with hand hygiene: is sustained replication possible? Am J Infect Control 2008; 36:349-55.
29. Arenas MD, Sanchez-Paya J, Bail G, Garcia-Valdecasas J, Goriz JL, Soriano A, et al. A multicentric survey of the practice of hand hygiene in haemodialysis units: factors affecting compliance. Nephrol Dial Transplant 2005; 20:1164-71. Epub 2005 Mar 15.
30. Nobile C, Diac E, Mantuori P, Villari P. Healthcare personnel and hand decontamination in intensive care units: knowledge, attitudes, and behaviour in Italy. J Hosp Infect 2012; 51:226-32.
31. Harris A, Nafziger R, Samore M, DiRosario K, Roghmann M, Carmeli Y. A survey on handwashing practices and opinions of healthcare workers. J Hosp Infect 2010; 45:318-21.

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