

The knowledge of hand hygiene among the healthcare workers of two teaching hospitals in MashhadHosein Zakeri¹, Fatemeh Ahmadi², Ehsan Rafeemanesh², Lahya Afshari Saleh²

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Type of article: Original**Abstract**

Introduction: Healthcare-associated infections (HAIs) affect millions of patients worldwide annually. Hand hygiene (HH) has been identified as the single most important factor preventing HAIs. The aim of this study was to determine the knowledge regarding hand hygiene practices amongst health care workers, and identifying the areas of gaps in their knowledge.

Methods: This cross-sectional analytic study was conducted in two university hospitals in Mashhad, Iran between May 2014 and September 2015. Data was collected using a translated version of the World Health Organization (WHO) Hand Hygiene Knowledge Questionnaire (revised 2009). The questionnaire contained questions on the participants' age, gender, profession, year of the course, formal training in HH and 27 multiple choice and "yes" or "no" questions to assess HH knowledge. Data were entered into IBM SPSS Statistics, Version 16. Descriptive statistical methods and also analytical statistical methods include ANOVA and Independent-samples t-test were used in data analyzing.

Results: In total, 161 respondents including 32 residents, 92 nurses and 37 nursing assistants enrolled in this study. All study groups had a moderate knowledge of HH. The score of 21% was $\leq 50\%$ (poor) and only 10.6% had a good knowledge score (i.e. the score $\geq 75\%$). There was no significant difference in the knowledge level of the participants who had received formal training in HH and those who had not ($p=0.68$). Also, the mean knowledge score was not associated with age ($p=0.12$), gender ($p=0.84$), department ($p=0.96$) or profession ($p=0.43$).

Conclusion: This study highlights the importance of applying the multimodal training program addressing providers' knowledge regarding hand hygiene, as well as strategies for cognitive, emotional and behavioral methods such as patient engagement in hand-hygiene interventions.

Keywords: Hand hygiene, Cross infection, Health personnel, Knowledge

1. Introduction

Globally, thousands of people die every day due to infections acquired through health care procedures. Transmission of germs during health care primarily occurs through contaminated hands (1). Health care-associated pathogens can be received from infected or draining wounds, frequently colonized areas of the intact patients' skin, patients' gowns, bed linen, bedside furniture and other objects in the immediate environment of the patient. Organisms such as *S. aureus*, *Proteus mirabilis*, *Klebsiella* spp., *Acinetobacter* spp., enterococci, or *Clostridium difficile* may play an important role in health care associated infections (HCAIs) (2). Practicing hand hygiene (HH), either washing the hands with water and soap or using alcohol-based hand rub, is a simple effective way to prevent infections (3). Any healthcare worker, who is involved in patient care directly or indirectly, should be aware of HH importance and also

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Received: November 05, 2016, Accepted: April 05, 2017, Published: August 2017

iThenticate screening: April 27, 2017, English editing: July 12, 2017, Quality control: July 28, 2017

This article has been reviewed / commented by three experts

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be able to carry out HH properly (2). Although HH procedures are relatively simple, studies have shown that the compliance among healthcare workers is not favorable (4-8). Several barriers to compliance with HH have been explained include lack of education, lack of persuasion, high work load, working status and not being aware of implementation guidelines (9). Despite the high prevalence of HAIs in Asia, unfortunately there are few studies assessing this issue in this part of the world (10-12); therefore, it appears that there is still a growing need regarding this issue. For instance, in a cross-sectional study by Maheshwari et al. in India, the average knowledge level regarding HH was observed in both residents and nurses. They found that positive attitude toward HH was higher in nurses than residents (13). In another cross-sectional study by Hosseini-Alhashemi et al. among 377 HCWs of Shiraz University of Medical Sciences, 64.9% of the participants had a moderate to good level of knowledge. Based on this study, training programs did not affect the participants' knowledge (14). Considering that the first and the most important part of controlling nosocomial infections acquired through poor HH, is raising the level of HCWs' knowledge and also because of scant attention to this issue in our region, identifying the knowledge regarding HH practices can be helpful. The aim of this study was to determine the knowledge regarding HH practices amongst healthcare workers and to identify the areas of gaps in their knowledge.

2. Material and Methods

2.1. Research design and setting

This cross-sectional analytic study was conducted in two teaching hospitals (Hashemi-Nejad and Emem Reza hospitals) in Mashhad, Iran between May 2014 and September 2015. The hospitals have specific infection control policies and also provide hand hygiene training seminars for staff.

2.2. Participants

Inclusion criteria included at least one-year employment in three major clinical wards (ICU, general and emergency department), ability to read and write, and willingness to participate in the study. Exclusion criteria included incomplete questionnaire or individual reluctance for participation.

2.3. Sampling

2.3.1. Sample size

Based on the similar articles (15), about 30% of Iranian healthcare workers had good knowledge about hand hygiene. Considering 30% prevalence and the 2% of standard deviation, the sample size was determined to be 164.

2.3.2. Sampling method

According to the estimated sample size, 165 healthcare personnel were selected by simple random sampling method. Emergency wards, general internal medicine wards and intensive care units (ICUs) were selected as the main major wards in these two hospitals. Based on the list of the staff, personnel were asked to participate in the study. If they did not propend to fill the questionnaire, the next one was invited according to the list. Sampling continued until achieving the minimum sample size.

2.4. Data Collection

For collecting data in this study, the World Health Organization (WHO) "Hand Hygiene Knowledge Questionnaire" - revised 2009 edition was used. The questionnaire contained questions on the participants' age, gender, profession, year of the course, formal training in HH and 27 multiple choice and "yes" or "no" questions to assess HH knowledge. For each correct answer one point was considered, and an incorrect answer was given zero. Overall scores were expressed in percentage; so that an overall score of >75% was considered as good, 50–74% as moderate and <50% as poor knowledge. The questionnaire was translated into Persian by an occupational medicine specialist. At the next step, 6 other specialists (including 2 occupational medicine specialists, an internist, an epidemiologist and 2 emergency medicine specialist) commented on the accuracy of the questionnaire. The expert panel evaluated each question and commented on each one as useful, necessary or not-necessary. Then CVR (content validity ratios) was calculated for each question. The content validity index of the questionnaire was equal to 0.8 and the tool's validity was approved.

2.5. Ethics

Medical students and nurses were explained the content and nature of the study. Verbal consent was obtained from the participants.

2.6. Statistical analyses

After collecting data, the information was entered into the computers. Statistical analysis was done using SPSS-16 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics were calculated. Preliminary assumption testing was carried out prior to multivariate analysis. ANOVA and Independent-samples-t-test were performed to investigate the difference between the groups. In all calculations, $p < 0.05$ was considered as the level of significance.

3. Results

3.1. Demographics

A total of 165 hospital staff were invited to participate in this study. Four questionnaires were excluded. The respondents included 32 residents, 92 nurses and 37 nursing assistants who were working in emergency wards, general internal medicine wards or intensive care units (ICUs). Demographic information is summarized in Table 1. About 88.5% of the participants expressed they usually used the alcohol-based hand rub.

3.2. Training Effect

According to the analysis, 53.4% (86 out of 161) of the participants had received the formal training in hand washing within the last three years. Of these, 48 were nurses, 22 were nursing assistants and 16 were residents ($p=0.68$).

3.3. Knowledge on Hand Hygiene

The participants' HH knowledge has been summarized in Table 2. As mentioned in Table 3, about 68% of the participants had a moderate level of knowledge regarding HH. The score of 21% was poor and only 10.6% had a good knowledge score. There was no significant difference in the knowledge level between the HCWs who had received formal training in HH and those who had not. Also, the mean knowledge score was not associated with age ($p=0.12$), gender ($p=0.84$), department ($p=0.96$) or job title ($p=0.43$) of the participants (Table 4). According to the analysis, the average of employment duration was significantly different in both moderate and poor level of knowledge ($p=0.01$). We observed that the more years of employment pass, the less it promoted a HCW's HH knowledge level. Conversely, there was no association between the knowledge level and an individual's age ($p=0.12$).

Table 1. Demographic data of the participants

Variable	Description; Mean±SD / n (%)	
Age (years)	32.2±6.6	
Gender	Male	72 (44.7%)
	Female	87 (54%)
Job title	Nurse	92 (57%)
	Nurse assistant	37 (23%)
	Resident	32 (20%)
Experience (years)	7.2±5.7	
Hospital Unit	ICU	31 (19%)
	Emergency	100 (63%)
	Internal	30 (18%)

Table 2. HH knowledge of the study participants. Data presented in "n (%)"

Knowledge statements (correct responses)	Nurses	Nursing Assistants	Residents
Which of the following is the main route of the transmission of potentially harmful germs between the patients? (Healthcare workers hands when not clean)	73 (79.3)	26 (70.3)	26 (81.2)
What is the most frequent source of germs responsible for healthcare associated infections? (Germs already present on or within the patient)	41 (44.6)	14 (37.8)	11 (34.4)
Hand hygiene actions that prevent the transmission of germs to the patient?	17 (18.5)	6 (16.2)	7 (21.9)
Which of the HH actions prevents the transmission of germs to the healthcare worker? (After touching a patient, after a risk of body fluid exposure, After exposure to the immediate surroundings of a patient)	28 (30.4)	8 (21.6)	14 (43.8)

Which of the following statements on alcohol-based hand rub and hand washing with soap and water are true?	Hand rubbing is more rapid for hand cleansing than hand washing (true)	83 (90.2)	31 (83.8)	26 (81.2)
	Hand rubbing causes skin dryness more than hand washing (false)	45 (48.9)	13 (35.1)	19 (59.4)
	Hand rubbing is more effective against germs than hand washing (false)	53 (57.6)	20 (54.1)	13 (40.6)
	Hand washing and hand rubbing are recommended to be performed in sequence (false)	26 (28.3)	18 (48.6)	11 (34.4)
What is the minimal time needed for alcohol-based hand rub to kill most germs on your hands? (20 s)		61 (66.3)	26 (70.3)	20 (62.5)
Which type of HH method is required in the following situations?	Before palpation of the abdomen (rubbing)	52 (56.5)	21 (56.8)	19 (59.4)
	Before giving an injection (rubbing)	43 (46.7)	19 (51.4)	17 (53.1)
	After emptying a bed pan (washing)	77 (83.7)	27 (73)	17 (53.1)
	After removing the examination gloves (rubbing/washing)	89 (96.7)*	37 (100)*	29 (90.6)*
	Making the patients bed (rubbing)	40 (43.5)*	9 (24.3) *	18 (56.2)*
	After visible exposure to blood (washing)	72 (78.3)*	33 (89.2)*	14 (43.8)*
Which of the following should be avoided, as associated with increased likelihood of colonization of hands with harmful germs?	Wearing jewelry (yes)	84 (91.3)	29 (78.4)	28 (87.5)
	Damaged skin (yes)	85 (92.4)	33 (89.2)	31 (96.9)
	Artificial fingernails (yes)	87 (94.6)*	30 (81.1)*	28 (87.5)*
	Regular use of the hand cream (no)	46 (50)	24 (64.9)	16 (50)

Table 3. The comparison of the participants' knowledge level

Hand Hygiene Knowledge	Total Participants; n (%)	Nurses; n (%)	Nursing Assistants; n (%)	Residents; n (%)
Good	17 (10.6)	10 (10.9)	3 (8.1)	4 (12.5)
Moderate	110 (68.3)	65 (70.7)	25 (67.6)	20 (62.5)
Poor	34 (21.1)	17 (18.5)	9 (24.3)	8 (25)

Table 4. The comparison of knowledge score according to the participants' age, gender, employment duration, department, Job title and training.

Variable		Knowledge score (Mean ± SD)	p-value
Job title	Residents	0.59 ± 0.11	0.43
	Nurses	0.61 ± 0.10	
	Nurse aids	0.58 ± 0.10	
Gender	Female	0.60 ± 0.10	0.12
	Male	0.60 ± 0.11	
HH training	Yes	0.59 ± 0.11	0.68
	No	0.61 ± 0.10	
Department	Emergency	0.6 ± 0.11	0.96
	General	0.59 ± 0.11	
	ICU	0.6 ± 0.08	

4. Discussion

In our study, all study groups had moderate knowledge of HH. Similar results were obtained in previous studies (13, 14, 16). The mean knowledge level in our study is higher compared to some similar studies in developed countries (17). But we did not note a lower HAI rate. It seems that evaluating the attitude and practice of our hospital staff could be useful. The results of our study showed that the mean knowledge level of HCWs who had received formal training in HH was lower compared to those who had not. This finding is in parallel with a study by Hosseini-alhashemi et al, in which training had no effect on knowledge level (14). Another study by Calabro et al is also in line with our study (18). In a study by Duggan et al, a negative relationship was reported between professional

education and the rate of hand washing compliance (19). Conversely, Suchitra et al reported that education had a positive impact on retention of knowledge, attitudes and practices in all HCW categories (20). It appears that we should re-evaluate the efficacy of our HH training course and decrease the intervals between these kinds of training programs. It seems that coupling educational programs that used cognitive, emotional and behavioral methods with motivational interventions is more effective (21, 22). Furthermore, we had better consider the adjuvant effect of the senior's staff behavior on the other HCW's points of view and their level of knowledge. The mean HH knowledge level of the nurses was higher than that of the residents, although this difference was not significant ($p=0.2$). This finding is in line with some other studies (17-20, 23). It seems that HH knowledge is considered more serious in nursing curriculums compared to medical students. Rezaee and her colleagues carried out an interventional study to assess the effect of an educational program on HH to medical students. The medical students who had passed physiopathology courses were selected to participate in a one-day teaching workshop about the importance of HH. The participants filled out the questionnaire before attending, on finishing, and 3 months after the workshop. There was a significant difference between the pre-test and the late post-test scores in knowledge and performance categories ($p=0.045$, $p=0.001$) (24). This study highlights the importance of improving the current training programs targeting HH knowledge among medical students. According to our study the mean knowledge level was similar among the different wards (emergency, general, ICU). This result is consistent with the findings of a study by Kim et al on healthcare workers in a teaching hospital in Korea (25). Also, it may suggest that we should design our education programs to target more high-risk wards where HAIs result in more serious consequences. Working on motivating factors is another important matter that we should focus on. Our results noted no difference in HH knowledge between men and women. The result is the same with some other studies that revealed that the overall score in knowledge did not differ between male and female nurses. Although some researchers noticed gender differences in the HH attitude and practice (26-28). A more detailed view showed that our participants have poor knowledge about the effect of hand rubbing and have an exaggerated belief about its side effect (skin dryness). This point should be intended by the HCWs' administrators. The present study is a cross-sectional study and inherently has its own limitations. Our sample distribution was not uniform in the field of hospital units. The main cause was the difference of the staff numbers and also cooperation of the staff. Also, we could not assess the participant's belief and attitude since we were not able to observe them in their wards. The strength of the study was assessing the knowledge level of different occupations in a hospital unit with different education levels and curriculums. Also, data collection was carried out in two main university hospitals in order to get a more representative sample.

5. Conclusions

Our study highlights the importance of applying the multimodal training program addressing providers' knowledge, attitudes, and beliefs regarding hand hygiene, as well as strategies for behavioral change such as patient engagement in hand-hygiene interventions. Emphasis on HH training programs in medical students is another important issue that should be considered more seriously by the health policy makers. Future studies should focus on new strategies which can influence the knowledge level of HCWs and also their compliance.

Acknowledgments:

We would thank the expert panel for translating the questionnaire. We wish to thank all the staff of Hasheminejad and Imam Reza hospital for their cooperation throughout the survey. We also appreciate Dr. Taha Hoseini for his valuable collaboration in the field of data collection.

Conflict of Interest:

There is no conflict of interest to be declared.

Authors' contributions:

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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