

Investigating the Factors Affecting on Hand Hygiene Compliance from the Viewpoints of Iranian Nurses Working in Intensive Care Units

Leila Sadeghi¹, Esmail Khodadadi^{1*}, Reza Sadeghi², Solmaz Mansour Bavani³,
Khatereh Almasi³, Marjaneh Fooladi⁴

¹Iranian Social Security Organization, Tehran, Iran

²Hamadan University of Medical Sciences, Iran

³Islamic Azad University, Urmia, Iran

⁴College of Health Sciences, School of Nursing, University of Texas, Campbell, El Paso, USA

ABSTRACT

Background: Hospital infections are known as one of the most important risk factors in health care units and the hand hygiene is the first step in controlling these infections. Considering the importance of hand hygiene in reducing hospital infections, especially in intensive care units (ICUs), this study aimed to determine the factors affecting on compliance of hand hygiene among the ICU nurses in educational hospitals of Tabriz in Iran.

Methods: This descriptive cross-sectional study was performed on 200 nurses working in ICU of educational hospitals in Tabriz. Sampling method determined the sample size and a 29-item researcher-made tool helped to collect data on demographic characteristics of nurses and organizational factors as self-report. The software SPSS 21 was used for descriptive analysis and statistics.

Results: The results of this study showed that majority of nurses' viewpoint as an individual was affirmative by indicating: "positive effects of hand hygiene on reducing the incidence of hospital infections", "skin irritation from repeated hand washes", and "wearing gloves instead of using hygiene solution". The nurses' viewpoint on the organizational factors, distinguished: "working in ICU with simultaneous care of several patients"; "the type of hand washing solution used in the hospital"; "the availability of hand washing solutions at all times"; "the correct sink location"; "continuing education and retrain for ICU nurses"; "caring for isolated patients", and "administrative support and their encouragement is effective for hand hygiene compliance".

Conclusions: The results of this study showed that the level of hand hygiene compliance among the healthcare personnel who working in ICU, are associated with several personal and organizational factors. These results can facilitate institutional application of more effective hand hygiene procedures in ICU by specialized nurses and reduce the hospital infection rates.

Key words: Hand hygiene, Personal and organizational factors, Intensive care units, Nurses

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Corresponding author: Esmail Khodadadi

e-mail ✉: esmailkhodadadi11@gmail.com

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INTRODUCTION

Currently, the World Health Organization (WHO) has reported hospital infections as a serious global issue leading to prolonged hospitalization, ineffective treatments, increased costs, and high mortality [1,2]. Hospital infections mostly occur in ICUs at 10-80%, rates and patients in these units are 5 to 7 times more likely to develop infections when compared to other units [3-5]. In fact, patients in the ICU units are more at risk for

injuries due to the lack of full consciousness, and weaker immunity [6,7].

However, about 50% of hospital infections are caused by the hands of personnel [8]. Evidence suggests that wearing gloves reduces the risk of pathogen transmission to the patients by the healthcare staff. The World Health Organization has also emphasized the use of gloves when it comes to contact with body fluids and secretions, or when necessary for meeting the precautionary requirements [1,9]. In addition, studies have shown that hand hygiene role is not well known and an average of hand washings rate is usually less than 50% among nurses, so the majority of them wear gloves in order to protecting themselves [6,10,11].

Other study findings show that healthcare personnel express various barriers for poor hand hygiene such as skin irritation, lack of hygiene products, negative view of patients when nurses wear gloves, forgetfulness, ignoring instructions, lack of time, high workload, personnel shortage and lack of scientific evidence on hand hygiene reducing hospital infections [12-14]. On the other hand, evidence suggests that hand hygiene among the healthcare personnel is influenced by religion and culture [15], attitude and awareness [16], personal and organizational factors [17]. The results of some studies have shown that personal factors such as age, gender, education, and the organizational factors include management style; work environment and education are important factors among the healthcare personnel [17-19].

A review of the studies shows that the acceptance of hand hygiene among nurses is low [20,21] and some studies have reported a direct correlation between hand hygiene rate among the nurses and medical staffs in ICU units and a statistical high rate of hospital infections [22-24]. Considering the importance of hand hygiene in reducing hospital infections, especially in ICUs, the review of previous studies show that factors affecting the hand hygiene compliance on reduction of infection among hospitalized patients have not been explored among the Iranian ICU nurses, therefore, the present study aimed to investigate the factors affecting the compliance of hand hygiene among ICU nurses in several hospitals in Tabriz, Iran.

METHOD

This cross-sectional descriptive study was conducted in 2015, in Tabriz, Iran by targeting ICU nurses who worked in teaching hospitals. Two hundred ICU nurses participated in this study by self-reporting a researcher-made 29-item questionnaire. There were two parts to the questionnaire for assessing nurses' demographic characteristics such as age, gender and marital status. On the second part of the questionnaire nurses were asked about personal (8 items) and organizational (21 items) factors. The scoring was based on Likert scale from "very effective=5" to "without effect=1". The content validity of the questionnaire was established by several nursing professors from Tabriz University of Medical Sciences. The reliability of the questionnaire was performed by a test-retest method and the correlation coefficient of items was calculated to be 78%.

Information about the overall goals of the study was provided for all participants and a written informed consent was signed by each participant. Voluntary participation and maximum confidentiality were emphasized. The informed consent and the study implementation were approved by the Ethics Committee of Tabriz University of Medical Sciences (No. 5/2079). The questionnaires were provided to ICU nurses and completed questionnaires were collected. Descriptive statistics (percentage and frequency, mean and standard

deviation) were used to analyze the data using SPSS 21 statistical software.

RESULTS

The demographic results of this study shown in Table 1, consists of 200 ICU nurses from Tabriz hospitals in Iran. Majority of nurses were female, married, held an undergraduate degree and their mean age was 33.9 ± 3.4 . Most of them were working in various shifts and reported attending hand hygiene workshops.

Table 1: Demographic characteristics of study participants

Demographic characteristics of Nurses N=200	Number/Percent
Gender	Female 135 (67.5)
	Male 65 (32.5)
Marital Status	Married 129 (64.5)
	Single 71 (35.5)
Academic Degree	Bachelor 173 (86.5)
	Master 27 (13.5)
Work Shift	Fix 47 (23.5)
	Circulate 153 (76.5)
Organizational Position	Head nurse 16 (8)
	Staff 35 (17.5)
	Practical 149 (32.5)
Hand hygiene educated experiences	Yes 141 (70.5)
	No 59 (29.5)
Age (Year)	33.9 ± 3.4
Work history (Year)	9.38 ± 4.42

Participating nurses agreed with personal factors such as "positive effects of hand hygiene on reducing the incidence of hospital infections, hand injuries due to the use of washing solutions, high workload and lack of time, heart belief about the effect of hand washing, wearing of gloves instead of hand hygiene" were as effective factors in hands hygiene and identified items "mental disturbances, the preference of satisfying the patient's needs for hand hygiene, the gender of nurses (male or female)" were as ineffective or low for hands hygiene compliance (Table 2).

The findings of this study showed that majority of nurses had considered organizational factors including ICU employment, simultaneous care of several patients, type of hand washing solution, availability of hand washing solutions, presence and location of sinks in ICU, offering continuing education programs, emergency care for patients, care for isolated patients, and organizational support to be influential in hand washing behavior. Other organizational factors included short-term care such as vital signs control, sufficient amount of paper napkins, impacts of higher skill senior nurses on junior nurses, head nurse continuous supervision on hand hygiene practice, getting feedback from infection control staffs, keeping organization's officials accountable in cases of "ineffective or low hand hygiene performance" (Table 3).

Table 2: The influence of personal factors on hand hygiene compliance

#	Personal Factors	Effectiveness Level (Number/Percent)					Mean
		Very effective	Effective	Somewhat effective	Little effective	Without effect	
1	The positive effect of hand hygiene compliance on reducing the incidence of nosocomial infections	142 (71)	57 (28.5)	1 (.5)	-	-	4.71
2	Skin damage due to the use of washing solutions	113 (56.5)	68 (34)	14 (7)	5 (2.5)	-	4.45
3	Prefer to meet patient's needs rather than hand hygiene	24 (12)	47 (23.5)	71 (35.5)	49 (24.5)	9 (4.5)	3.14
4	Workload and lack of time	33 (16.5)	114 (57)	34 (17)	13 (6.5)	6 (3)	3.78
5	Belief in the effect of hand washing	109 (54.5)	78 (39)	11 (5.5)	2 (1)	-	4.47
6	Preoccupation and negligence	12 (6)	27 (13.5)	61 (30.5)	91 (45.5)	9 (4.5)	2.71
7	Sex type of nurses	14 (7)	52 (26)	40 (20)	49 (24.5)	45 (22.5)	2.71
8	Sufficient wearing gloves instead of hand hygiene compliance	33 (16.5)	107 (53.5)	33 (16.5)	16 (8)	11 (5.5)	3.68

Table 3: Effective organizational factors on hand hygiene compliance

#	Organizational Factors	Effectiveness Level (Number/Percent)					Mean
		Very effective	Effective	Somewhat effective	Little effective	Without effect	
1	Being employed in ICU ward	84 (42)	76 (38)	28 (14)	11 (5.5)	1 (0.5)	4.16
2	Non-holiday work shifts	19 (9.5)	24 (12)	28 (14)	61 (30.5)	68 (34)	2.33
3	Holiday work shifts	15 (7.5)	25 (12.5)	30 (15)	63 (31.5)	67 (33.5)	2.29
4	Simultaneous care of a large number of patients	26 (13)	56 (28)	62 (31)	50 (25)	6 (3)	3.23
5	The need for prompt action in multiple care and procedures for several patients	19 (9.5)	8 (4)	59 (29.5)	101 (50.5)	13 (6.5)	3.73
6	Type of hand washing solution used in the hospital	95 (47.5)	69 (34.5)	21 (10.5)	11 (5.5)	4 (2)	4.2
7	Existence of sufficient amount of hand washing solutions	78 (39)	80 (40)	30 (15)	10 (5)	2 (1)	4.11
8	Existence of sufficient number of sink in ward	39 (19.5)	68 (34)	68 (34)	20 (10)	5 (2.5)	3.58
9	Putting sinks at the appropriate place in ward	38 (19)	46 (23)	90 (45)	22 (11)	4 (2)	3.46
10	Conducting continuing education programs (retraining) in the ward or hospital	27 (13.5)	60 (30)	82 (41)	29 (14.5)	2 (1)	3.41
11	Enough paper hold	43 (21.5)	33 (16.5)	80 (40)	35 (17.5)	9 (4.5)	3.33
12	Emergency care for critically ill patients	52 (26)	125 (62.5)	18 (9)	3 (1.5)	2 (1)	4.11
13	Caring for isolated patients	139 (69.5)	44 (22)	13 (6.5)	4 (2)	-	4.59
14	Carrying out short-term care such as blood pressure control	18 (9)	43 (21.5)	44 (22)	80 (40)	15 (7.5)	2.85
15	The Impact of Senior Nurses 'Performance on Novice Nurses' Performance	23 (11.5)	29 (14.5)	23 (11.5)	23 (11.5)	102 (51)	2.24
16	Continuous head nurse supervision for nursing staff	32 (16)	41 (20.5)	67 (33.5)	55 (27.5)	5 (2.5)	3.2
17	Give feedback about hand hygiene by the head nurse	28 (14)	42 (21)	68 (34)	58 (29)	4 (2)	3.16
18	Continuous supervision by infection control manager on Nurses' hand hygiene	24 (12)	32 (16)	79 (39.5)	57 (28.5)	8 (4)	3.04
19	Give feedback about hand hygiene by infection control manager	26 (13)	29 (14.5)	79 (39.5)	58 (29)	8 (4)	3.04
20	Application of punitive methods by the organization's authorities	7 (3.5)	22 (11)	65 (32.5)	69 (34.5)	37 (18.5)	2.47
21	Applying encouragement methods by the organization's authorities	45 (22.5)	92 (46)	25 (12.5)	19 (9.5)	19 (9.5)	3.63

DISCUSSION

The results of this study showed that several factors from nurses' point of view affected the hand hygiene practices. Based on their importance these factors were attitude and beliefs about the impact of hand hygiene, the shortage of personnel and excessive workload, forgetfulness, and the belief in the cleansing solution hazards for the skin. In other studies most nurses did not believe in hand hygiene and the rate among medical personnel was low pointing to a global concern [12,19,21,25-27]. Farbakhsh *et al.* [28] found a low rate of hand hygiene practice among the Iranian nurses. Similarly, Ghorbani *et al.* [29] showed that compliance of hand hygiene rate and wearing gloves among the nurses in ICU units was low and most nurses used gloves without hand hygiene. On the other hand, from the nurses' point

of view, there were barriers to hand hygiene, which made it less likely for them to use hygiene while working with the patient. The results of Pan *et al.* [30] research, revealed that hand washing could have negative effects on the skin, since frequent washing with soap resulted in dry skin, sensitivities and dermatitis. Therefore, nurses in certain places refrained from hand hygiene. In a study by De Wandel *et al.* [12], researchers found that disinfectant solutions with drying and irritation to the skin were obstacles to the hand hygiene practice. They reported that general attitude of nurses in ICUs were positive toward hand hygiene and increased work load did not directly affect on health of their hands.

However, the results of other studies have indicated that a busy and high stressed environment negatively affect on hand hygiene practices [31-33]. In a study by

McArdle et al. [32], the shortage of personnel and heavy workload made hand hygiene less important, because more time and energy was needed to take care of several patients. High level of work pressure and nursing shortage generally affected the quality of nursing care [34-36]. Evidence suggests that knowledge and attitude of healthcare staff and how hand hygiene could reduce infection were directly influenced by the level of hands hygiene promotion [37-39]. In fact, the positive attitude of nurses showed that they were influenced by their knowledge about the scientific evidence of hand hygiene efficacy [16,40]. Ravaghi et al. [41] indicated that increased knowledge of personnel can improve their attitude toward hand hygiene. They also found that junior nurses were more accepting of hand hygiene compared to senior nurses. Nicol et al. [42] reported that staffs' sense of responsibility, work ethics and level of experience played an important role on hand hygiene compliance. While, Whitby et al. [43] asserted that nurses had unpleasant feelings and discomfort regarding hand hygiene, where they had to be encouraged to protect themselves and ultimately change their attitude toward hand hygiene. In contrast, Hazavehei et al. [44] showed that personnel's level of knowledge and attitude towards hands hygiene was high, but these factors alone seemed insufficient to reach their goals.

In this study we found that nurses in ICUs needed to enhance their hand hygiene practices. These results were inconsistent with findings of some researches in past [14,45,46]. It is likely that different participants' attitudes and practices generated different results and in this study nurses' gender had no effect on the hand hygiene, while other studies indicated that female nurses practiced more hand hygiene than male nurses [19,47]. Similar to this study, Nazari et al. [6] found that hand hygiene practices were the same between male and female nurses.

Our findings, similar to other studies showed that availability of hand sanitizer's increased the rate of hand hygiene among nurses and healthcare personnel, but heavy workload and overcrowding will reduce the rate [20,31,48]. Our findings of effective health education and staff encouragement on promotion of hand hygiene among the nurses were consistent with other study findings [49-52]. Ashraf et al. [31] showed that heavy workload and overcrowding limited hand hygiene, especially when there were insufficient supplies such as paper towels gloves, hand washing solutions, skin irritation due to persistent washing, and absence of washstand sink nearby. Other studies have reported lack of time and sinks [53], high workload, patient's condition, and lack of hand washing solutions [20] and lack of time as a reason for less hand hygiene practices [48]. In a review by Smiddy et al. [33], researchers showed that high workload and shortage of personnel were barriers to hand hygiene. Other studies indicated that shortage of nursing staff in ICUs had a negative effect on hand hygiene and an increase in mortality rates [32].

In other words, a sufficient number of nursing personnel could effectively reduce the hospital infection rates [54] in support of the results of in this study.

CONCLUSION

Based on the results of this and other studies, there are numerous personal and organizational factors affecting the compliance of hand hygiene among the ICU nurses. Working in ICU, personal beliefs, knowledge and attitude towards the effects of hand hygiene on reducing infections, availability hand hygiene supplies, continuous health education training, and a supportive organizational management are all part of an effective hand hygiene practice. Therefore, these results could help hospital administrators to effectively implement policies to increase the rate of hand hygiene practices among the healthcare providers and hospital staffs to reduce preventable infections.

LIMITATIONS

The ICU nurses from Tabriz hospitals in Iran took part in this study and researchers acknowledge the study limitation regarding generalizability of the results. Therefore, it is recommended that similar research to be conducted among a larger number of the ICU nurses in different cities to obtain an overall understanding of factors contributing to a low rate of hand hygiene.

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CONFLICT OF INTEREST

All authors declare that there is no conflict of interest.

REFERENCES

1. Huis A, van Achterberg T, de Bruin M, et al. A systematic review of hand hygiene improvement strategies: A behavioural approach. *Implement Sci* 2012; 7:92.
2. Squires JE, Suh KN, Linklater S, et al. Improving physician hand hygiene compliance using behavioural theories: A study protocol. *Implement Sci* 2013; 8:16.
3. Amini M, Sanjary L, Vasei M, et al. Frequency evaluation of the nosocomial infections and related factors in Mostafa Khomeini Hospital" ICU" based on" NNI" system. *JAUMS* 2009; 7:9-14.
4. Mohammadimehr M, Feizabadi MM, Bahadori

- O, et al. Study of prevalence of gram-negative bacteria caused nosocomial infections in ICU in Besat hospital in Tehran and detection of their antibiotic resistance pattern-year 2007. *Iran J Med Microbiol* 2009; 3:47-54.
5. Vincent JL, Rello J, Marshall J, et al. International study of the prevalence and outcomes of infection in intensive care units. *JAMA* 2009; 302:2323-9.
 6. Nazari R, Haji Ahmadi MA, et al. Study of hand hygiene behavior among nurses in Critical Care Units. *Iran J Crit Care Nurs* 2011; 4:93-6.
 7. Rock C, Harris AD, Reich NG, et al. Is hand hygiene before putting on nonsterile gloves in the intensive care unit a waste of health care worker time?-A randomized controlled trial. *Am J Infect Control* 2013; 41:994-6.
 8. Abdella NM, Tefera MA, Eredie AE, et al. Hand hygiene compliance and associated factors among health care providers in Gondar University Hospital, Gondar, North West Ethiopia. *BMC Public Health* 2014; 14:96.
 9. Loveday HP, Lynam S, Singleton J, et al. Clinical glove use: Healthcare workers' actions and perceptions. *J Hosp Infect* 2014; 86:110-6.
 10. Goldmann D, Larson E. Hand-washing and nosocomial infections. *N Engl J Med* 1992; 327:120-2.
 11. Jarvis W. Handwashing-The Semmelweis lesson forgotten? *Lancet* 1994; 344:1311-2.
 12. De Wandel D, Maes L, Labeau S, et al. Behavioral determinants of hand hygiene compliance in intensive care units. *Am J Crit Care* 2010; 19:230-9.
 13. Larson EL, Kretzer EK. Compliance with handwashing and barrier precautions. *J Hosp Infect* 1995; 30:88-106.
 14. Pittet D. Improving adherence to hand hygiene practice: a multidisciplinary approach. *Emerg Infect Dis* 2001; 7:234.
 15. Allegranzi B, Memish ZA, Donaldson L, et al. Religion and culture: Potential undercurrents influencing hand hygiene promotion in health care. *Am J Infect control* 2009; 37:28-34.
 16. Elaziz KA, Bakr IM. Assessment of knowledge, attitude and practice of hand washing among health care workers in Ain Shams University hospitals in Cairo. *J Prev Med Public Health* 2009; 50.
 17. Larson EL, Early E, Cloonan P, ET AL. AN ORGANIZATIONAL CLIMATE INTERVENTION ASSOCIATED WITH INCREASED HANDWASHING AND DECREASED NOSOCOMIAL INFECTIONS. *Behav Med* 2000; 26:14-22.
 18. Lam BC, Lee J, Lau Y. Hand hygiene practices in a neonatal intensive care unit: A multimodal intervention and impact on nosocomial infection. *Pediatrics* 2004; 114:e565-71.
 19. van de Mortel T, Bourke R, McLoughlin J, et al. Gender influences handwashing rates in the critical care unit. *Am J Infection control* 2001; 29:395-9.
 20. Akyol AD. Hand hygiene among nurses in Turkey: Opinions and practices. *J Clin Nurs* 2007; 16:431-7.
 21. Najafi Ghezeljeh T, Abbas Nejhad Z, Rafii F. A literature review of hand hygiene in Iran. *Iran J Nurs* 2013; 25:1-3.
 22. Bagheri P. The review systematic and meta analysis of prevalence and causes of nosocomial infection in Iran. *IJMM* 2015; 8:1-2.
 23. Choi JY, Kwak YG, Yoo H, et al. Trends in the incidence rate of device-associated infections in intensive care units after the establishment of the Korean nosocomial infections surveillance system. *J Hosp Infect* 2015; 91:28-34.
 24. Dasgupta S, Das S, Chawan NS, et al. Nosocomial infections in the intensive care unit: Incidence, risk factors, outcome and associated pathogens in a public tertiary teaching hospital of Eastern India. *Indian J Crit Care Med* 2015; 19:14.
 25. Albughbish M, Neisi A, Borvayeh H. Hand hygiene compliance among ICU health workers in Golestan hospital in 2013. *Jundishapur J Microbiol* 2016; 15:355-62.
 26. Shimokura G, Weber DJ, Miller WC, et al. Factors associated with personal protection equipment use and hand hygiene among hemodialysis staff. *Am J Infect control* 2006; 34:100-7.
 27. Erasmus V, Kuperus M, Richardus JH, et al. Improving hand hygiene behaviour of nurses using action planning: A pilot study in the intensive care unit and surgical ward. *J Hosp Infect* 2010; 76:161-4.
 28. Farbakhsh F, Shafieezadeh T, Zahraie M, et al. Hand hygiene compliance by the health care staff in medical centers affiliated to Shahid Beheshti medical university. *Trop Med Infect Dis* 2013; 18:9-13.
 29. Ghorbani A, Sadeghi L, Shahrokhi A, et al. Hand hygiene compliance before and after wearing gloves among intensive care unit nurses in Iran. *Am J Infect Control* 2016; 44:e279-e81.
 30. Pan SC, Tien KL, Hung IC, et al. Compliance of health care workers with hand hygiene practices: Independent advantages of overt and covert observers. *PLoS One* 2013; 8:e46.
 31. Ashraf MS, Hussain SW, Agarwal N, et al. Hand hygiene in long-term care facilities a multicenter study of knowledge, attitudes, practices, and barriers. *Infect Control Hosp Epidemiol* 2010; 31:758-62.
 32. McArdle F, Lee R, Gibb A, et al. How much time is needed for hand hygiene in intensive care? A prospective trained observer study of rates of contact between healthcare workers and intensive care patients. *J Hosp Infect* 2006; 62:304-10.
 33. Smiddy MP, O'Connell R, Creedon SA. Systematic qualitative literature review of health care workers' compliance with hand hygiene guidelines. *Am J Infect control* 2015; 43:269-74.
 34. Aiken LH, Sloane DM, Bruyneel L, et al. Nurses' reports of working conditions and hospital quality

- of care in 12 countries in Europe. *Int J Nurs Stud* 2013; 50:143-53.
35. Nantsupawat A, Srisuphan W, Kunaviktikul W, et al. Impact of nurse work environment and staffing on hospital nurse and quality of care in Thailand. *J Nurs Scholarsh* 2011; 43:426-32.
 36. Van Bogaert P, Kowalski C, Weeks SM, et al. The relationship between nurse practice environment, nurse work characteristics, burnout and job outcome and quality of nursing care: A cross-sectional survey. *Int J Nurs Stud* 2013; 50:1667-77.
 37. Nair SS, Hanumantappa R, Hiremath SG, et al. Knowledge, attitude, and practice of hand hygiene among medical and nursing students at a tertiary health care centre in Raichur, India. *ISRN Prev Med* 2014.
 38. Pittet D, Simon A, Hugonnet S, et al. Hand hygiene among physicians: performance, beliefs, and perceptions. *Ann Intern Med* 2004; 141:1-8.
 39. Sharif A, Arbabisarjou A, Balouchi A, et al. Knowledge, attitude, and performance of nurses toward hand hygiene in hospitals. *Glob J Health Sci* 2016; 8:57.
 40. Nobile C, Montuori P, Diaco E, et al. Healthcare personnel and hand decontamination in intensive care units: Knowledge, attitudes, and behaviour in Italy. *J Hosp Infect* 2002; 51:226-32.
 41. Ravaghi H, Abdi Z, Heyrani A. Hand hygiene practice among healthcare workers in intensive care units: A qualitative study. *J Hosp Infect* 2015; 13:41-52.
 42. Nicol PW, Watkins RE, Donovan RJ, et al. The power of vivid experience in hand hygiene compliance. *J Hosp Infect* 2009; 72:36-42.
 43. Whitby M, Pessoa-Silva C, McLaws ML, et al. Behavioural considerations for hand hygiene practices: The basic building blocks. *J Hosp Infect* 2007; 65:1-8.
 44. Hazavehei MM, Noryan F, Rezapour, et al. Assessing the effective factors on hand hygiene using planned behavior model among nursing and midwifery staff in Atea hospital of Hamadan in 2015. *J Hosp Infect* 2016; 15:51-8.
 45. Pittet D, Boyce JM. Hand hygiene and patient care: Pursuing the Semmelweis legacy. *Lancet Infect Dis* 2001; 1:9-20.
 46. Samadipour E, Daneshmandi M, Salari M. Hand hygiene practice in Sabzevar hospitals Iran. *JSUMS* 2008; 15:59-64.
 47. Tai J, Mok E, Ching P, et al. Nurses and physicians' perceptions of the importance and impact of healthcare-associated infections and hand hygiene: A multi-center exploratory study in Hong Kong. *Infection* 2009; 37:320-33.
 48. Kampf G, Löffler H, Gastmeier P. Hand hygiene for the prevention of nosocomial infections. *Dtsch Arztebl Int* 2009; 106:649.
 49. Helder OK, Brug J, Looman CW, et al. The impact of an education program on hand hygiene compliance and nosocomial infection incidence in an urban neonatal intensive care unit: An intervention study with before and after comparison. *Int J Nurs Stud* 2010; 47:1245-52.
 50. Picheansathian W, Pearson A, Suchaxaya P. The effectiveness of a promotion programme on hand hygiene compliance and nosocomial infections in a neonatal intensive care unit. *Int J Nurs Pract* 2008; 14:315-21.
 51. Suchitra J, Devi NL. Impact of education on knowledge, attitudes and practices among various categories of health care workers on nosocomial infections. *Glob J Health Sci* 2007; 25:181.
 52. Wisniewski MF, Kim S, Trick WE, et al. Effect of education on hand hygiene beliefs and practices a 5-year program. *Infect Control Hosp Epidemiol* 2007; 28:88-91.
 53. 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.
 54. Hugonnet S, Harbarth S, Sax H, et al. Nursing resources: A major determinant of nosocomial infection? *Curr Opin Infect Dis* 2004; 17:329-33.