

# Alcohol-containing Hand Rubs: A Survey on Beliefs and Self-reported Practices of Muslim Nurses

**Mehrdad Askarian**

<https://orcid.org/0000-0003-4163-7414>  
Shiraz University of Medical Sciences  
askariam@sums.ac.ir

**Ramin Shiraly**

<https://orcid.org/0000-0002-7429-0106>  
Shiraz University of Medical Sciences  
shiralyr@sums.ac.ir

**Yves Longtin**

<https://orcid.org/0000-0002-4532-379X>  
McGill University  
yves.longtin@mcgill.ca

**Seyed Sadeq Seyed Nematian**

<https://orcid.org/0000-0002-1084-8086>  
Shiraz University of Medical Sciences  
s\_nematian@sums.ac.ir

## Abstract

Although alcohol-containing liquid cleansers have been increasingly used by healthcare workers, their application is still suboptimal. This study was carried out to assess the beliefs and practices of Muslim nurses with respect to alcohol-based hand rub solutions (ABHRs). A total of 374 hospital nurses from a large tertiary referral medical centre in Southern Iran were recruited. Beliefs and self-reported practices toward ABHRs were measured using a structured questionnaire. The validity and reliability of the questionnaire were shown to be satisfactory (Cronbach's alpha value: 0.77 for beliefs and 0.86 for practices.) Overall, 16% of Muslim nurses believed that the use of ABHRs is religiously prohibited; approximately the same proportion of respondents believed that there may be concerns related to the fact that the alcoholic content of these hand rubs might be absorbed through the skin or respiratory tract. Overall, more than half of participants reported use of ABHRs before (60%) and after (75%) touching patients. Religious believers were less likely to report performing hand hygiene with ABHRs before patient contact. However, the total mean practice scores were not statistically different between religious believers and non-believers ( $t(372) = -0.88$ ,  $P = 0.413$ ). Mean practice scores of nurses who had participated in hand hygiene training courses during the year before the study were higher than those who had not ( $t(372) = 3.41$ ,  $P < 0.001$ ). The results of the present study showed that the practice of hand hygiene with alcohol-containing



Africa Journal of Nursing and Midwifery  
<https://upjournals.co.za/index.php/AJNM>  
Volume 23 | Number 2 | 2021 | #8927 | 15 pages

<https://doi.org/10.25159/2520-5293/8927>  
ISSN 2520-5293 (Online)  
© Unisa Press 2021



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hand rubs is common among Iranian Muslim nurses and is not influenced by their religious beliefs toward alcohol.

**Keywords:** hand hygiene; alcohol-based hand rubs; Muslim; practice; religion

## Introduction

Healthcare-associated infections are a serious problem in hospitals worldwide and affect 5% of hospitalised patients, which are mostly spread *via* healthcare workers' hands. Hence, hand hygiene is one of the most effective ways to reduce nosocomial infections (Chavali, Menon, and Shukla 2014). Hand washing with soap and water is the most common hand cleansing method in hospitals, but in recent decades, the use of alcohol-based hand rub solutions (ABHRs) has become more popular amongst healthcare workers (Bessonneau, Clément, and Thomas 2010). Microbiologic studies have shown that ABHRs are more effective than the combination of soap and water for removing microorganisms from the hands (Bessonneau et al. 2010; Picheansathian 2004). The antimicrobial properties of alcohol are well established and include bactericidal, virucidal, mycobactericidal and fungicidal activities. In contrast to antiseptic soaps, ABHRs do not require a basin or water supply, and are less time consuming than hand washing (Bessonneau et al. 2010; Picheansathian 2004). According to studies, hand disinfection with ABHRs is considered a simple way to reduce nosocomial infections as well as being the most cost-effective (Girou et al. 2002; Von Lengerke 2017). Hand rubbing with alcohol-based solutions increases compliance with hand hygiene and is associated with a greater reduction in bacterial contamination of hands than conventional hand washing with soaps/detergents (Ahmed et al. 2006).

Cultural and religious beliefs can potentially affect hand hygiene practices (Allegranzi et al. 2009). Deep-seated beliefs in some communities might influence healthcare workers' attitudes towards hand cleansing during healthcare delivery. For instance, Judaism, Islam and Sikhism have specific rules for hand washing before religious practices, and therefore a believer is careful of any ramifications according to religious principles in everyday life (Pittet 2009).

Islamic rules strictly prohibit the consumption of any alcoholic beverages; it is believed that drinking alcohol can cause disconnection from a state of spiritual awareness or consciousness. However, there are different opinions regarding contact with materials likely to contain alcohol such as perfumes or antiseptics. According to Islamic rules, any material, such as alcohol, which is religiously prohibited is called "Najis" and should be avoided; however, the use of alcohol as a medical agent is authorised (Longtin et al. 2011; Michalak, Trocki, and Katz 2009). While many Muslims believe that the prohibition of alcohol does not apply to the use of perfumes or antiseptics with an alcoholic content, some believe that any exposure to alcohol is strictly forbidden (Ng, Shaban, and Van de Mortel 2019).

Although ABHRs are highly efficacious in preventing healthcare-associated infections, healthcare professionals' compliance is sub-optimal (Kingston, O'Connell, and Dunne 2018). Initiatives to improve hand hygiene compliance clearly must address different factors, including sociocultural and religious issues (Borg et al. 2009). This study aimed to assess whether religious beliefs play a role in Muslim nurses' choice to use ABHRs as a hand disinfectant.

## Methods

### Study Setting

The study setting was a university hospital in Shiraz city in Fars Province. Shiraz is the largest metropolis in Southern Iran and has a population of approximately 2 million in an area of 240 km<sup>2</sup>. Namazi hospital is a 1 200-bed tertiary care centre affiliated with Shiraz University of Medical Sciences. It is the largest general public hospital in Southern Iran serving the town, surrounding townships and provinces. It provides diverse services for patients from different parts of the country. The hospital includes outpatient and inpatient services and 24-hour emergency wards, as well as 10 ICUs and many general, specialty and subspecialty wards.

### Study Design

This was a cross-sectional study, conducted from December 2017 to January 2018, aimed to assess Iranian Muslim nurses' beliefs and self-reported practices with regard to alcohol-based hand rubs. A structured face-to-face interview approach was chosen to enable participants to express their beliefs and to report their practices. As a result, data were obtained by a self-reported questionnaire.

### Participants

We selected our target sample from Muslim nurses with a minimal work experience of one year, who directly give care to hospitalised patients. There were more than 1 000 currently practising nurses in Namazi hospital. The selected nurses were invited to participate in the study, were informed about the study aims and were ensured of data confidentiality.

### Sample Size

The required sample size was calculated using a single population proportion formula, with the assumption that 50% of nurses practise hand hygiene with alcoholic hand rubs regardless of their religious views, and a 95% CI and 4% margin of error. We estimated that there were 800 eligible nurses for the study. Considering a non-response rate of 10%, the final minimum sample size was 370 nurses. Inclusion criteria included nurses who were Muslim, practising as a nurse for at least one year, and regularly provided direct care to patients for more than 30 hours a week on an in-patient ward. A total of 374 eligible participants were randomly selected (using a table of random digits) from

the list of working nurses in the hospital (with a nursing diploma degree or higher) obtained from the hospital nursing office.

### **Instruments and Data Collection**

The data were collected via a purpose-designed, structured questionnaire to assess nurses' religious beliefs and practices with regard to ABHRs. The questionnaires were delivered in person by research staff, and the nurses completed the questionnaires anonymously and returned them on the same day. The questionnaire included the following sections:

1. Demographic information included age, gender, educational levels and work experience and a question about their participation in hand hygiene training courses during the past year.
2. Seven questions about the nurses' religious beliefs and perceptions regarding ABHRs. The nurses could respond as "Agree" or "Don't agree."
3. Five questions about the nurses' practice of ABHRs.

Practice questions were rated on the Likert scale (always, most of the time, occasionally, rarely and never). The total scores ranged between 5 and 25.

Practice scores were compared between religious believers and non-believers.

The questionnaire was designed by an expert in hospital infection control and the content and face validity of the questionnaire were confirmed by two other specialists in the field of epidemiology and infectious diseases. The reliability of the questionnaire was calculated after a pilot study and the Cronbach's alpha value was found to be 0.77 for beliefs and perceptions and 0.86 for practices.

### **Statistical Analysis**

The data were analysed using SPSS statistical software, version 19 (IBM, United States). Demographic factors were described as frequency and percentage for categorical variables and mean and standard deviation for numerical variables. The mean and standard deviation of the practice scores were calculated and the differences between the two groups were tested using an independent t-test. With regard to the use of ABHRs in different patient care situations, we considered "always" or "most of the time" responses as high frequency use and "occasionally, rarely and never" responses as low frequency use of ABHRs. A Chi square test was used to compare that behaviour between believers and non-believers. The significance level was considered 0.05 for all statistical analyses.

### **Ethical Approval**

This project received ethical approval from the Research Ethics Committee of Shiraz University of Medical Sciences. Written, informed consent was obtained from all participants.

## Results

A total of 374 nurses participated in the study, with a response rate of 100%. The mean age of participants was 29.9 ( $\pm 6.1$ ) years (range 21–59) with a mean work experience of 5.5 ( $\pm 4.8$ ) years (range 1–27). Most participants (82.7%) were female, 93.3% had a bachelor or master's degree, 67.6% were working in medical wards, and 52.9% had participated in hand hygiene training courses during the past year (table 1).

**Table 1:** Main characteristics of the study population

Variable	Staff nurses (N=374)	
	Mean	$\pm$ SD
Age (yrs)	30	6.1
Work experience (yrs)	5.5	4.8
	Number	%
<b>Gender</b>		
Female	309	82.7%
Male	65	17.3%
<b>Educational level</b>		
A nursing diploma	25	6.7%
A bachelor or master's degree	349	93.3%
<b>Hospital wards</b>		
Surgical	121	32.4%
Medical	253	67.6%
<b>Attending in hand hygiene training class</b>		
Yes	198	52.9%
No	176	47.1%

Sixteen per cent of nurses believed that the use of ABHRs is religiously prohibited; approximately the same proportion of respondents believed that there may be religious concerns related to the fact that the alcoholic content of these hand rubs might be absorbed through the skin (14.7%) or through the respiratory tract (15.8%).

At the same time, more than 80% of nurses thought that the use of ABHRs is an easy and fast way for hand disinfection. More than half of the participants agreed that ABHRs

are more effective than water and soap for hand hygiene. Nonetheless, about one third of nurses were worried about skin irritation side effects (table 2).

Regarding practice, more than 60% of nurses reported using ABHRs before touching patients, and 75% used them after touching patients always or most of the time. High frequency use of ABHRs was common among nurses who were religious believers, so that more than half of them reported application of ABHRs during patient care always or most of the time. The most common situation in which ABHRs were used was after doing a clean/aseptic procedure (84.2%). Believers were less likely to report performing hand hygiene before patient contact, compared with non-believers (OR: 1.83, CI 95%:1.05–3.20, P =0.040) (table 3).

Table 4 shows the mean and standard deviation of practice scores of participants according to the study variables. The mean of practice scores of all of the participants was  $20.15 \pm 3.53$ .

The mean practice scores were not statistically different between subgroups including religious believers and non-believers (t (df): -0.88 (372), P=0.378). Mean practice scores of nurses who had participated in hand hygiene training courses were higher than those who had not (t (df): -3.41 (372), P< 0.001).

**Table 2:** Muslim nurses’ perceptions and religious beliefs regarding application of alcohol-based hand rub solutions (ABHRs) for hand disinfection during patient care

Beliefs and perceptions regarding ABHRs	Agree		Don't agree	
	Number	%	Number	%
Use of ABHRs is religiously prohibited	60	16%	314	84%
I am concerned that alcoholic content of ABHRs might be absorbed through the skin	55	14.7%	319	85.3%
I am concerned that ABHRs might be absorbed through the respiratory tract	59	15.8%	315	84.2%
Use of ABHRs is an easy way to disinfect hands	327	87.4%	47	12.6%
ABHRs are more effective than water and soap for hand disinfection	198	52.9%	176	47.1%
ABHRs are less harmful to skin compared to water and soap	216	57.8%	158	42.2%
ABHRs hurt hands and I am concerned about adverse skin irritation	118	31.6%	256	68.4%

**Table 3:** Comparison of frequency use of alcohol-based hand rub solutions (ABHRs) between religious believers and non-believers

Frequency of use of alcohol-based hand rubs during different patient care situations		Believers** Number (%)	Non-believers Number (%)	OR (CI 95%)	P value
Before touching patients	High frequency*	31 (51.7)	208 (66.2)	1.83 (1.05–3.20)	0.040***
	Low frequency	29 (48.3)	106 (33.8)		
After procedures with potential exposure to blood and secretions	High frequency	37 (61.7)	211 (67.2)	1.27 (0.71–2.25)	0.456
	Low frequency	23 (38.3)	103 (32.8)		
After touching patients	High frequency	43 (71.7)	243 (77.4)	1.35 (0.72–2.51)	0.325
	Low frequency	17 (28.3)	71 (22.6)		
After doing a clean/aseptic procedure	High frequency	45 (75)	270 (86)	2.04 (1.05–3.98)	0.051
	Low frequency	15 (25)	44 (14)		
After touching a patient's bed sheet/bed	High frequency	45 (75)	268 (85.4)	1.94 (1.00–3.76)	0.056
	Low frequency	15 (25)	46 (14.6)		

\*High vs. Low frequency use: using ABHRs “always, most times” vs. “occasionally, rarely and never”

\*\*Nurses who believed that alcohol-based hand rubs are religiously prohibited

\*\*\* Significance level: 0.05

**Table 4:** Practice scores of Muslim nurses (n=374) regarding use of alcohol-based hand rubs based on demographic and other associated variables

Characteristics	Mean practice score	Standard deviation	t statistics (df: 372)	P value**
<b>Gender</b>				
Female	20.24	3.61	0.62	0.372
Male	19.93	3.21		
<b>Age</b>				
<28	20.70	3.32	-1.03	0.305
≥28	20.44	3.21		
<b>Educational level</b>				
A bachelor or master's degree	20.38	3.51	-0.28	0.781
A nursing diploma	20.61	3.28		
<b>Work experience</b>				
< 5 years	20.32	3.44	-0.31	0.759
≥ 5 years	20.44	3.05		
<b>Ward</b>				
Surgical	20.10	3.63	-0.17	0.863
Medical	20.17	3.47		
<b>Hand hygiene training course in the past year</b>				
Yes	20.73	3.36	-3.41	<0.001
No	19.50	3.61		
<b>Religious belief</b>				
Believers*	19.78	3.84	-0.88	0.378
Non-believers	20.22	3.47		

\* Nurses who believed that use of alcohol-based hand rubs is religiously prohibited

\*\* Significance level: 0.05

## Discussion

Hand hygiene practice, as a health-related behaviour, might be of multifactorial origin. It has been stated that cultural and religious beliefs can significantly influence the hand hygiene behaviour of healthcare workers (Allegranzi et al. 2009). Numerous studies have investigated barriers to hand hygiene and interventions to improve compliance (Doronia et al. 2017; Erasmus et al. 2010; Sands and Aunger 2020), yet few studies have considered religious beliefs as an influencing factor on nurses' behaviour regarding alcohol-based hand rubs (Borg et al. 2009)



According to the results of our study, only a minority of Muslim nurses thought that the use of alcohol-based hand rubs is religiously forbidden, and interestingly, more than half of the believers used alcohol-based hand rubs always or most of the time during their practice. There seems to be a discrepancy between what they believe and what they do. Maybe some nurses do not take religious beliefs into account when they are caring for patients because they think their beliefs might impact the quality of care negatively. Another possible reason is that they might be in doubt whether this religious prohibition on alcohol would be applicable to alcohol-based hand rubs. Even though believers did not differ from non-believers in terms of hand hygiene practice score, believers were significantly less likely to report the application of ABHRs before patient contact. Clarification of this discrepancy necessitates further study.

There are few studies that have investigated Muslim nurses' behaviour with regard to ABHRs. A study of healthcare workers in the Saudi Arabian National Guard Health Affairs Hospitals showed that there was no difficulty or reluctance for the use of ABHRs, but the authors declared that most of the participants were expatriates, often non-Muslim or highly selected professionals with Western training (Ahmed et al. 2006). In a study conducted in Jordan, most Muslim nurses showed a positive attitude towards hand hygiene, but their compliance with respect to religious issues was not reported as a studied variable (Darawad et al. 2012).

The findings of the present study also showed that 14.7% and 15.8% of nurses were worried about cutaneous and respiratory absorption of the alcohol into their body, respectively, and so they believed that it is forbidden by their religion. It had been previously reported that some Muslim healthcare workers were concerned about potential cutaneous or respiratory exposure to alcohol when using ABHRs (Ahmed et al. 2006). During hand disinfection with ABHRs, alcohol might be absorbed via skin or lungs, but it has been shown that even after long-term exposure, the amount of absorbed ethanol is negligible (Below et al. 2012; Brown et al. 2007; Gessner et al. 2016). Hence, alcohol-based hand rubs are safe but for some Muslim nurses, their negligible absorption may be a matter of concern.

Amongst our study population, about one third of nurses were concerned about adverse skin irritation side effects of alcohol-based hand rubs. This finding was in line with many other studies in which a commonly reported side effect of ABHRs was skin dryness and irritation (Assefa et al. 2021; Kampf and Löffler 2007; Sharma et al. 2015; Takra, Gutkowska, and Nitsch-Osuch 2019). Skin irritation and contact dermatitis with ABHRs were specially reported in people with an aldehyde dehydrogenase deficiency (Lachenmeier 2008). In a study in China among healthcare workers, skin irritation was one of the most common barriers to use ABHRs (Li et al. 2015). Also, a study within a large teaching hospital in Ireland showed that the major barriers to using ABHRs by nurses were skin sensitivity and irritation (Kingston et al. 2017). Regardless of religious beliefs, the fear of skin damage from ABHRs is a common misconception. It must be noted that ABHRs cause less dermatitis than soap and water if used at the same

frequency. ABHRs contain emollients that will protect the skin from irritation, whereas soap and water remove lipids from the skin surface, causing drying and dermatitis (Kampf and Kramer 2004; Picheansathian et al. 2004).

The frequency of use of ABHRs varies substantially among nurses under different situations; with the greatest frequency recorded from intensive care units (Boyce et al. 2017). Our findings showed that the highest frequencies of self-reported usage of ABHRs by Muslim nurses were after touching patients and after performing clean/aseptic procedures, and the lowest frequency was before touching patients. There was no significant difference between the frequency of the use of ABHRs in medical and surgical wards. An observational study in a surgical ICU ward in India found that nurses' compliance with hand hygiene was lowest (39%) before aseptic procedures and highest (93%) after touching a patient, and the overall compliance was 63% (Chavali et al. 2014). In another study from Ethiopia, overall compliance was 18.7%, the highest before cleaning or aseptic procedures. In this study, using ABHRs was the most common method of hand disinfection (Awoke et al. 2018).

A study on Irish nursing students' attitude towards hand hygiene found highly positive attitudes, but only 22% of them reported routine use of ABHRs, and hand hygiene compliance was the highest after exposure to body fluids and lowest after touching patients' bed sheets (Kingston et al. 2018).

Finally, the results of the present study indicated that hand hygiene training courses might have a positive impact on nurses' practice with regard to ABHRs. Many studies have demonstrated a positive association between hand hygiene training and health workers' compliance (Alshehari, Park, and Rashid 2018) and it seems that this is also true for alcohol-based hand rubs.

WHO has launched different strategies and published guidelines to improve hand hygiene practices around the world. Although most countries are following the recommended guidelines to improve hand hygiene practices, self-reported hand hygiene compliance among healthcare workers was suboptimal and lowest before touching patients (Li et al. 2015; Reichardt et al. 2013). Even in high income countries, average compliance was reported in 2010 to be about 40% (Erasmus et al. 2010). To improve hand hygiene compliance, multifaceted approaches including education, reminders and continuous performance feedback are more effective than a single type intervention. Also, the impact of religious beliefs has been emphasised by the WHO to be taken into consideration (Randle et al. 2014; World Health Organisation 2009).

## Limitations

There are some limitations to our study. This was a single-centre cross-sectional study; therefore, it is difficult to generalise the results to all Iranian Muslim nurses. However, the study setting was the main referral centre in Fars (the largest province of Southern Iran with 5 million inhabitants) with more than 1 000 practising nurses. We assessed

self-reported practices of nurses with regard to hand hygiene, which is less accurate than direct observation of behaviours. Nevertheless, the self-report is a widely used method that could be relied upon as an alternative choice to assess an extensive range of health behaviours, particularly when there is no stigma associated with those specific behaviours.

## Conclusions

Alcohol-containing hand rubs are commonly used by Iranian Muslim nurses so that more than half of them utilise ABHRs in different patient care situations. The results of the present study showed that the practice of hand hygiene with alcohol-containing hand rubs among Iranian Muslim nurses is not influenced by their religious beliefs toward alcohol.

For those who were reluctant to use ABHRs, skin dryness and irritation were the biggest concern. Periodic refresher training courses should be scheduled, where the safety of ABHRs should be emphasised.

## Contributions, Competing Interests and Ethical Clearance

All authors have equally contributed to the design of the study, acquisition of data, analysis, and interpretation of results and have read and approved the final manuscript. No competing interests are declared. The study was approved by the Research Ethics Committee of Shiraz University of Medical Sciences.

## Acknowledgements

The Vice Chancellor for Research at Shiraz University of Medical Sciences funded this project. This research was performed by Dr Seyed Nematian in partial fulfilment of the requirements for certification as a specialist in community medicine at Shiraz University of Medical Sciences in Shiraz, Iran (No. 94-9720). The authors wish to thank Mr H. Argasi for his invaluable assistance in editing this manuscript.

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