

## ■ Original article

## The effect of alcohol-based handrub solution on hands skin integrity of health care providers

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### Abstract

**Background and Purpose:** Nosocomial infection is a threat to patient safety. In this study, we aimed to investigate the effect of alcohol-based handrub solutions recommended by the World Health Organization on skin integrity of health care providers.

**Methods:** This experimental study was carried out on 40 healthcare personnel of 17 Shahrivar Hospital, Amol, Iran, in 2016. The subjects were selected through convenience sampling method. The participants used the recommended solution for one month. The participants' skin condition was evaluated by using two questionnaires filled out by the observer and participants in the first week and after one month. To analyze the data, the phi coefficient and Cochran's Q test were used in SPSS, version 19.

**Results:** The results of the objective skin evaluation showed that there was no significant difference between the evaluations regarding skin redness ( $P=0.846$ ), scaliness ( $P=0.276$ ), and visual scoring of the skin ( $P=0.5$ ). However, a significant difference was observed in terms of skin tears ( $P=0.05$ ). The visual skin evaluation ( $P=0.001$ ), skin disorders ( $P=0.006$ ), moisture content ( $P=0.001$ ), sensation ( $P=0.004$ ), and overall skin integrity ( $P=0.023$ ) showed a significant change after the use of the solution.

**Conclusion:** The results indicated that the recommended solution was compatible with the hand skin of the participants. We highly recommend the authorities to provide the necessary education for health personnel to improve compliance.

**Keywords:** Alcohol-based solution, Hand hygiene, Tolerability

### Introduction

Hand hygiene is a very simple and inexpensive measure to reduce nosocomial infections and increase patient safety (1). Hand hygiene can effectively reduce healthcare infections. The prevalence of infection due to poor compliance with hand hygiene can increase mortality and costs (2). According to statistics, nosocomial infections annually affect two million people, and 19 million die due to these infections (3).

Hand hygiene is recognized as the leading measure to prevent cross-transmission of microorganisms and to reduce the incidence of health care-associated infections. Despite the relative simplicity of this behavior, compliance with hand hygiene among health care providers is as low as 40% (4).

Important benefits of proper hand hygiene include reduction of nosocomial infections, reduced transmission of multi-drug resistant pathogens,

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and cost-effectiveness (5). Hospital infection is a threat to patient safety and it imposes high costs to the health care service delivery systems (6). Nosocomial infections can be caused during hospitalization or as a result of it (7). These infections increase the mean duration of hospitalization to 5-7 days and cost of treatment. The hidden and harmful effects of these infections are undeniable not only for patients, but also for caregivers. Moreover, these infections may increase mortality and absenteeism from work, they might also waste national resources (6). According to studies performed in Iran, adherence to hand hygiene recommendations among healthcare workers in different parts of hospital is unacceptably low (30-50%), which is similar to studies performed in other countries (8).

Alcoholic handrub is regarded superior to soap and water. It has greater activity against microorganisms, less time constraints, and better skin tolerability (8, 9). Furthermore, alcoholic handrub is accessible in most settings as it can be provided in pocket bottles and may thus be available at any time at the point of care. The World Health Organization (WHO) has identified formulations for the local preparation of alcohol-based handrubs with substantially lower costs compared to commercial products (10).

Adherence to hand hygiene is a simple way to diminish nosocomial infection, prevent the spread of antimicrobial resistance, and increase patient safety (11). Because nurses are directly involved in patient care, they have an essential role in the prevention of hospital infection (10). The evidence shows that despite easy and inexpensive implementation of hand hygiene its adherence among health providers is less than expected (12). According to the results of the related studies, even in the best systems with favorable conditions, the implementation of this practice is less than 40-50% (13-15). Former studies expressed various reasons for this behavior the most important of which were lack of a suitable solution, being time-consuming, lack of equipment for drying hands, and causing skin damage (16, 17).

In recent years, use of alcohol-based solutions is recommended by the authorities, organizations, and institutions, and it seems to solve the above-mentioned difficulties, but still we are faced with low adherence to hand hygiene. Most healthcare providers refuse to utilize these solutions because of worries about skin tolerability (4). The aim of this study was to investigate the effect of hand sanitizer solutions recommended by WHO on skin integrity of healthcare providers.

## Materials and Methods

This experimental study was performed in 2016 to evaluate skin tolerability and acceptability of alcohol-based products, without comparison with other products. The participants including 40 nurses and healthcare providers were chosen through convenience sampling method from 17 Shahrivar Hospital in Amol, Iran. After obtaining approval of the University Research Council, we explained the method and objectives of the study to the participants and assured them of the confidentiality of the data. To persuade the medical center authorities to support testing alcohol-based products with their health workers a meeting was held. Afterwards, an identification code was assigned to each of the volunteers.

For the purpose of this study, skin condition of the participants was evaluated by using two questionnaires completed by the observer and participants in the first week and after one month. The assigned identification number to each participant was written on their questionnaires, evaluation forms, and bottles. With coordination of hospital management, a temporary place in the hospital was considered for our interviews with participants and maintenance of solutions. We scheduled an appointment with each nurse based on working hours. The content of bottles was 100 ml easy-to-use product. Each bottle was enough for three working days. The bottles were taken back from the participants at the end of the three working days and new bottles were given to them. It was requested from the participants to only use their own bottles, which had their

**Table 1.** Participants' characteristics

Age (years)		32.64±4.25	
		Frequency	Percentage
Gender	Male	9	22.5
	Female	31	77.5
No experience of other works that could be the cause of skin damage, except for nursing	Yes	6	15
	No	34	85
Experience of using alcohol-based solution	First time	8	20
	Less than one year	12	30
	1-5 years	20	50
	5-10	3	7.5
Count of direct contact with patients in one working day	5-10	8	20
	10-15	8	20
	More than 15	21	52.5

assigned identification number labels.

All the data was collected by the tools provided by WHO, including a questionnaire that was completed by the participants and the objective skin evaluation form completed by the observer. Each participant met the observer three times (first day before starting work, after the first week, one month after use). The observer objectively evaluated the participants' hands, based on objective skin evaluation form. In addition, the participants did self-evaluation of their hands' skin condition in the third meeting based on a questionnaire.

Each participant applied the solution for 30 days. If the use of the product was discontinued for more than five days, the participant was scheduled again, if s/he would like to use, otherwise s/he was excluded from the study and another volunteer was replaced. According to guidelines of WHO, if at least 75% of the participants in questionnaire (A) in section "self-evaluation of hand skin condition" rated all the items higher than 4 and in "objective skin evaluation filled by observer" 75% of the participants or more scored higher than 2, it was considered as skin tolerability and acceptability index (18). To analyze the data, phi coefficient and Cochran's Q test were used in SPSS, version 19. *P value* less than 0.05 was considered

statistically significant.

## Results

Table 1 shows the participants' characteristics. Objective skin evaluation performed by the observer showed that no significant difference was observed regarding redness ( $P=0.846$ ), skin scaliness ( $P=0.276$ ), and visual scoring of skin ( $P=0.5$ ) between the three objective evaluations. However, Table 2 shows a significant difference was noted regarding skin tear ( $P=0.05$ ).

Table 3 shows self-evaluation of hand skin condition. There were significant differences after the use of solution between the two evaluations regarding visual skin evaluation ( $P=0.001$ ), skin disorders ( $P=0.006$ ), moisture content ( $P=0.001$ ), sensation ( $P=0.004$ ), and overall skin integrity ( $P=0.023$ ). The most important drawbacks in the use of alcohol-based solution as expressed by the participants were

**Table 2.** Criteria for evaluation of skin condition by the observer (objective evaluation)

Skin condition	N	df	Cochran's Q	<i>P value</i>
Redness	40	2	0.33	0.846
Scaliness	40	2	2.571	0.276
Skin tears	40	2	6.00	0.05
Visual scoring of skin	40	2	1.385	0.05

**Table 3.** Skin conditions reported by the participants in the first and second weeks after using alcohol-based handrub solution (n=40)

Skin condition	Percent of people in the first week	Percent of people in the second week	Phi test	P-value
Skin disorders (scratch and skin tear)	85	75	0.492	0.006
Appearance (flexibility, redness, and hives)	82.5	70	0.616	0.001
Moisture content (dryness)	65	55	0.590	0.001
Sensation (irritation, burn, and pain)	75	70	0.513	0.004
Overall skin integrity	45	67.5	0.407	0.023

limited time ( $3.77 \pm 1.45$ ), forgetfulness ( $3.42 \pm 1.25$ ), and fear of skin damage ( $2.90 \pm 1.91$ ), respectively.

## Discussion

This study demonstrated no significant difference between the two evaluations, except for tears in hand skin. These results indicate that sanitizer solution has suitable compatibility with hand skin, which is consistent with the findings of Zaragoza et al., where the skin condition and tolerability improved by using alcoholic products (19), this result was consistent with the outcomes of Elaine et al. They found that skin disorders were less in alcoholic solutions with emollient (20). Also, the results of Maier et al. demonstrated that frequent use of alcoholic solutions for hygiene is not a danger for people and it can be one of the best ways to prevent infection (21).

Moreover, in this study, evaluation of hand skin was performed by the participants. In the first week of using solution, skin tears, scratch, moisture, and sensation were in high level, except for overall skin integrity, but after one month of using the solution, the mentioned symptoms were decreased. It may be because of the initial skin irritation and consistency during its long-term use. Few studies reported irritation effect of ethanol in solution and various studies showed that ethanol does not cause skin dryness (22). To reduce skin irritation due to frequent hygiene, Health-Care Settings provides health-care workers (HCWs) recommends that workers use emollients (23). According to this issue, solution used in this study contained glycerol and it has skin conditioning properties.

In this study, the main reasons for not using

solutions were expressed lack of time, forgetfulness, and fear of skin damage by health workers. In a study by Catherine et al., the main reasons for poor hand hygiene were reported negligence, forgetting, and lack of time (15). Also, in the study by Ravaghi et al., the main barriers in the implementation of this behavior were factors such as lack of facilities, heavy work load, and poor physical structure of sectors (8). Also, the results of another study determined that the main reasons of nonconformity were forgetfulness and lack of time (24). In this regard, the attention of managers to provide adequate resources for hand hygiene, appropriate education to increase motivation of health workers, and suitable strategies for lack of time can be effective in implementing this important matter. The limitations of this study include small amount of solutions and limited sample size.

## Conclusion

The results of this study suggested that alcohol-based solutions recommended by WHO are compatible with hand skin of the studied healthcare providers and the use of this solution is acceptable. To improve the efficiency of the use of these solutions, the authorities are recommended to provide the necessary education to healthcare team.

## Conflicts of interest

None declared.

## Authors' contributions

R. Nazari and A. Hassani contributed to study

design and editing. SH. Sharif Nia analyzed the data. P. Fereidouni translated the article and collected the data.

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