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ORIGINAL CONTRIBUTION

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Relationship between hand hygiene and cutaneous findings during COVID-19 pandemic

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Abstract

Background: In the current situation of the COVID-19 pandemic, healthcare workers (HCWs) have to comply with hygiene conditions and use gloves more frequently and for a longer period of time than they would previously to avoid infection and prevent transmission.

Aims: We aimed to characterize the adverse skin reactions occurring after hand hygiene and glove use in HCWs in a tertiary university hospital to determine the possible causative factors and whether the use of these measures is affected.

Methods: Between April 15 and May 1, 2020, a cross-sectional survey was conducted, using online questionnaire, answered by HCWs in a tertiary university hospital.

Results: The increase in general hand-skin problems during the pandemic period was statistically significant ($P = .004$). The most common symptom was dryness. During the pandemic period, 67 (24.3%) HCWs thought that the conditions were caused by glove use, and 197 (71.4%) thought that they were due to alcohol-based hand antiseptics. The incidence of other hand-skin conditions except for vesicles was statistically higher in women than in men ($P < .001$).

Conclusions: Increased number of hand-skin conditions during the pandemic should not be ignored, since hand hygiene and glove use are expected to increase.

KEYWORDS

COVID-19 pandemic, gloves use, Hand hygiene, hands, skin findings

1 | INTRODUCTION

Hand hygiene, hand washing, and glove use are the main recommendations of the World Health Organization (WHO) and the Center for Disease Control and Prevention (CDC) as well as standard measures for the protection of healthcare workers (HCWs) and contact isolation measures.[1,2]

In the current COVID-19 pandemic, healthcare personnel have to comply with hygiene conditions and use gloves more frequently and for a longer period of time than they did previously to avoid infection and prevent transmission.[3-5] Consequently, HCWs are prone to various adverse skin conditions associated with handwashing and use of alcohol-based hand sanitizers and gloves. Adverse reactions may cause HCWs to avoid the application of these measures. Observational studies conducted in the pandemic process may provide awareness of the situation and measures to be taken. With this study, we aimed to characterize the adverse skin reactions occurring after hand hygiene in the HCWs in our hospital to determine the possible causative factors and whether the use of these measures is affected.

2 | METHODS

Between April 15 and May 1, 2020, a cross-sectional survey was conducted, using online questionnaires that were answered by HCWs in a tertiary university hospital in Turkey. The surveyed healthcare staff included nurses, doctors, caregivers, cleaning staff, radiology technicians, and other staff who looked after COVID-19 patients and worked in other areas where non-COVID-19 patients were cared for.

In the questionnaires, the participants were asked whether they experienced any adverse effects of using gloves, washing with water and soap, and using alcohol-based hand antiseptics for hand hygiene and whether hand-skin-related symptoms made it difficult to adhere to these measures. The participants were asked about their experience with hand hygiene during the pandemic period. In addition to demographic information, adverse skin reactions and type of reaction (such as dryness, redness, itching, burning, pain, vesicles, and fissure) were recorded. The relationship between hand-skin conditions and variables, such as the frequency of hand washing, the number of gloves used, the temperature of the water, and whether the unit of work contained COVID-19 patients, was evaluated. Details of the survey questions are provided in the Appendix S1.

Ethical approval was obtained from the Clinical Research Ethics Committee. The statistical analyses of the data were performed by using SPSS (Statistical Package for Social Sciences) for Windows 22.0 software. Data for qualitative variables were presented as number and percentage, and data for quantitative variables, as mean ± SD. Pearson chi-square and Fisher's exact chi-square were used to compare independent categorical variables. McNemar test was used to compare dependent categorical variables. A value of $P < .05$ was accepted as statistically significant.

3 | RESULTS

Of the 267 HCWs in our study, 171 (62%) were female and 105 (38%) were male. The mean ages (mean ± SD) were 34.9 ± 6.6 years for women and 35.1 ± 7.3 years for men. Seventy-seven (27.9%) of them were involved in the follow-up of COVID-19 pandemic patients. Table 1 shows the demographic characteristics of the participants, their daily working hours, their duties, and whether they took part in the follow-up of COVID-19 patients. During the pandemic period, 67 (24.3%), 197 (71.4%), and 134 (48.6%) HCWs thought that the symptoms were caused by gloves, alcohol-based hand antiseptics, and water and soap, respectively; 10 (3.6%) HCWs reduced the hand hygiene measures due to complaints (Table 1); 148 (53.6%) HCWs preferred warm water. Regarding water temperature preference, 84 (30.4%) preferred cold water, 33 (12%) did not mind any temperature, and 11 (4%) preferred hot water.

In all, 180 (65.2%) reported general hand-skin-related symptoms caused by hand hygiene and use of gloves prior to the pandemic period. In the pandemic period, 203 (73.6%) reported these findings. The increase in the number of hand-skin conditions during the pandemic period was statistically significant ($P = .004$). The distribution of dryness, redness, itching, burning-pain, vesicles, and other hand-skin conditions is shown in Table 2. The complaint of dryness increased significantly in the pandemic period ($P = .008$).

The relationship between developing symptoms and gender during the pandemic is shown in Table 3. Generally, hand-skin-related complaints were observed in 87.1% of the female HCWs and 51.4% of the HCWs participants, indicating statistical significance ($P < .001$). The incidence of other hand-skin conditions, except for vesicles, was significantly higher in female HCWs than in male HCWs ($P < .001$).

Regarding the relationship between the complaints and unit of work (Table 4), the complaints increased in the units without COVID-19 patients; this increase was statistically significant for general hand-skin conditions, dryness, rash, and itching complaints ($P < .05$).

There were no statistically significant differences between those who worked less than 8 hours and those who worked 8 hours and above (Table 5).

The relationship between hand-skin conditions and the number of handwashing times, use of alcohol-based hand antiseptics, avoidance of powdered gloves, and the number of gloves is shown in Table 6. There was no statistically significant difference in the hand-skin conditions between those who washed their hands fewer than 10 times and those who did so more than 10 times in one day. Likewise, there was no statistical difference in the hand-skin conditions between HCWs who used alcohol-based hand antiseptics fewer than 10 times a day and those who did so 10 or more times ($P > .05$). Out of 206 HCWs who avoided powdered gloves, 131 (77.1%) complained of hand-skin conditions. Of the 70 people who did not avoid powdered gloves, 49 (70%) had hand-skin conditions. There was no statistically significant difference between these two groups ($P = .53$). One hundred thirty-nine (77.2%) of 180 HCWs who previously had hand-skin conditions were avoiding powdered gloves, and 41 (22.8%) were not; 67 (69.8%) of 96 HCWs who had no previous hand-skin conditions were avoiding powdered gloves. There was a statistically significant difference between both groups ($P = .016$).

4 | DISCUSSION

HCWs are more likely to experience skin irritation than the general population, given the need for increased hand hygiene. Irritated skin can not only cause discomfort and deterioration in performance but also cause infection. Avoiding hand hygiene and control measures due to irritation increases the risk of infection transmission.[6] Hence, identifying hand-skin conditions and related risk factors in healthcare settings, especially in periods when the number and intensity of control measures increase, is crucial to determining the measures to be taken.

The number of hand-skin conditions increased significantly in the pandemic period as opposed to before the pandemic. Of the 276 HCWs, 203 (73.6%) reported hand-skin conditions. The most common symptom was dryness (187 [67.8%]). Overall, compared to the

TABLE 1 The demographic and working characteristics of the participants

Features	Groups	Number (percentile) n (%)
Age, mean ± SD	Female	34.9 ± 6.6
	Male	35.1 ± 7.3
	Total	35.0 ± 6.9
Gender	Female	171 (62)
	Male	105 (38)
Duties	Patient carer	23 (8.3)
	Cleaning staff	29 (10.5)
	Nurse	148 (53.6)
	Doctor	7 (2.5)
	Radiology technician	26 (9.4)
	Anesthesia technician	3 (1.1)
	Emergency service technician	3 (1.1)
	Others	37 (13.4)
Daily working hours	<8 h	108 (39.1)
	≥8 h	168 (60.9)
Whether they took part in the follow-up of	Yes	77 (27.9)
COVID-19 patients	No	199 (72.1)
HCWs thought that the symptoms were	Yes	67 (24.3)
caused by gloves	No	209 (75.7)
HCWs thought that the symptoms were	Yes	197 (71.4)
caused by alcohol-based hand antiseptics	No	79 (28.6)
HCWs thought that the symptoms were	Yes	134 (48.6)
caused by soap and water	No	142 (51.4)
HCWs reduced the hand hygiene measures	Yes	10 (3.6)
due to complaints	No	266 (96.4)

TABLE 2 The distribution of hand-skin-related symptoms in prior to pandemic and pandemic periods

Features		Prepandemic n (%)	Pandemic n (%)	*P* values
Hand-skin-related symptoms	Yes No	180 (65.2) 96 (34.8)	203 (73.6) 73 (26.4)	**.004**
Dryness	Yes No	166 (60.1) 110 (39.9)	187 (67.8) 89 (32.2)	**.008**
Erythema	Yes No	122 (44.2) 154 (55.8)	133 (48.2) 143 (51.8)	.17
Itching	Yes No	121 (43.8) 155 (56.2)	130 (47.1) 146 (52.9)	.27
Burning-pain	Yes No	65 (23.6) 211 (76.4)	73 (26.4) 203 (73.6)	.26
Vesicle	Yes No	5 (1.5) 271 (98.2)	8 (2.9) 268 (97.1)	.45
Hand fissure	Yes No	121 (43.8) 155 (56.2)	130 (47.1) 146 (52.9)	.30
Others	Yes No	10 (3.6) 266 (96.4)	7 (2.5) 269 (97.5)	.54

Bold indicates statistically significant *P* values.

TABLE 3 The relationship between developing symptoms and gender during the pandemic

Features		Female (n = 171) n (%)	Male (n = 105) n (%)	*P* values
Hand-skin-related symptoms	Yes No	149 (87.1) 22 (12.9)	54 (51.4) 51 (48.6)	**<.001**
Dryness	Yes No	142 (83) 29 (17)	45 (42.9) 60 (57.1)	**<.001**
Erythema	Yes No	108 (63.2) 63 (36.8)	25 (23.8) 80 (76.2)	**<.001**
Itching	Yes No	107 (62.6) 64 (37.4)	23 (21.9) 82 (78.1)	**<.001**
Burning-pain	Yes No	59 (34.5) 112 (65.5)	14 (13.3) 91 (86.7)	**<.001**
Vesicle	Yes No	6 (3.5) 165 (96.5)	2 (1.9) 103 (98.1)	.71
Hand fissure	Yes No	101 (59.1) 70 (40.9)	29 (27.6) 76 (72.4)	**<.001**
Others	Yes No	7 (4.1) 164 (95.9)	0 (0) 105 (100)	**.047**

Bold indicates statistically significant *P* values.

TABLE 4 The relationship between the complaints and unit of work

Features		Work in the units with COVID-19 patients (n = 77) n(%)	Work in the units without COVID-19 patients (n = 199) n(%)	*P* values
Hand-skin-related	Yes	49 (63.6)	154 (77.4)	**.030**
symptoms	No	28 (36.4)	45 (22.6)	
Dryness	Yes	43 (55.8)	144 (72.4)	**.013**
	No	34 (44.2)	55 (27.6)	
Erythema	Yes	28 (36.4)	105 (52.8)	**.014**
	No	49 (63.6)	94 (47.2)	
Itching	Yes	26 (33.8)	104 (52.3)	**.006**
	No	51 (66.2)	95 (47.7)	
Burning-pain	Yes	15 (19.5)	58 (29.1)	.13
	No	62 (80.5)	141 (70.9)	
Vesicle	Yes	2 (2.6)	6 (3)	1.00
	No	75 (97.4)	193 (97)	
Hand fissure	Yes	25 (32.5)	105 (52.8)	**.002**
	No	52 (67.5)	94 (47.2)	
Others	Yes	2 (2.6)	5 (2.5)	1.00
	No	75 (97.4)	194 (97.5)	

Bold indicates statistically significant *P* values.

prepandemic period, there was an increase in complaints of dryness, redness, itching, burning-pain, and vesicles, but the increase in complaints about dryness was statistically significant, possibly due to increased hand hygiene measures during the pandemic period. Recent studies on this subject, such as the study by Lan et al,[3] reported that dryness was the most common symptom (70.3%).

In our hospital, in addition to the follow-up of COVID-19 patients, the follow-up of other patients takes place in different units. Regarding place of work, 154 (77.4%) HCWs with general hand complaints were working in places where non-COVID-19 patients were being followed. Interestingly, 49 (63.6%) HCWs working in places where COVID-19 patients were present reported hand-skin conditions; the reduction was statistically significant ($P = .030$). Despite the expectation of high prevalence of hand-skin conditions among medical staff working in areas where COVID-19 patients were followed, the prevalence was high among medical staff in other areas not related to COVID-19 patients. Thus, hand hygiene and glove use measures were followed by all personnel.

Further, 171 (62%) HCWs were female and 105 (38%) were male. In the study conducted by Lin et al,[7] 84 (22.3%) were male and 292 (77.7%) were female. In their multivariate analysis, female sex was

TABLE 5 The relationship of complaints to hours of work after pandemic process

Features		<8 h (n = 108) n (%)	≥8 h (n = 168) n (%)	*P* values
Hand-skin-related symptoms	Yes No	78 (72.2) 30 (27.8)	125 (74.4) 43 (25.6)	.79
Dryness	Yes No	73 (67.6) 35 (32.4)	114 (67.9) 54 (32.1)	.96
Erythema	Yes No	47 (43.5) 61 (56.5)	86 (51.2) 82 (48.8)	.21
Itching	Yes No	47 (43.5) 61 (56.5)	83 (49.4) 85 (50.6)	.33
Burning-pain	Yes No	27 (25) 81 (75)	46 (27.4) 122 (72.6)	.76
Vesicle	Yes No	2 (1.9) 106 (98.1)	6 (3.6) 162 (96.4)	.48
Hand fissure	Yes No	51 (47.2) 57 (52.8)	79 (47) 89 (53)	.97
Others	Yes No	3 (2.8) 105 (97.2)	4 (2.4) 164 (97.6)	1.00

TABLE 6 The relationship between hand-skin conditions and the number of handwashing times, use of alcohol-based hand antiseptics, avoidance of powdered gloves, and the number of gloves

Features	Subgroup	n (%)	Hand findings		*P* values
			Yes, n (%)	No, n (%)	
Number of hand washes in one day	<10	22 (8)	13 (59.1)	9 (40.9)	.17
	≥10	254 (92)	190 (74.8)	64 (25.2)	
Number of applying hand alcohol-based hand antiseptic	<10	54 (19.6)	38 (70.4)	16 (29.6)	.67
	≥10	222 (80.4)	165 (74.3)	57 (25.7)	
Avoiding powdered Gloves	Yes	206 (74.6)	154 (74.8)	52 (25.2)	.53
	No	70 (25.4)	49 (70)	21 (30)	
Number of gloves	Single glove	170 (61.6)	131 (77.1)	39 (22.9)	**.035**
	Double	71 (25.7)	44 (62)	27 (38)	
	Gloves Under glove—Transparent Glove	35 (12.7)	28 (80)	7 (20)	

Bold indicates statistically significant *P* values.

associated with increased adverse skin reactions. In our study, 149 (87.1%) female HCWs had general skin conditions, at a statistically significant level ($P < .001$). In addition, in the study of Lin et al, adverse skin reactions were reported by 280 (74.5%) participants. This rate was similar to that reported in our study—203 (73.6%) participants.

Remarkably, the rates of adverse hand-skin conditions in the COVID-19 pandemic period were much higher than the rate of professional contact dermatitis (31.5%) in HCWs under normal working condition and the negative skin reactions (21.4%–35.5%) during the SARS outbreak.[7] In our participants, adverse skin symptoms 180 (65.2%) were reported in the pre-COVID 19 pandemic period.

In all, 197 (71.4%) HCWs thought that the conditions were related to alcohol-based hand antiseptic use. The alcohol-based hand antiseptics used in our hospital contain 70% ethanol, 0.5% propranolol, 1%-3% softening agents, 0.05% pH stabilizers, and deionized water. The active ingredient ethanol is safe and effective for topical use.[8] Washing hands with soap and water reduces skin moisture, but alcohol-based hand antiseptics with moisturizing additives such as glycerin increase skin hydration and do not decrease skin moisture.[8,9] In our study, 134 (48.6%) thought that their conditions were due to water and soap. In a study involving nurses working in the intensive care unit, alcohol-related skin reactions were expected but less common and milder than reactions related to hand washing with soap and water.[10]

In a study on how zero infection rate can be achieved in HCWs working in the front lines facing high risk of infection during the 2014-2015 Ebola epidemic in West Africa, the importance of using

the correct equipment and of effective hand hygiene was emphasized.[11] In our study, 10 (3.6%) avoided hand hygiene measures because of the skin conditions. This could be attributed to two reasons: HCWs were afraid of the risk of infection and could not avoid the control measures despite their conditions and the symptoms were not severe. Severity assessment could not be carried out since the dermatologist did not perform direct skin examination.

In our study, 71 (25.7%) preferred wearing double gloves, 35 (12.7%) preferred gloves with transparent gloves, and 170 (61.6%) preferred single gloves. Forty-four (62%) of HCWs who preferred double gloves complained of hand-skin conditions. Significantly fewer hand-skin conditions were reported in couple wearing gloves ($P < .035$). Casanova et al[12] found that single glove use was more prone to virus transmission to the hand during the removal of protective equipment than double glove use. However, in the CDC's recommendations for the using personal protective equipment during COVID-2019, it is recommended to first remove the glove and then carry out hand hygiene. There is no recommendation for use of double gloves.[13]

In the literature, powder in the gloves has been reported to absorb latex particles and act as a carrier.[14] Two hundred and six (74.6%) HCWs in our study avoided using powdered gloves. However, 154 (74.8%) of those who avoided powdered gloves had evidence of hand-skin conditions. Hand-skin conditions were reported in 49 (70%) among 70 (25.4%) HCWs who did not avoid powder gloves. In our study, no statistically significant finding in terms of hand-skin conditions and use of powdered gloves ($P > .53$). Further, 72.2% of the HCWs who previously had and 69.8% who did not have hand-skin conditions avoided powdered gloves ($P = .016$).

In our study, 148 (53.6%) HCWs stated that they preferred warm water. Since washing hands with extremely hot or cold water can irritate the skin, warm water is recommended.[15]

As a result, an increase in hand-skin conditions was reported in our HCWs, particularly in women, during the COVID 19 pandemic period. This increase was seen in HCWs working in areas where COVID-19 patients were evaluated and those working in other areas. Hence, it is important to determine the hand-skin conditions that may affect the hand hygiene and glove usage of HCWs during pandemic periods. The frequency of working hours and hand hygiene did not affect the emergence of hand-skin conditions. Our study can contribute to the literature by hand-skin conditions that may arise with the use of hand hygiene and gloves, especially in the current situation.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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