













ORIGINAL ARTICLE

How does working in pandemic units affect the risk of occupational hand eczema in healthcare workers during the coronavirus disease-2019 (COVID-19) pandemic: A comparative analysis with nonpandemic units

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Abstract

Background: Hand eczema (HE) has increased among healthcare workers (HCWs) working in coronavirus disease-2019 (COVID-19) units, and was associated with increased hand hygiene practices.

Objectives: To compare the prevalence and clinical characteristics of HE, and hand hygiene practices in HCWs working in COVID-19 and non-COVID-19 units.

Methods: A total of 244 HCWs working in COVID-19 (n = 118) and non-COVID-19 patient care units (n = 126) were examined by dermatologists with regard to demographic parameters and hand hygiene practices. The COVID-19 and non-COVID-19 groups were matched at a 1:1 ratio according to age, atopy, and generalized dry skin.

Results: HE was more frequent in the COVID-19 group (48.3% vs 12.7%, $P < .001$), whereas working years ($P < .05$) and additional housework at home ($P < .001$) were longer in the non-COVID-19 group. After the development of HE, moisturizing creams were reported to be more frequently used in the COVID group ($P < .001$). Topical corticosteroids were used in a minority (40% in the COVID group and 26.7% in the non-COVID group).

Conclusions: HCWs in COVID-19 units developed HE more frequently. A majority increased the frequency of moisturizer use, instead of using topical corticosteroids, after the development of HE for the purpose of treating eczema. New approaches are needed for the prevention and management of HE in HCWs, especially by facilitating access to dermatologists.

KEYWORDS

COVID-19, hand eczema, hand hygiene, handwashing, healthcare workers, management, moisturizing cream, pandemic

1 | INTRODUCTION

Coronavirus disease-2019 (COVID-19) is a life-threatening infection that has spread rapidly worldwide and was eventually declared a pandemic. Although *severe acute respiratory syndrome coronavirus 2* (SARS-CoV-2) is mainly disseminated via respiratory droplets, contact transmission from infected surfaces and objects is also known to play a role in the human-to-human transfer of the virus.¹ Because hand hygiene is one of the most important methods to prevent contact transmission of SARS-CoV-2, the World Health Organization (WHO) recommended hand hygiene practices by using alcohol-based hand rubs and/or handwashing with water and soap.¹

The risk of occupational hand eczema (HE) has increased in healthcare workers (HCWs), due to infection control methods including frequent hand hygiene practices (handwashing and using disinfectants) and wearing protective gloves.²⁻⁵ The prevalence of HE was

reported to be between 12% and 65% depending on different methods applied during the nonpandemic era.²⁻⁵ Personal atopy, familial atopy, and handwashing more than 20 times per day have been suggested as independent risk factors for the development of HE in HCWs.²⁻⁴ The frequency of additional handwashing and the use of disinfectants have increased among HCWs during the pandemic when compared with the non-pandemic era and these were related to the increase in the number of patients with HE.⁶⁻⁹ Lan et al⁶ reported that about 70.4% of HCWs in COVID-19 units had hand skin damage. However, the frequency of hand hygiene practices and HE was found to increase among HCWs in non-COVID-19 units as well.⁷

We have previously showed that HE was diagnosed in 50.5% of HCWs in COVID-19 units.⁸ In this study, we aimed to compare the prevalence and the clinical characteristics of HE as well as hand hygiene practices in HCWs working in COVID-19 and non-COVID-19 units.

TABLE 1 The description of the overall demographics and the comparison of demographical parameters between groups

Demographic features	Total number of patients (n = 244)	COVID group (n = 118)	Non-COVID group (n = 126)	P value
Hand eczema, n (%)	73 (29.9)	57 (48.3)	16 (12.7)	<.001
Gender				
Male, n (%)	91 (37.3)	39 (33.1)	52 (41.3)	.185
Female, n (%)	153 (62.7)	79 (66.9)	74 (58.7)	
Age, mean (standard deviation)	30.6 (7.3)	29.6 (6.3)	31.5 (8.1)	.048
Profession				
Physician, n (%)	98 (40.2)	53 (44.9)	45 (35.7)	
Nurse, n (%)	107 (43.9)	51 (43.2)	56 (44.5)	.087
Medical caretaker, n (%)	18 (7.3)	4 (3.4)	14 (11.1)	
Other, n (%)	21 (8.6)	10 (8.5)	11 (8.7)	
Workplace				
Inpatient clinic, n (%)	191 (78.3)	100 (84.8)	91 (72.2)	
Intensive care unit, n (%)	21 (8.6)	9 (7.6)	12 (9.5)	.031
Emergency unit, n (%)	32 (13.1)	9 (7.6)	23 (18.3)	
Working years, (month), median (range)	48 (1-396)	36 (1-348)	60 (12-396)	<.001
Weekly work hours, median (range)	45 (24-168)	45 (24-168)	45 (30-100)	.029
History of personal atopy, n (%)	78 (32.0)	45 (38.1)	33 (26.2)	.046
Atopic dermatitis and/or atopic skin, n (%)	53 (21.7)	36 (30.5)	17 (13.5)	.002
History of familial atopy, n (%)	60 (24.6)	27 (22.9)	33 (26.2)	.549
History of metal allergy, n (%)	30 (12.3)	17 (14.4)	13 (10.3)	.437
History of glove allergy (type 4), n (%)	33 (13.5)	14 (11.9)	19 (15.1)	.585
Generalized dry skin, n (%)	80 (32.8)	45 (38.1)	35 (27.8)	.085
History of hand eczema in the past year, n (%)	71 (29.1)	36 (30.5)	35 (27.8)	.639
Additional housework at home, n (%)	173 (70.9)	68 (57.6)	105 (83.3)	<.001
Smoking status				
Nonsmoker, n (%)	146 (59.8)	76 (64.4)	70 (55.6)	.159
Smoker (current or ex-smoker), n (%)	98 (40.2)	42 (35.6)	56 (44.4)	

Note: Categorical variables were compared using the chi-square test and nonparametric continuous variables were compared using the Mann-Whitney U test. $P < .05$ was accepted as statistically significant. Statistically significant P values are highlighted in bold.

Abbreviation: COVID, coronavirus disease.

TABLE 2 The descriptive statistics of hand hygiene practices of the study population at workplace and at daily life and the comparison of two groups

Hand hygiene practices	Total number of patients (n = 244)	COVID group (n = 118)	Non-COVID group (n = 126)	P value
At work				
Frequency of handwashing				
<5 times a shift, n (%)	8 (3.3)	5 (4.2)	3 (2.4)	.718
5-10 times a shift, n (%)	23 (9.4)	10 (8.5)	13 (10.3)	
11-20 times a shift, n (%)	69 (28.3)	31 (26.3)	38 (30.2)	
>20 times a shift, n (%)	144 (59.0)	72 (61.0)	72 (57.1)	
Frequency of use of alcohol-based disinfectants				
<5 times a shift, n (%)	32 (13.1)	14 (11.9)	18 (14.3)	.587
5-10 times a shift, n (%)	53 (21.7)	30 (25.4)	23 (18.2)	
11-20 times a shift, n (%)	56 (23.0)	26 (22.0)	30 (23.8)	
>20 times a shift, n (%)	103 (42.2)	48 (40.7)	55 (43.7)	
Frequency of glove use				
<5 times a shift, n (%)	26 (10.7)	10 (8.4)	16 (12.7)	.249
5-10 times a shift, n (%)	36 (14.7)	14 (11.9)	22 (17.5)	
11-20 times a shift, n (%)	54 (22.1)	31 (26.3)	23 (18.2)	
>20 times a shift, n (%)	128 (52.5)	63 (53.4)	65 (51.6)	
Frequency of use of moisturizing creams after handwashing				
Never, n (%)	130 (53.3)	35 (29.7)	95 (75.4)	<.001
<50%, n (%)	63 (25.8)	46 (39.0)	17 (13.5)	
50%, n (%)	33 (13.5)	23 (19.5)	10 (7.9)	
>50%, n (%)	12 (4.9)	9 (7.6)	3 (2.4)	
Always, n (%)	6 (2.5)	5 (4.2)	1 (0.8)	
At home				
Frequency of handwashing				
<5 times a day, n (%)	17 (7.0)	8 (6.8)	9 (7.1)	.030
5-10 times a day, n (%)	88 (36.0)	36 (30.5)	52 (41.3)	
11-20 times a day, n (%)	81 (33.2)	50 (42.4)	31 (24.6)	
>20 times a day, n (%)	58 (23.8)	24 (20.3)	34 (27.0)	
Frequency of use of alcohol-based disinfectants				
<5 times a day, n (%)	188 (77.0)	95 (80.5)	93 (73.8)	.345
5-10 times a day, n (%)	36 (14.8)	15 (12.7)	21 (16.7)	
11-20 times a day, n (%)	14 (5.7)	6 (5.1)	8 (6.3)	
>20 times a day, n (%)	6 (2.5)	2 (1.7)	4 (3.2)	
Frequency of use of moisturizing creams after handwashing				
Never, n (%)	71 (29.1)	26 (22.0)	45 (35.7)	.081
<50%, n (%)	110 (45.1)	54 (45.8)	56 (44.4)	
50%, n (%)	34 (13.9)	21 (17.8)	13 (10.3)	
>50%, n (%)	12 (4.9)	6 (5.1)	6 (4.8)	
Always, n (%)	17 (7.0)	11 (9.3)	6 (4.8)	
Preventive and therapeutic measures in patient with HE (n = 70)^a				
Regular use of moisturizing creams before the development HE, n/N (%)				
Yes	40/70 (57.1)	33/55 (60.0)	7/15 (53.3)	.395
No	30/70 (42.9)	22/55 (40.0)	8/15 (46.7)	
Frequency of use of moisturizing creams after the development of HE, n/N (%)				
More frequent (general)	46/70 (65.7)	43/55 (78.2)	3/15 (20.0)	

(Continues)

TABLE 2 (Continued)

Hand hygiene practices	Total number of patients (n = 244)	COVID group (n = 118)	Non-COVID group (n = 126)	P value
Less frequent/not changed	24/70 (34.3)	12/55 (21.8)	12/15 (80.0)	<.001
More frequent (in severe HE)	18/21 (85.7)	17/20 (85.0)	1/1 (100)	
Less frequent/not changed	3/21 (14.3)	3/20 (15.0)	0/1 (0)	.574
More frequent (in mild-moderate HE)	28/49 (57.1)	26/35 (74.3)	2/14 (14.3)	
Less frequent/not changed	21/49 (42.9)	9/35 (25.7)	12/14 (85.7)	<.001
Frequency of handwashing and use of alcohol-based disinfectants after the development of HE, n/N (%)				
More frequent/not changed (general)	56/70 (80.0)	43/55 (78.2)	13/15 (86.7)	.466
Less frequent	14/70 (20.0)	12/55 (21.8)	2/15 (13.3)	
More frequent/not changed (in severe HE)	18/21 (85.7)	18/20 (90.0)	0/1 (0)	.296
Less frequent	3/21 (14.3)	2/20 (10.0)	1/1 (100)	
More frequent/not changed (in mild-moderate HE)	38/49 (77.6)	25/35 (71.4)	13/14 (92.9)	.292
Less frequent	11/49 (22.4)	10/35 (28.6)	1/14 (7.1)	
Use of a topical corticosteroid for HE treatment, n/N (%)				
Yes (general)	26/70 (37.1)	22/55 (40.0)	4/15 (26.7)	.343
No	44/70 (62.9)	33/55 (60.0)	11/15 (73.3)	
Yes (in severe HE)	9/21 (42.9)	9/20 (45.0)	0/1 (0)	.282
No	12/21 (57.1)	11/20 (55.0)	1/1 (100)	
Yes (in mild-moderate HE)	17/49 (34.7)	13/35 (37.1)	4/14 (28.6)	.647
No	32/49 (65.3)	22/35 (62.9)	10/14 (71.4)	

Abbreviations: COVID, coronavirus disease; HE, hand eczema.

Note: Categorical variables were compared using the chi-square test. $P < .05$ was accepted as statistically significant. Statistically significant P values are highlighted in bold.

^aData on 70 patients with HE were available.

2 | METHODS

This case-control study was conducted on 244 HCWs including physicians, nurses, medical caretakers, and others (ie, medical secretaries and laboratory technicians) in two tertiary-care hospitals in Turkey between May 15, 2020, and July 15, 2020. The study group included those who were working in COVID-19 patient care units (n = 118) and those who were working in non-COVID-19 patient care units (n = 126) for at least one month. The detailed demographic parameters and hand hygiene practices at work and at home were recorded (Tables 1 and 2).

All participants of the study were examined face-to-face (only once) by dermatologists during the study period. HCWs have been working for at least one month (median 45 days) in COVID or non-COVID units at the time of examination. Those with HE underwent a detailed dermatological examination with regard to the etiologic type, morphology, localization, accompanying pruritus, and the severity of HE.

Eczema severity was assessed by Hand Eczema Severity Index (HECSI).¹⁰ Six clinical signs, namely, erythema, infiltration/papulation, vesicles, fissures, scaling, and oedema, in four areas (fingertips, fingers, palms, backs of hands, and wrists) were evaluated on both hands. The HECSI score was calculated between 0 and 360 points. The severity of HE was classified as mild eczema (0-11 points), moderate eczema (12-27 points), and severe eczema (>27 points).¹⁰

According to whether the participants were working in COVID-19 or non-COVID-19 units, they were divided into two groups: COVID and non-COVID. First, the demographic and hand hygiene practice parameters were compared between the two groups (Tables 1 and 2). Then, the COVID and non-COVID groups were matched at a 1:1 ratio according to age (within a range of ± 5 years), history of atopic dermatitis (AD)/atopic skin, history of familial atopy, and generalized dry skin. The matched group consisted of 162 individuals including 81 in the COVID group and 81 in the non-COVID group. The COVID and non-COVID groups of matched cohort were compared for demographic and clinical parameters as well as for hand hygiene practices (Tables 3 and 4).

The study was approved by the local ethics committee at the Şişli Hamidiye Etfal Training and Research Hospital, Istanbul, Turkey (approval number:2942/2020) and conducted in accordance with the Declaration of Helsinki.

2.1 | Statistical methods

The descriptive statistics of the evaluated parameters were presented as the mean, standard deviation, minimum and maximum values, and median scores for the numerical variables and as numbers and percentages for the categorical variables. The comparative analyses were

TABLE 3 The description and the comparison of demographical parameters of COVID and non-COVID groups in matched-pair analysis^a

Demographic features	Total number of patients (n = 162)	COVID group (n = 81)	Non-COVID group (n = 81)	P value
Hand eczema, n (%)	44 (27.2)	33 (40.7)	11 (13.6)	<.001
Gender				
Male, n (%)	63 (38.9)	31 (38.3)	32 (39.5)	.872
Female, n (%)	99 (61.1)	50 (61.7)	49 (60.5)	
Age, mean (standard deviation)	29.3 (5.9)	29.3 (5.9)	29.3 (6.0)	.798
Profession				
Physician, n (%)	69 (42.6)	39 (48.1)	30 (37.0)	
Nurse, n (%)	72 (44.4)	35 (43.2)	37 (45.7)	.159
Medical caretaker, n (%)	10 (6.2)	2 (2.5)	8 (9.9)	
Other, n (%)	11 (6.8)	5 (6.2)	6 (7.4)	
Workplace				
Inpatient clinic, n (%)	127 (78.4)	70 (86.4)	57 (70.4)	
Intensive care unit, n (%)	14 (8.6)	4 (4.9)	10 (12.3)	.041
Emergency unit, n (%)	21 (13.0)	7 (8.7)	14 (17.3)	
Working years, (month), median (range)	36 (1-384)	36 (1-348)	60 (12-384)	.001
Weekly work hours, median (range)	45 (24-168)	45 (24-168)	45 (30-100)	.066
History of personal atopy, n (%)	44 (27.2)	22 (27.2)	22 (27.2)	>.99
Atopic dermatitis and/or atopic skin, n (%)	26 (16.0)	13 (16.0)	13 (16.0)	>.99
History of familial atopy, n (%)	26 (16.0)	13 (16.0)	13 (16.0)	>.99
History of metal allergy, n (%)	15 (9.3)	9 (11.1)	6 (7.4)	.588
History of glove allergy (type 4), n (%)	18 (11.1)	6 (7.4)	12 (14.8)	.134
Generalized dry skin, n (%)	42 (25.9)	21 (25.9)	21 (25.9)	>.99
History of hand eczema in the past year, n (%)	39 (24.1)	17 (21.0)	22 (27.2)	.358
Additional housework at home, n (%)	113 (69.8)	46 (56.8)	67 (82.7)	<.001
Smoking status				
Nonsmoker, n (%)	96 (59.3)	50 (61.7)	46 (56.8)	.522
Smoker (current or ex-smoker), n (%)	66 (40.7)	31 (38.3)	35 (43.2)	

Note: Categorical variables were compared using the chi-square test and nonparametric continuous variables were compared using the Mann-Whitney *U* test. Statistically significant *P* values are highlighted in bold.

Abbreviation: COVID, coronavirus disease.

^aTwo groups were matched at a ratio of 1: 1 for age (within a range of ± 5 years), history of personal atopy, atopic dermatitis and/or atopic skin, history of familial atopy, and generalized dry skin.

performed using the Student *t* test when there was a normal distribution and the Mann-Whitney *U* test when there was a non-normal distribution. The comparison was performed using the Kruskal-Wallis test when there were more than two groups. A matched-pairs design was used to exclude several known personal risk factors for HE such as age, personal and familial atopy, and generalized dry skin. The statistical significance was defined as $P < .05$.

3 | RESULTS

The cohort included 244 HCWs (153 females and 91 males). The mean age of the cohort was 30.6 (standard deviation 7.3) years. The demographic and clinical parameters, as well as the hand hygiene

practices at work and at home are summarized in Tables 1 and 2. HE was significantly more frequent ($P < .001$) in the COVID group. The mean age of individuals ($P < .05$), working years ($P < .001$), weekly work hours ($P < .05$), and additional housework at home ($P < .001$) were significantly higher in the non-COVID group. HCWs in the COVID group were more frequently working in inpatient clinics, whereas those in the non-COVID group were more frequently working in the emergency units. AD/atopic skin was significantly more frequent in the COVID group ($P < .05$).

The number of patients who never use moisturizing creams after handwashing at work was higher in the non-COVID group ($P < .001$). Handwashing at home five to ten times a day was more common in the non-COVID group, whereas 11 to 20 times a day was more frequent in the COVID group ($P < .05$).

TABLE 4 The description and the comparison of hand hygiene practices of the COVID and non-COVID groups in matched-pair analysis

Hand hygiene practices	Total number of patients (n = 162)	COVID group (n = 81)	Non-COVID group (n = 81)	P value
At work				
Frequency of handwashing				
<5 times a shift, n (%)	4 (2.5)	3 (3.7)	1 (1.2)	
5-10 times a shift, n (%)	18 (11.1)	9 (11.1)	9 (11.1)	.771
11-20 times a shift, n (%)	52 (32.1)	25 (30.9)	27 (33.4)	
>20 times a shift, n (%)	88 (54.3)	44 (54.3)	44 (54.3)	
Frequency of use of alcohol-based disinfectants				
<5 times a shift, n (%)	20 (12.3)	11 (13.6)	9 (11.1)	
5-10 times a shift, n (%)	39 (24.1)	22 (27.2)	17 (21.0)	.695
11-20 times a shift, n (%)	41 (25.3)	20 (24.7)	21 (25.9)	
>20 times a shift, n (%)	62 (38.3)	28 (34.5)	34 (42.0)	
Frequency of glove use				
<5 times a shift, n (%)	15 (9.3)	6 (7.4)	9 (11.1)	
5-10 times a shift, n (%)	30 (18.5)	13 (16.0)	17 (21.0)	.404
11-20 times a shift, n (%)	36 (22.2)	22 (27.2)	14 (17.3)	
>20 times a shift, n (%)	81 (50.0)	40 (49.4)	41 (50.6)	
Frequency of use of moisturizing creams after handwashing				
Never, n	91 (56.2)	29 (35.8)	62 (76.5)	
<50%, n (%)	40 (24.7)	32 (39.5)	8 (9.9)	<.001
50%, n (%)	21 (12.9)	14 (17.3)	7 (8.7)	
>50%, n (%)	7 (4.3)	4 (4.9)	3 (3.7)	
Always, n (%)	3 (1.9)	2 (2.5)	1 (1.2)	
At home				
Frequency of handwashing				
<5 times a day, n (%)	9 (5.5)	5 (6.2)	4 (4.9)	
5-10 times a day, n (%)	64 (39.5)	26 (32.1)	38 (46.9)	.087
11-20 times a day, n (%)	50 (30.9)	32 (39.5)	18 (22.2)	
>20 times a day, n (%)	39 (24.1)	18 (22.2)	21 (26.0)	
Frequency of use of alcohol-based disinfectants				
<5 times a day, n (%)	122 (75.3)	63 (77.8)	59 (72.8)	
5-10 times a day, n (%)	27 (16.7)	13 (16.1)	14 (17.3)	.692
11-20 times a day, n (%)	10 (6.2)	4 (4.9)	6 (7.4)	
>20 times a day, n (%)	3 (1.8)	1 (1.2)	2 (2.5)	
Frequency of use of moisturizing creams after handwashing				
Never, n (%)	51 (31.5)	20 (24.7)	31 (38.3)	
<50%, n (%)	72 (44.5)	37 (45.7)	35 (43.2)	.212
50%, n (%)	20 (12.3)	14 (17.3)	6 (7.4)	
>50%, n (%)	8 (4.9)	4 (4.9)	4 (4.9)	
Always, n (%)	11 (6.8)	6 (7.4)	5 (6.2)	

Note: Statistically significant P-values are highlighted in bold.

Abbreviation: COVID, coronavirus disease.

HCWs in the COVID group significantly increased the frequency of moisturizer use after the development of HE in comparison to those in the non-COVID group (78.2% vs 20.0%, $P < .001$; odds ratio 5.8, 95% confidence interval [CI] 2.1-15.9),

even those with severe HE. No lessening in the frequency of handwashing and the use of alcohol-based disinfectants in both groups was reported. Topical corticosteroids were used in 40% and 26.7% in the COVID and non-COVID groups, respectively,

TABLE 5 Clinical characteristics of patients with hand eczema (n = 73) in the COVID and non-COVID groups

Clinical features	COVID (n = 57)	Non-COVID (n = 16)
One hand, n (%)	4 (7.0)	5 (31.2)
Both hands, n (%)	53 (93.0)	11 (68.8)
Clinical type		
Irritant contact dermatitis, n (%)	55 (96.5)	14 (87.5)
Allergic contact dermatitis, n (%) ^a	2 (3.5)	1 (6.3)
Atopic hand eczema, n (%)	0 (0)	1 (6.3)
Morphology		
Dyshidrotic/vesicular, n (%)	4 (7.0)	3 (18.8)
Erythema-squamous, n (%)	42 (73.7)	12 (75.0)
Hyperkeratotic/rhagadiform, n (%)	7 (12.3)	1 (6.2)
Combined morphology, n (%)	4 (7.0)	0 (0)
Localizations ^b		
Palm, n (%)	11 (19.3)	3 (18.7)
Dorsum, n (%)	48 (84.2)	9 (56.3)
Finger webs, n (%)	10 (17.5)	3 (18.8)
Sides of finger, n (%)	6 (10.5)	4 (25.0)
Fingertips, n (%)	10 (17.5)	4 (25.0)
Hand and wrist, n (%)	6 (10.5)	4 (25.0)
Periungual eczema and nail eczema, n (%)	2 (3.5)	0 (0)
Pruritus, n (%)	39 (68.4)	7 (43.8)
HECSI, median (range)	24 (3-84)	3 (1-32)
Eczema severity ^c		
Mild, n (%)	15 (26.2)	12 (75.0)
Moderate, n (%)	21 (36.8)	3 (18.8)
Severe, n (%)	21 (36.8)	1 (6.3)

Abbreviations: COVID, coronavirus disease; HECSI: Hand Eczema Severity Index.

^aAllergic contact dermatitis was diagnosed by dermatological examination and patch test results.

^bSome patients had lesions in more than one location.

^cHECSI—0-11 points: mild eczema; 12-27 points: moderate eczema, >27 points: severe eczema.

without a significant difference between the groups regarding the severity of HE.

A matched-pair analysis to exclude personal risk factors confirmed the significantly higher share of HE in the COVID group ($P < .001$). Similar to the overall cohort, working years ($P < .05$), additional housework at home ($P < .001$), and the number of patients who never use moisturizing creams after handwashing at work were higher in the non-COVID group ($P < .001$). In addition, the matched-pair analysis showed that working in intensive care unit was higher in the non-COVID group (Tables 3 and 4).

The clinical features of the participants with HE are detailed in Table 5. Irritant contact dermatitis and erythema-squamous

morphology were the most common clinical features in both groups. The median HECSI score was 24 (range 3-84) in the COVID group, and 3 (range 1-32) in the non-COVID group. HE was severe in 36.8% and 6.25% of the COVID and non-COVID groups, respectively (Fisher exact test, $P < .05$; odds ratio 6.5, 95% CI 0.9-46.1). In particular, HE was mild in 75% of the participants in the non-COVID group.

4 | DISCUSSION

The share of HE among HCWs was 29.9% in this study. HE was significantly more frequently observed in the COVID group (48.3%) than in the non-COVID group (12.7%). Various skin symptoms have been reported among HCWs owing to the use of protective equipment and frequent handwashing practices during the pandemic period.^{6,11} HE was the most important and frequently detected skin reaction.⁶⁻⁹ The frequency of HE was 50.5% in our previous study, which evaluated the development of HE among HCWs working in COVID-19 units only.⁸ A previous study⁸ and this study were conducted by face-to-face examination of the participants by a team of dermatologists. Lan et al⁶ reported a higher share of HE (74.5%) among HCWs investigated using self-administered online questionnaires. In another study on HCWs working in the COVID and non-COVID units, the self-reported isolated symptoms of acute hand dermatitis such as erythema, itching, scaling, pain, and burning were as high as 90.4%⁷; interestingly, in that study, the self-reported HE was only 14.9%, without a significant difference between the two groups.

The development of irritant HE is known to be associated with individual risk factors such as AD/atopic skin and filaggrin mutation, and with certain environmental risk factors such as frequent handwashing and use of occlusive gloves. Personal and/or familial atopy, in particular AD, are considered as independent risk factors for the development of HE among HCWs in many studies conducted prior to the pandemic.^{3,4,12-14} The reduced skin barrier function in both the affected and unaffected skin of patients with AD¹⁵ was suggested to predispose patients with AD to the development of HE by decreasing their tolerability to skin irritants.¹⁶ Therefore, a matched-pair analysis was performed to evaluate the effect of environmental risk factors by excluding the individual risk factors that might be associated with the development of HE, which showed that there was no significant difference between the COVID and non-COVID groups regarding the frequency of handwashing, use of disinfectants, and use of gloves before the development of HE.

Handwashing more than 20 times/shift, having water exposure for more than 2 hours/shift, and occlusive glove use for more than 2 hours/shift were defined as "wet work," and were reported as the most important environmental irritant factors increasing the risk of HE.^{17,18} Handwashing frequency over 20 times daily was described as an independent risk factor for the development of HE in HCWs.^{4,14} However, these irritant factors were not identified as independent risk factors for HE in this study. Hamnerius et al² reported a dose-dependent association between handwashing with water-soap and HE. It might be assumed that the handwashing frequency of HCWs

increased in the pandemic period. Indeed, Guertler et al⁷ reported that the frequency of handwashing was between 20 and 30 times a day in 27.4% of HCWs, and over 30 times a day in 5.3% of them during the COVID-19 period, which was significantly higher than the rates in the pre-pandemic period. Higher shares of handwashing (>20 times/day) at work were observed in the present study in both the COVID (61%) and non-COVID groups (57.1%). This was unexpectedly high, especially for the non-COVID group, as HE was significantly more frequent in the COVID group. Factors other than the frequency of handwashing might have played a role, such as the duration of handwashing or the type of the soap used. Furthermore, a higher threshold for the frequency of handwashing, such as 30 to 40 times a day or even higher, might help differentiate both groups more properly, especially during the pandemic scenario.

Exposure to irritant factors such as water, soap, and glove was reported to vary among HCWs working in different departments and units.¹⁹ Wet work activities were reported to have increased in the regular wards, whereas the frequency of glove use was higher in intensive care units during the pre-pandemic period.¹⁹ Accordingly, an increased risk for the development of HE was reported among HCWs working in intensive care units and/or regular wards.^{5,12,20} By contrast, no association between the HE risk and the working unit could be demonstrated in this study and in some other studies.^{13,14}

Interestingly, HCWs in the non-COVID group in this study had a higher share of working years and additional housework, the latter probably due to the prohibition of HCWs in the COVID group from doing housework due to social isolation from other family members at home. Additional wet work at home might be regarded as an additional irritant factor due to increased exposure to water/soap. Lan et al²⁰ showed that there was a positive correlation between the risk of HE in HCWs and the duration of work. Indeed, the longer duration of work and additional housework were more frequently associated with the development of HE in the non-COVID group, although this was not statistically significant.

As a striking finding, the frequency of moisturizer use after handwashing was higher in individuals with HE in this study. The use of moisturizer is one of the most important skincare precautions recommended to prevent the development of HE. Moisturizers provide a protection against HE by supporting the regeneration of epidermal barrier.²¹ Kütting and Drexler²² demonstrated the protective role of moisturizer against HE in their prospective randomized controlled study on metalworkers. Diepgen et al²³ recommended the use of moisturizers particularly after work and before bedtime. They suggested lighter lotion forms during daytime, and lipid-rich forms before bedtime.²³ Previous studies showed a successful protective effect of the moisturizer on the development of HE.^{4,12} As an interesting finding, however, some recent studies before the pandemic^{14,24} and the present study showed that the frequency of the moisturizer use was higher in individuals who developed HE. Luk et al¹⁴ stated that patients with

HE had a greater tendency to use moisturizers and that most of them used moisturizers as a therapeutic rather than as a preventive measure. Similar findings are reported in this study during the pandemic conditions, that is, only a minority of HCWs with HE used topical corticosteroids, whereas a majority increased the frequency of moisturizer use after the development of HE, especially those in the COVID group and those with severe HE. HCWs who developed HE and were unable to see a dermatologist during the pandemic period increased the use of the moisturizer instead of receiving an appropriate treatment for their eczema. These data supported the previous suggestion by Luk et al¹⁴ that individuals used moisturizers for the purpose of treating eczema as well. Moreover, only 20% of HCWs reduced the frequency of handwashing and/or disinfectant use after the development of HE, probably as a result of the fear of virus contamination.

Occupational HE in HCWs is a well-known problem that became more prominent during the pandemic period. Skin protection programmes and guidelines for the prevention of HE, which were developed before the pandemic,^{23,25} have regained importance during the COVID-19 pandemic, during which hand hygiene became crucial for preventing transmissions. The importance of using alcohol-based hand disinfectants rather than water and soap, if hands are not visibly dirty, was highlighted²⁶⁻²⁸ as well as wearing cotton gloves under the medical gloves to reduce sweating and irritation, if gloves should be worn for a long time.²⁸ Moreover, regular use of moisturizers after handwashing and before wearing gloves was underlined.²⁵ A lipid-rich moisturizer should be used at night; then, cotton gloves or loose plastic gloves should be worn to create an occlusive barrier.²⁵ All products which come into contact with hands (eg, soap, moisturizer, disinfectants) should be fragrance and preservative free.²⁶⁻²⁸ In addition to these, it was recommended that patients with severe and persistent HE should be evaluated by the dermatologists.²⁵⁻²⁷ It is utmost important for HCWs to follow these recommendations as there is an increased exposure to skin-irritating factors such as frequent handwashing and use of disinfectants and gloves owing to the pandemic conditions. However, a considerable number of HCWs in this study did not comply with these recommendations, considering that almost one-third of HCWs in the COVID group and three-fourth of HCWs in the non-COVID group never used moisturizing hand creams after handwashing in the hospital.

The main limitation of this study was that the number of the participants was not high; however, it might be adequate when considering the special pandemic conditions. The main strength of this study was that all participants were evaluated by face-to-face examinations by dermatologists.

5 | CONCLUSION

Our study showed that the risk of HE was significantly increased in HCWs working in COVID-19 units, when compared with those in non-COVID-19 units. The most striking finding was that HCWs who

were unable to contact a dermatologist continued to use a moisturizer for the purpose of treating their HE. The frequency of moisturizer use was higher in those with severe HE. There is need for a better approach to the prevention and management of HE in HCWs during the pandemic conditions, especially by facilitating access to the dermatologists.

CONFLICTS OF INTEREST

There are no conflicts of interest.

AUTHOR CONTRIBUTIONS

Yasemin Erdem: Conceptualization; data curation; formal analysis; investigation; methodology; resources; software; writing-original draft; writing-review & editing. **Sena Inal:** Data curation; investigation; software. **Onur Sivaz:** Data curation; investigation; software. **Sevkiye Copur:** Data curation; investigation; software. **Kubra Boluk:** Data curation; investigation; software. **Ece Ugurer:** Data curation; investigation; software. **Hazel Kaya:** Data curation; investigation; software. **Ilayda Gulsunay:** Data curation; investigation; software. **Gul Sekerlisoy:** Data curation; investigation; software. **Osman Vural:** Data curation; investigation; software. **Ilknur Altunay:** Data curation; investigation; methodology. **Aslı Aksu Çerman:** Data curation; investigation; methodology. **Esen Özkaya:** Conceptualization; formal analysis; investigation; methodology; project administration; resources; supervision; writing-original draft; writing-review & editing.

DATA AVAILABILITY STATEMENT

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