



# Hand eczema, wet work exposure, and quality of life in health care workers in Denmark during the COVID-19 pandemic

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**Background:** The focus on hand hygiene during the pandemic has been reported to increase the hand eczema (HE) prevalence in health care workers (HCWs); however, detailed prospective data are missing.

**Objective:** To evaluate changes in HE prevalence, exposures, and health-related quality of life among HCWs during the COVID-19 pandemic.

**Methods:** In this prospective cohort study, HCWs employed at the hospitals in Copenhagen responded to a digital questionnaire at the beginning of the pandemic and 11 months thereafter.

**Results:** A total of 795 HCWs responded to both questionnaires (83.4% women). The calculated 1-year HE prevalence decreased from 16.0% at baseline to 13.0% at follow-up. The number of hand washings decreased significantly, whereas the use of alcohol-based hand rubs on wet skin increased significantly. In a logistic regression model, increased use of alcohol-based hand rubs on wet skin was associated with HE at follow-up (odds ratio, 1.78; 95% CI, 1.11-2.87). Health-related quality of life worsened slightly at follow-up, with HE severity and frequent flareups being risk factors for a reduced health-related quality of life.

**Limitations:** Sample size.

**Conclusion:** In contrast to previous studies undertaken during the pandemic, we found a relatively low and stable HE prevalence. Our findings suggest that the interaction between changed exposures and HE is complex and cannot be linked to a single factor. (JAAD Int 2022;7:86-94.)

**Key words:** COVID-19; epidemiology; hand eczema; health-related quality of life; risk factors; dermatitis.

## INTRODUCTION

Hand washings, use of alcohol-based hand rubs (ABHRs), and gloves are important preventive measures prohibiting the transmission of microorganisms, including SARS-CoV-2, in the health care sector.<sup>1,2</sup> However, hand washings and glove use are also well-known risk factors for the development of hand eczema (HE). Studies evaluating the prevalence of HE during the pandemic found that up to

33% of health care workers (HCWs) reported HE,<sup>3-7</sup> and an even higher prevalence was reported in studies with symptom-based HE diagnosis,<sup>8,9</sup> with an increased frequency of hand washings and use of ABHRs during the pandemic as suggested causes.<sup>3-5</sup> However, detailed cohort data are lacking, and a more thorough evaluation of the interplay between HE prevalence and wet work exposures is needed. The use of ABHRs has not previously been

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considered a risk factor for skin barrier damage<sup>10</sup>; however, irritation of the skin as an effect of ABHRs being applied to wet skin has recently been suggested.<sup>11,12</sup>

The enormous workload and fear of being infected with the virus causing COVID-19 have affected the well-being of HCWs.<sup>13,14</sup> HE is known to have a negative influence on the health-related quality of life (HRQOL),<sup>15</sup> and occupational stress, in addition, is anticipated further to worsen the HRQOL. However, HRQOL data in HCWs with HE during the pandemic are limited.<sup>16,17</sup>

In this study, we aimed to evaluate changes in the prevalence of HE, wet work exposures, and the HRQOL in HCWs with HE in a prospective follow-up study undertaken during the COVID-19 pandemic.

## MATERIALS AND METHODS

### Study design and population

This study is a prospective follow-up study to a previous survey conducted between April and May 2020, where 2125 of 4886 HCWs responded to a digital questionnaire regarding HE in the past 12 months and exposures.<sup>12</sup> In February 2021, a follow-up digital questionnaire was distributed to 1663 of the 2125 participants from the previous survey, who had agreed to being contacted again and provided an email address (Fig 1). For inclusion in the study, the HCWs were required to be actively employed during the study period (Fig 1).

The participants were nurses; auxiliary nurses; physicians; and a mixed group of biotechnicians, physiotherapists, and midwives from clinical departments of 4 hospitals in the Greater Copenhagen area, Denmark. During the pandemic, nurses and physicians in particular, were invited to work overtime in the departments with patients with COVID-19 or temporarily moved to departments with patients with COVID-19. Consequently, the HCWs cannot be grouped as COVID versus non-COVID staff.

### Baseline questionnaire

The baseline questionnaire comprised questions on HE and exposures.<sup>12</sup> The HRQOL in HCWs with HE was assessed by Quality of Life Hand Eczema Questionnaire (QOLHEQ).<sup>18</sup>

### Follow-up questionnaire

The follow-up questionnaire was distributed between February 2, 2021 and February 16, 2021, using SurveyXact (Aarhus, Denmark). A digital reminder was sent after 1 week. The follow-up questionnaire comprised questions on HE (since the outbreak of COVID-19) and exposures partly based on questions from the Nordic Occupational Skin Questionnaire (NOSQ-2002)<sup>19</sup> and some additional questions developed by the research group. QOLHEQ was used to evaluate the HRQOL in HCWs with HE. None of the questions were mandatory.

### Variables

The prevalence of HE at follow-up was self-reported (“Have you had HE since March 1, 2020?”), and incident cases of HE were evaluated by new HE cases since the baseline questionnaire and the question, “Did you develop HE for the first time during the pandemic (since March 1, 2020)?” The HE severity was assessed on a visual analog scale ranging from 0 to 10, with 10 indicating very severe eczema. The exposures (hand washings, ABHRs, glove use, use of ABHRs and gloves on wet skin) were reported at both baseline and follow-up, and a change in exposure levels was coded into new variables: “increased,” “decreased,” or “unchanged.”

None of the included clinical departments were exclusively for patients with COVID-19, as most departments were exposed to patients with COVID-19 to some extent. Therefore, we decided to code the departments into “high exposure departments” and “low exposure departments” based on hospitalization rates of patients with COVID-19 during the study period.

The total QOLHEQ score was divided into 4 categories (minimal impairment, ≤8; slight impairment, 9-25; moderate impairment, 26-58; severe impairment, 59-80).<sup>20</sup>

**Confounders.** History of atopic dermatitis was self-reported at follow-up (“Have you ever had childhood eczema?”), together with data on perceived stress (“How often do you feel stressed?”).<sup>21,22</sup>

### Timing of the study

The study was conducted during the pandemic with the baseline survey in the beginning of the

### CAPSULE SUMMARY

- Despite increased focus on hand hygiene, we found a relatively low hand eczema prevalence in health care workers in contrast with previous studies undertaken during the pandemic
- Our findings suggest that the interaction between exposures and hand eczema is complex and cannot be linked to a single factor.

*Abbreviations used:*

ABHR:	alcohol-based hand rub
CI:	confidence interval
HCW:	health care worker
HE:	hand eczema
HRQOL:	health-related quality of life
OR:	odds ratio
QOLHEQ:	Quality of Life in Hand Eczema Questionnaire

pandemic, where the hospitalization of patients with COVID-19 was at its highest (in March and April 2020), and the follow-up questionnaire was sent just after the second wave in Denmark.

### Statistics

The  $\chi^2$  test was used to compare respondents to nonrespondents. Descriptive statistics were used to characterize the study population and to compare HCWs with incident HE and HCWs without HE. The 1-year prevalence of HE at follow-up was time-corrected by adding 1 month to the calculation. Logistic regression analyses were used to assess exposures associated with HE during the pandemic and for assessment of risk factors for a reduced HRQOL (moderate to severe) in HCWs with HE. Paired *t* test was used to compare the mean QOLHEQ score at baseline with that at the follow-up. Missing data were not imputed and remained missing in all analyses. *P* values of  $<.05$  were considered statistically significant.

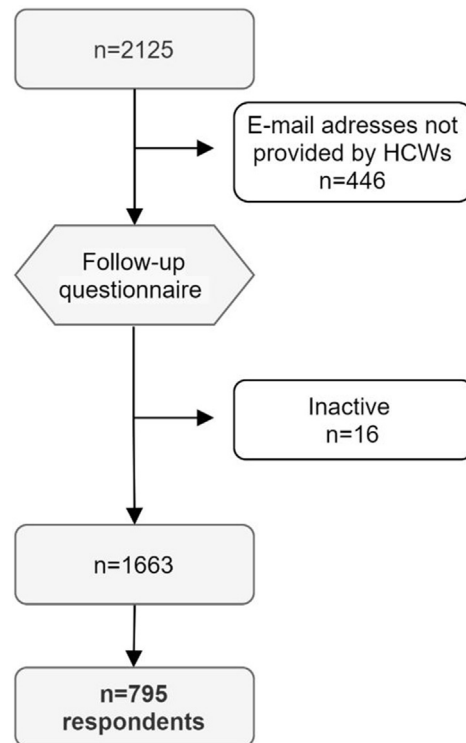
### Ethical considerations

The study was approved by the local ethical committee (no.: H-20007169) and the Danish Data Protection Agency.

## RESULTS

### Background characteristics

A total of 795 HCWs (83.4% women and 16.6% men) were included, giving a response rate of 47.8%. The participants were 458 nurses; 202 physicians; 49 auxiliary nurses; and 86 biotechnicians, physiotherapists, and midwives (mixed group). A total of 451 (56.8%) HCWs were employed at departments with high exposure to patients with COVID-19. The background characteristics of respondents and nonrespondents are given in Table I. HCWs with HE and HCWs with a history of atopic dermatitis were evenly distributed between respondents and nonrespondents. The respondents were significantly older than the nonrespondents, with an even distribution between men and women (Table I).



**Fig 1.** Flowchart illustrating the inclusion of participants in the study cohort. A total of 795 HCWs were included in the study. *HCW*, Health care worker.

### Prevalence of HE

The calculated 1-year prevalence was 16.0% at baseline and 13.0% at follow-up. At baseline, the point-prevalence was 6.4%, and at follow-up, it was 6.9%. The HE severity was 1.7 and 3.0 at baseline and follow-up, respectively ( $P < .001$ ). When comparing the HE prevalence at baseline with that at follow-up grouped by sex, age, profession, and departments, no overall differences were observed (Supplementary Table I, available via Mendeley at <https://data.mendeley.com/datasets/kyp8xcbrgp/1>).

Of the 93 HCWs with HE at follow-up, 22 had the onset of HE since the outbreak, giving an incidence rate of 34 cases per 1000 person-years during the pandemic. A comparison of HCWs with incident HE and HCWs without HE with respect to demographics and exposures is given in Supplementary Table II (available via Mendeley at <https://data.mendeley.com/datasets/kyp8xcbrgp/1>).

### Change of exposures during the study period

The changes in hand washings, use of ABHRs and gloves on dry and wet skin, respectively, and nonoccupational wet work are shown in (Fig 2, A). The use of moisturizers increased in 73.5% of all HCWs from baseline to follow-up. In a subgroup

**Table I.** Background characteristics of respondents and nonrespondents

Demographics	Respondents n (%)	Row pct.	Nonrespondents n (%)	P value $\chi^2$ test
Total	795	47.8	868	
Sex				.298
Female	663 (83.4)	47.3	740 (85.3)	
Male	132 (16.6)	50.8	128 (14.7)	
Age, y				<b>&lt;.001*</b>
23-29	93 (11.7)	39.4	143 (16.5)	
30-39	172 (21.7)	37.9	282 (32.5)	
40-49	195 (24.6)	47.3	217 (25.0)	
50-59	193 (24.3)	57.1	145 (16.7)	
>60	141 (17.8)	63.8	80 (9.2)	
Profession				
Nurse	458 (57.6)	47.9	498 (57.4)	
Auxiliary nurse	49 (6.2)	43.0	65 (7.5)	
Physician	202 (25.4)	47.4	224 (25.8)	
Mixed group	86 (10.8)	51.5	81 (9.3)	
Department (baseline)				<b>&lt;.001*</b>
Surgical	223 (28.1)	46.3	259 (29.9)	
Medical	300 (37.8)	48.5	318 (36.7)	
Emergency	61 (7.7)	43.0	81 (9.3)	
Anesthetics + intensive care	91 (11.5)	42.3	124 (14.3)	
Dermato-Venerology	52 (6.5)	72.2	20 (2.3)	
Pediatrics	24 (3.0)	40.7	35 (4.0)	
Biochemistry/Physiotherapy	43 (5.4)	58.9	30 (3.5)	
History of HE (baseline)				.190
Yes	226 (28.4)	50.4	222 (25.6)	
No	559 (71.6)	46.8	646 (74.4)	
History of atopic dermatitis (baseline)				.501
Yes	135 (17.3)	50.6	132 (16.0)	
No	594 (76.1)	48.6	627 (76.0)	
Do not know	52 (6.7)	44.1	66 (8.0)	

HE, Hand eczema; pct., percentage.

\*Statistically significant values are shown in bold.

analysis of only HCWs with HE, the same overall pattern was observed; however, the hand washings did not decrease significantly (Fig 2, B).

In the multivariate logistic regression analysis including all wet work exposures, increased use of ABHRs on wet skin was associated with HE at follow-up (adjusted odds ratio [OR], 1.78; 95% confidence interval [CI], 1.11-2.87) (Supplementary Table III, available via Mendeley at <https://data.mendeley.com/datasets/kyp8xcbrgp/1>). Increased use of moisturizer was not associated with HE in the univariate or multivariate analysis (Supplementary Table III).

### Atopic dermatitis and work-related factors

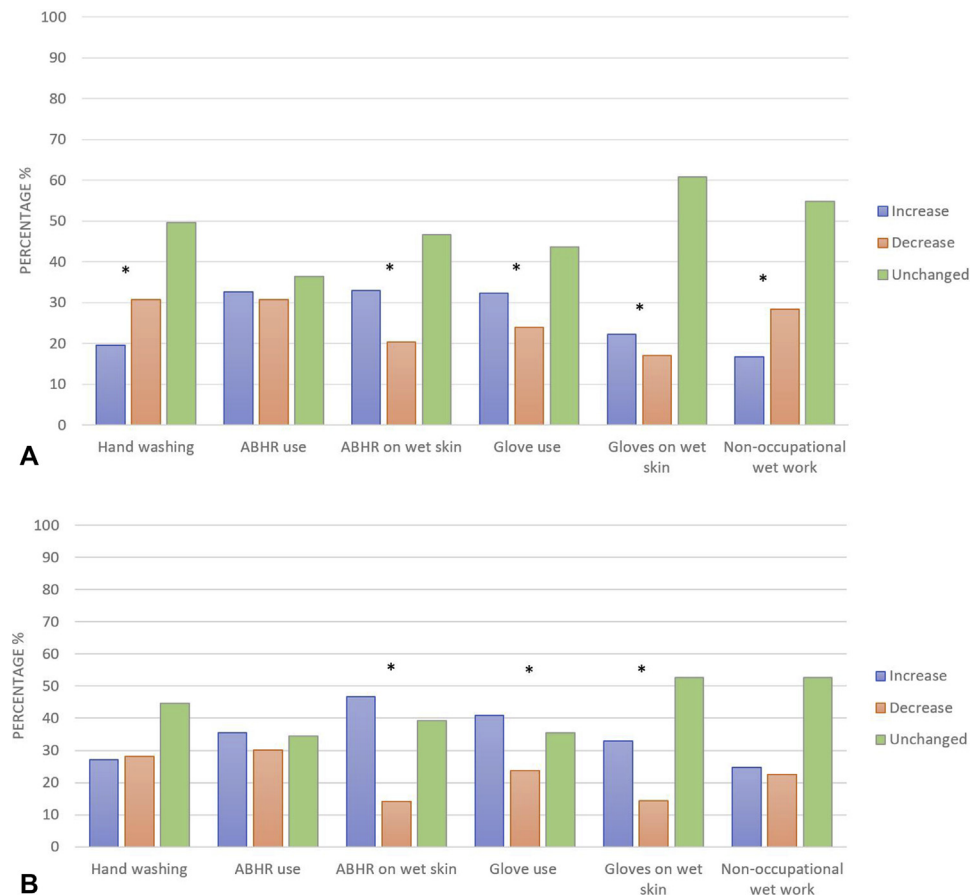
The onset of HE during the pandemic was more often reported by HCWs with atopic dermatitis compared with those without atopic dermatitis (Supplementary Table II). Atopic dermatitis was strongly associated with HE at follow-up (adjusted

OR, 9.04; 95% CI, 5.21-15.68) (Supplementary Table IV, available via Mendeley at <https://data.mendeley.com/datasets/kyp8xcbrgp/1>). In a subgroup analysis of HCWs with atopic dermatitis, we found no association between changed exposures and HE at follow-up (Supplementary Table III).

Working at a department with high exposure to patients with COVID-19 did not increase the risk of HE (adjusted OR, 0.92; 95% CI, 0.56-1.53) (Supplementary Table IV). During the pandemic, the nurses and auxiliary nurses were at increased risk of developing HE compared with physicians (adjusted OR, 2.01; 95% CI, 1.03-3.92 and adjusted OR, 3.19; 95% CI, 1.09-9.36, respectively) (Supplementary Table IV).

### HRQOL in HCWs with HE

The QOLHEQ was answered by 184 HCWs with HE at baseline and by 172 at follow-up. The total QOLHEQ score increased from 16.0 at baseline to



**Fig 2.** A, Bar plot showing the change of exposures from baseline to follow-up in all HCWs ( $N = 795$ ). The use of ABHRs on the wet skin and gloves on the dry and wet skin, respectively, increased more than it decreased during the pandemic. The number of hand washings decreased more than it increased. The use of ABHRs increased with the same magnitude as it decreased. Statistically significant difference in change of exposures between baseline and follow-up is marked with asterisk (Wilcoxon Signed Rank Test). **B**, Bar plot showing the change of exposures from baseline to follow-up in HCWs with HE ( $N = 93$ ). The use of ABHRs on the wet skin and gloves on the dry and wet skin, respectively, increased more than it decreased during the pandemic. Hand washings, the use of ABHRs, and nonoccupational wet work increased with the same magnitude as they decreased. Statistically significant difference in change of exposures between baseline and follow-up is marked with asterisk (Wilcoxon Signed Rank Test). *ABHR*, Alcohol-based hand rub; *HCW*, health care worker; *HE*, hand eczema.

18.3 at follow-up ( $P = .290$ ) (Table II). The change in QOLHEQ scores was evaluated in HCWs responding to QOLHEQ at both baseline and follow-up, and 58 (47.9) deteriorated, 53 (43.8) improved, and 10 (8.3) remained unchanged at the follow-up.

A reduced HRQOL was associated with increasing self-reported severity and frequent flares at follow-up (Table III).

## DISCUSSION

In this cohort study, the 1-year HE prevalence declined from 16.0% at baseline, 1 month since the start of the pandemic, to 13.0% at the follow-up

11 months later. During this period, the number of hand washings decreased, whereas the use of ABHRs on wet skin increased markedly, together with an increase in the use of gloves. The increased exposure to ABHRs on wet skin was significantly associated with HE. During the pandemic, the HRQOL worsened slightly, with HE severity and frequent flares being risk factors for a reduced HRQOL in HCWs with HE.

Despite the increased focus on intensive hand hygiene measures and several studies suggesting increasing prevalence of HE during the pandemic, we found a slightly decreasing prevalence during

**Table II.** Characterization of HRQOL, HE severity, and perceived stress in HCWs with HE

Variables	Baseline	Follow-up
	n (%)	n (%)
QOLHEQ score (mean)	16.0 (range 0-78)	18.3 (range 0-83)
Minimal ( $\leq 8$ )	80 (43.5)	56 (32.6)
Slight (9-25)	55 (29.9)	64 (37.2)
Moderate (26-58)	47 (25.5)	50 (29.1)
Severe (59-80)	2 (1.1)	2 (1.2)
HE severity (0-10) (mean)	1.7 (range 0-10)	3.0 (range 1-10)
HE flares		
Once	58 (43.3)	34 (33.0)
Several times	76 (56.7)	69 (67.0)
Perceived stress		
Never/a few times	85 (37.6)	88 (35.5)
Monthly	86 (38.1)	80 (32.2)
Weekly	33 (14.6)	50 (20.2)
A few times per week	15 (6.6)	22 (8.9)
Most of the week	7 (3.1)	8 (3.2)

HCW, Health care worker; HE, hand eczema; HRQOL, health-related quality of life; QOLHEQ, Quality of Life Hand Eczema Questionnaire.

this period. Similar to our findings, the prevalence was 14.9% in German HCWs<sup>3</sup>; however, the prevalence was between 29% and 33% in other European studies and up to 90.4% in Asian studies,<sup>5,7-9</sup> Although the prevalence declined from baseline to follow-up, the HE severity worsened significantly. The increased use of ABHRs on wet skin and increased use of gloves (on dry and wet skin) in HCWs with HE may have had an impact on the worsening of the HE symptoms.

The observed decrease in the prevalence during the study period likely reflects the change of exposures reported in our study. The reduced number of hand washings may have contributed to the lower HE prevalence since it is a well-known risk factor for HE.<sup>10,23</sup> At the same time, however, the exposure to ABHRs on wet skin increased markedly and was significantly associated with HE at follow-up, which is in alignment with an experimental study indicating that ABHRs may induce a skin barrier disruption when applied on wet or moist skin,<sup>11</sup> as opposed to findings on ABHRs on dry skin.<sup>10</sup> Thus, it can be anticipated that the risk of applying ABHRs on wet skin increases with the increased use of ABHRs. Moreover, the change in the exposures reflects the efficacy of hand hygiene recommendations given by the Danish health authorities, who recommend fewer hand washings and increased use of ABHRs.

The prolonged use of gloves has previously been identified as a risk factor for HE,<sup>12,23</sup> and the slightly increased exposure in our study may have facilitated the skin barrier damage. Moreover, the increased information campaigns on skin protective measures facilitated in the public media and in hospitals in relation to the pandemic may have resulted in a behavioral change in HCWs.<sup>24,25</sup> Accordingly, the use of moisturizers increased considerably in HCWs and may have had a preventive effect with respect to HE.<sup>26</sup> The increased use was, however, not directly related to the HE prevalence, indicating that the behavior has changed not only in HCWs with HE but also in those without HE. Taken together, these findings suggest that the change in the prevalence of HE is caused by a complex interplay between several exposures rather than 1 single driving factor.

In our study, working in departments with high exposure to patients with COVID-19 did not increase the risk of HE at follow-up as previously reported.<sup>5,7</sup> Because the patients with COVID-19 were distributed to different departments throughout the pandemic, it was not possible for us totally to separate COVID-19 exposed HCWs from those not exposed to COVID-19. We found a higher risk of HE in nurses and auxiliary nurses than in physicians, which could be explained by the fact that nurses and auxiliary nurses are more involved in the primary care of patients, resulting in higher exposure to wet work. Taken together, these findings indicate that the risk of HE is more likely related to the profession and work tasks than the individual department.

HCWs with HE may have been more affected by the consequences of the pandemic, owing to the disabling nature of HE. In HCWs with HE, HRQOL worsened during the pandemic. Although not significantly, it is important to pay attention to this group because 47.9% of the HCWs reported a deteriorated HRQOL. Although an association to the working environment was hypothesized, a reduced HRQOL appeared to be associated only with HE severity and frequency of flares; nevertheless, it cannot be ruled out that the responses in the QOLHEQ questionnaire may be affected by the present psychosocial state of the individual respondents. In a recent study, an improvement in the HRQOL score was observed in HCWs receiving actual moisturizers compared with HCWs only receiving recommendations on skin protection,<sup>17</sup> implying that early and effective treatment/prevention of HE is of great value for HCWs.

### Strength and limitations

To our knowledge, this is the first cohort study that evaluates change in HE prevalence and exposures in HCWs during the pandemic. A limitation of

**Table III.** Risk factors for a reduced HRQOL in HCWs with HE at follow-up (N = 172)\*

Variables	Univariate	Multivariate <sup>†</sup>
	OR (95% CI)	OR (95% CI)
Sex		
Male (n = 18)	Ref	
Female (n = 154)	1.80 (0.57-5.71)	0.60 (0.08-4.35)
Age	1.00 (0.98-1.03)	1.00 (0.95-1.05)
Profession		
Physician (n = 37)	Ref	
Nurse (n = 107)	2.02 (0.84-4.83)	1.61 (0.37-6.94)
Auxiliary nurse (n = 13)	1.72 (0.42-7.06)	1.52 (0.17-13.16)
Mixed group (n = 15)	2.33 (0.65-8.33)	0.18 (0.01-3.44)
HE severity (0-10)	<b>1.73 (1.42-2.12)<sup>‡</sup></b>	<b>1.54 (1.15-2.07)<sup>‡</sup></b>
HE flares		
Once in a year (n = 32)	Ref	
Several times (n = 68)	<b>4.49 (1.72-11.75)<sup>‡</sup></b>	<b>3.03 (0.97-9.49)<sup>‡</sup></b>
Self-reported change of HE symptoms		
Improved/unchanged (n = 58)	Ref	
Deteriorated (n = 47)	<b>3.29 (1.49-7.29)<sup>‡</sup></b>	2.56 (0.89-7.42)
Atopic dermatitis		
No (n = 69)	Ref	
Yes (n = 74)	1.35 (0.66-2.73)	1.49 (0.40-5.52)
Do not know (n = 28)	0.84 (0.31-2.27)	0.78 (0.14-4.45)
Perceived stress		
Never/a few times (n = 108)	Ref	
>Monthly (n = 63)	0.99 (0.51-1.92)	1.56 (0.45-5.44)
Guidance on HE at work		
Yes (n = 101)	Ref	
No (n = 68)	1.81 (0.95-3.46)	1.93 (0.61-5.50)

CI, Confidence interval; HCW, health care worker; HE, hand eczema; HRQOL, health-related quality of life; OR, odds ratio; Ref, reference.

\*A reduced HRQOL was defined as a Quality of Life Hand Eczema Questionnaire score >26 (moderate to severe).

<sup>†</sup>Following variables were included in the multivariate model: sex, age, profession, HE severity, HE flares, change of HE symptoms, atopic dermatitis, perceived stress, and guidance on HE at work.

<sup>‡</sup>Statistically significant values are shown in bold.

our study was the small sample size; nevertheless, it is markedly larger than other studies evaluating the prevalence during the pandemic.<sup>3-5,8</sup> A response rate of 47.8% could be considered a limitation; however, it is similar to the average response rate found in most surveys today.<sup>27</sup> We found no differences between respondents and nonrespondents with respect to previous HE or atopic dermatitis, making selection bias an unlikely influence on our study. The distribution of men (16.6%) and women (83.4%) reflected the work force. Because our study was based on self-reports, recall bias may occur. The population comprised Danish HCWs only; thus, our results may only be generalizable to working environments comparable to Danish hospitals. Because of the time-corrected estimate, the 1-year prevalence of HE at follow-up is subject to some uncertainty; however, it is comparable with a German study conducted in the same period.<sup>3</sup> The diagnosis-based self-reported HE has been validated for use in epidemiological studies; however, an

underestimation of the true 1-year prevalence may be present.<sup>28</sup> Clinical examinations of all participants at different time points during a year would have strengthened the study; however, it may be linked to other limitations, such as a smaller sample size. Because most departments were exposed to patients with COVID-19 to some extent, a total division of the departments into units with and without patients with COVID-19 was not possible.

## CONCLUSION

Despite an increasing focus on hand hygiene during the study period because of the pandemic, we found a slightly declining HE prevalence but a significant worsening of the HE severity. With regard to change in the exposures, we found a reduction in the number of hand washings, however, with an increase in the use of ABHRs on the wet skin, which was significantly associated with HE, and an increase in glove use. Our findings suggest that the interaction between HE and changed exposures is quite

complex and cannot be linked to a single factor. Finally, HE severity and the frequency of flareups were risk factors for a reduced HRQOL, underlining the need for effective secondary prevention in HCWs with HE.

#### Conflicts of interest

None disclosed.

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