

Profile of Occupational Skin Diseases among Saudi Health Care Workers

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Abstract Background: Occupational skin diseases (OSD) are frequently encountered causes of morbidity and disability among health care workers (HCWs). This study was aimed to estimate the prevalence of OSD among Saudi HCWs and to characterize the possible causative factors for OSD. **Methods:** A total of 361 HCWs from eight governmental hospitals were included in this study. A cross sectional self-administered questionnaire survey was employed. Then, an analytical case control study design was adopted to identify the possible risk factors for OSD. **Results:** In this study, the estimated prevalence of OSD among Saudi HCWs was 32%. One hundred sixteen HCWs had either skin eczema (29 cases; 25%) or itchy skin wheals (Urticaria) (87 cases; 75%) caused by activities related to their jobs. In eczema cases, hands were the most affected sites (68.1% of cases). Majority of HCWs diagnosed with hand eczema were nurses (59%) compared to 15.4% of physicians and less than 10% of dentists and lab technicians. Intensive care unit, medical and surgical wards HCWs recorded the highest prevalence 25%, 24% and 19.8% respectively. Hand eczema was significantly higher among females than males HCWs. All affected cases were markedly exposed to wet environment at daily work such as using gloves, cleaning agents or frequent hand washing as well as preparing food and care of children under 4 years at home. **Conclusion:** HCWs are highly susceptible for OSD with a need for discovery of novel biomarkers that will be helpful for diagnosis, monitoring and prevention of OSD.

Keywords: Occupational Dermatitis, Health Care Workers, eczema, Urticaria

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1. Introduction

Occupational skin diseases (OSD) are groups of skin disease that occur due to chemical, physical or biological exposure at the workplace, in which the working environment plays an important role in disease causation or aggravation [1]. Most of the work activities in different jobs involve manual performance that makes the exposure of workers' skin to hazardous agents an inevitable process [2]. At workplace, exposure to chemical hazards including irritants, sensitizing and photosensitizing agents is a common leading cause for OSD [1]. Moreover, physical hazards such as rubbing, mechanical pressure, radiations and temperature extremes have an adverse effect on skin integrity and considered as causal or contributing factors for the disease [1]. OSD ranks among the three most frequent work related diseases [3] with an estimation 20-30% of all occupational diseases [4]. Occupational contact dermatitis represents around 80-90% of OSD [5] and encompasses

two types; allergic contact dermatitis (ACD) and irritant contact dermatitis (ICD), the latter is around four times more frequent [6]. Irritant chemical agents including acids, alkalies, organic solvents and detergents can induce direct skin damage at contact place and lead to ICD that may be manifested by dryness of the skin, erythematous rashes, swelling (oedema) or even development of bullae (blistering), necrosis and peeling (desquamation) in more severe cases [7]. Chronic repeated exposures to a chemical substance may lead to development of fully-fledged eczema [8,9]. The lack of consensus on clinical classification of hand eczema represent a major challenge in diagnosis of OSD as the morphologic features cannot be distinguished in many occasions [10]. ACD is an inflammatory late onset cell-mediated immune response acquired after skin exposure to sensitizing agents and clinical manifestations may take a latency period to appear [11,12]. Working in a wet environment may cause ICD [13] specially if occupational activities require skin exposure to water, aqueous solutions, irritants or sustained wearing of protective gloves which makes the hands moist [14]. The incidence

of skin diseases among different occupations has markedly increased with abundant range of occupations including health care, hairdressing, rubber manufacturing, cleaning, printing, painting, construction, food preparation and catering [5,15]. Among occupational groups well known for hazardous skin exposure are health care workers (HCWs) whose work environment entails wearing protective gloves and exposure to contact allergens or skin irritants such as organic solvents, detergents and disinfectants that can initiate and/or aggravate skin diseases [16]. Lacking in cases report and variation of the registration criteria represent major challenges for the current epidemiologic studies on work related skin diseases. In Kingdom of Saudi Arabia, the real extent of this problem and the estimated burden has not been determined yet. Therefore, this study was conducted to assess the prevalence of OSD among Saudi HCWs, specifically physician, nurses, technicians and dentists. In addition we aimed to investigate the underlying occupational risk factors for this problem with full characterization of each occupational group.

2. Subjects and Methods

This study was conducted in Al-Madinah Al Mounwara Region, Kingdom of Saudi Arabia. Eight governmental hospitals (King Fahd, Maternity and Children, Al-Amal Mental Health, Ohud, Al-Meeqat, National Guard, Arm Force and Al-Ansar hospitals) from which physicians, nurses, technicians and dentists were randomly selected. Our study was performed in two phases: Phase I a descriptive cross sectional survey to estimate the prevalence of OSD among HCWs & Phase II a nested case control

study design to identify the possible risk factors for OSD. In Phase I subjects were recruited to the study according to the following inclusion and exclusion criteria.

Inclusion criteria:

- Full time permanent works (Physicians, Dentists, Nurses and Technicians) of work duration not less than one year (Males and females).

Exclusion criteria:

- Any health care worker who have an office work and not involved in health care activities.
- Any health care worker who works part-time or works less than 8 hours per day.

In Phase II, subjects were classified into two groups:

- Group I (Cases): Included all cases detected in phase I and diagnosed to have OSD and showed skin manifestations by Nordic Occupational Skin Questionnaire (NOSQ) short version [17] and confirmed through comprehensive skin examination by two independent occupational physicians and a dermatologist.
- Group II (Control): Included age- and sex-matched healthy individuals. Controls were selecte randomly from the same hospital workers involved in phase I and were free from any skin disease & did not show any skin manifestations by NOSQ.

The sample size for our study was calculated using Epi info software version 7 with a power of 80 %, confidence interval level 95 %. Stratified sampling with proportionate allocation was arranged depending on the percentage of each occupational group. Throughout this research, we adhered to the Saudi ethical guidelines for epidemiologic studies; and the study protocol was approved by the Institutional Review Boards of Al Maddinah Directorate for health Affairs.

Table 1 Demographic and socio-economic characteristics of HCWs at AL Maddinah Region, KSA, 2018 (N = 361)

Variables	Study group				X ²	P*
	Cases		Controls			
	No.	%	No.	%		
Gender:						
Male	23	19.8%	78	31.8%	5.635	0.018*
Female	93	80.2%	167	68.2%		
Marital status:						
Single	42	36.2%	103	42.0%	1.562	0.458
Married	70	60.3%	137	55.9%		
Widowed/Divorced	4	3.4%	5	2.0%		
Education level:						
Diploma	48	41.4%	89	36.3%	1.842	0.398
University	52	44.8%	109	44.5%		
Postgraduate	16	13.8%	47	19.2%		
Current job:						
Physician	19	16.4%	72	29.4%	7.094	0.069
Dentist	7	6.0%	12	4.9%		
Nurse	81	69.8%	144	58.8%		
Lab technician	9	7.8%	17	6.9%		
Department:						
Emergency	7	6.0%	26	10.6%	11.599	0.115
Medical	28	24.1%	66	26.9%		
Surgical	23	19.8%	58	23.7%		
ICU	29	25.0%	32	13.1%		
Dental clinic	7	6.0%	12	4.9%		
Laboratory	9	7.8%	19	7.8%		
Operation room	11	9.5%	20	8.2%		
OPD	2	1.7%	12	4.9%		
Duration of work in the current job:	5.5(3-8.75)		5(2-9)			
Weekly working hours:	48(42.75-48)		48(40-48)		13957.5	0.778

* = P-value ≤ 0.05, ** P-value ≤ 0.001.

3. Results

A total of three hundred sixty one HCWs were assessed in this study; among them 91 (25.2%) were physicians, 19 (5.2%) dentists, 26 (7.2%) technicians and 225 (62.3%) nurses. The estimated prevalence of OSD among Saudi HCWs was around 32%. One hundred sixteen (32.1%) HCWs had either skin eczema or itchy skin wheals (Urticaria) caused by activities related to their jobs. Two hundred forty five (67.9%) did not suffer any skin manifestations and were selected in phase II as control subjects with a case/control ratio of almost 1:2. Detailed demographic characteristics of the study group (cases and controls) including gender, marital status, current job, department, duration of work and the average number of weekly working hours were shown in [Table 1](#). Majority of cases were female (80.2%), while they formed 68.2% of the control group (P -value < 0.05). There were no statistically significant age, marital status, education, current job, duration of work in the current job and weekly working hours differences between both groups. One quarter (29 of cases; 25%) had urticaria and three quarters (87 of cases; 75%) had eczema.

3.1. Characteristics of Cases with Skin Eczema

HCWs suffered from skin eczema were 87 cases; 55 (47.4%) had hand eczema, 8 (6.9%) had wrist/forearm eczema and 24 (20.7%) had combined hand and wrist/forearm eczema. Nurses constitute the majority of cases who have hand and wrist/forearm eczema (59%). Most of cases with hand (78.5%) and wrist/forearm eczema (87.7%) reported that they had been affected by the disease above age of 18 years. Almost one third of HCWs with hand eczema (32.9%) reported that they suffer from more than eczematous episode weekly, while 16.5% suffer nearly all the time. Last eczematous attack was present (at the time of the study) among nearly one quarter of cases with hand and wrist/forearm eczema (25.3% and 25% respectively). Half of HCWs cases with hand eczema (53.2%) or wrist/forearm eczema (46.9%) expressed that there was no seasonal variations for experiencing their eczema manifestations. Twenty two cases with hand eczema (27.8%) and 6 cases with wrist/forearm eczema (18.8%) reported that they had no symptoms in the past 12 months (Supplementary materials; [Table S1](#)). In hand eczema suffered cases, dry skin with scaling was the most frequent symptom (59.5%) followed by redness (49.4%). Interestingly, in wrist/forearm eczema suffered cases the commonest symptom was redness (43.8%) followed by dry skin with scaling (40.6%) (Supplementary materials; [Table S2](#)). Regarding factors provoking or exaggerating eczema among cases, almost one half of HCWs with hand eczema (46.8%) considered that wearing gloves is main factor compared to 18.8% of HCWs with wrist/forearm eczema. Most of cases agreed that their eczema got worse when come in contact with certain chemicals and materials at work (73.4% of hand eczema cases and 62.5% of wrist/forearm eczema cases) (Supplementary materials; [Table S3](#)). On the other hand, 50.6% of hand eczema cases and 31.3% of wrist/forearm eczema cases agreed that their eczema manifestations got

worse in contact with materials and activities outside their work. Using household cleansing and laundry products were reported by 34.2% of cases with hand eczema and 25% of wrist/forearm eczema. In an attempt to evaluate the effect of eczema on the daily life and activities of the participants, we found that one half of eczema cases (52.9%) reported that eczema badly affects their occupational work. Out of them there were 6 cases (6.9%) expressed large effect and 13 cases (14.9%) perceived moderate effect. The second affected area was the daily housework activities (49.4%) and social activities (33.3%) (Supplementary materials; [Table S4](#)). On the same context, almost one quarter of eczema cases (24.4%) indicated that they suffered from negative influence of eczema on their financial situation which included direct expenses on medical treatment and indirect expenses in the form of lost workdays, work capacity and/or change of their job (Supplementary materials; [Table S4](#)).

3.2. Characteristics of Cases with Itchy Wheals (Urticaria)

HCWs suffered from skin urticaria were 29 cases, 93.1% of them experienced the disease after age of 18 years. One third of cases (31%) were affected 2-5 times, while around one third of cases had been affected more than five times by the disease. Twenty seven percentage (27.6%) indicated that the last attack of urticaria occurred within the past week. The severity of skin urticaria as perceived by the cases on a scale ranging between zero and ten, showed that the median for the current state was 3 with IQR (0-5), while for the worst ever felt was 5 with IQR (2-7) (Supplementary materials; [Table S5](#)).

3.3. Relevant Factors Potentiating Development of OSD among HCWs.

Majority of the cases (87.1%) reported that they are exposed to wetness daily at their work. Out of them, 44.8% exposed to wetness for more than two hours. The comparable percentages for controls was much lower, where 54.9% of controls are exposed daily to wetness, with only 8.3% exposed to wetness for more than two hours daily (P < 0.001, [Table 2](#)). Almost all cases (99.1%) are washing their hands more than five times during the usual working day compared to 81.7% of controls. In addition, 43.1% of cases reported that they are washing their hands daily more than twenty times compared to 23.7% of controls (P < 0.001, [Table 2](#)). A significantly higher proportion of cases (83.6%) are using gloves at work compared to 74.3% of controls. Around one half of cases (48.3%) expressed that they are usually exposed to cleaning agents compared to 19.8% of controls. Regarding home daily activities, cases are more involved in preparing foods than controls (80.1% vs. 65%). One half of cases reported that they were caring for children under 4 years (20.7% of them were doing so for more than two hours daily). While 29.3% of controls were caring for children under 4 years (7.4% of them were caring them for more than two hours daily) (P < 0.05, [Table 2](#)).

It was noted that cases were using gloves for a significantly longer duration daily than controls (5.1 ± 3.3 vs. 3.3 ± 2.9 hours, [Figure 1](#)) and interestingly percentage

of cases who reported that they are using both natural and synthetic gloves was twice the percentage among controls ($P < 0.001$, Figure 2). The backwards Wald binary logistic regression for factors that had been found to be significantly different between cases and controls shown in Table 3. Being a health care worker with positive

history of itchy rash (Odds; 5.778), allergic eye symptoms (Odds, 2.977), and working in wet environment (Odds, 2.395), washing hands frequently (Odds, 1.890) and wearing protective glove for longer duration (Odds, 1.109) increase significantly the likelihood of getting occupational skin diseases.

Table 2. Practices and environmental exposures to potential irritants during daily life of the health care workers

Practices and exposures	Study group				X^2	P*
	Cases		Controls			
	No	%	No	%		
Daily exposure to wetness at work:						
No	15	12.9%	109	45.0%	98.820	<0.001**
<30 minutes	14	12.1%	79	32.6%		
30-120 minutes	35	30.2%	34	14.0%		
>120 minutes	52	44.8%	20	8.3%		
Frequency of washing hands during usual working day:						
0-5 times	1	0.9%	44	18.3%	49.836	<0.001**
6-10 times	16	13.8%	83	34.4%		
11-20 times	49	42.2%	57	23.7%		
>20 times	50	43.1%	57	23.7%		
Using protective gloves at work:						
No	11	9.5%	57	23.3%	13.025	<0.001**
Yes at present	97	83.6%	182	74.3%		
Yes, but not at present	8	6.9%	6	2.4%		
Exposure to cleaning agents :						
No	60	51.7%	194	80.2%	35.913	<0.001**
<30 minutes	25	21.6%	30	12.4%		
30-120 minutes	19	16.4%	8	3.3%		
>120 minutes	12	10.3%	10	4.1%		
Preparing food:						
No	23	19.8%	85	35.0%	11.023	0.012*
<30 minutes	33	28.4%	65	26.7%		
30-120 minutes	49	42.2%	68	28.0%		
>120 minutes	11	9.5%	25	10.3%		
Care of children under 4 years:						
No	61	52.6%	171	70.7%	16.469	0.001**
<30 minutes	20	17.2%	34	14.0%		
30-120 minutes	11	9.5%	19	7.9%		
>120 minutes	24	20.7%	18	7.4%		

* = P-value ≤ 0.05 , ** P-value ≤ 0.001 .

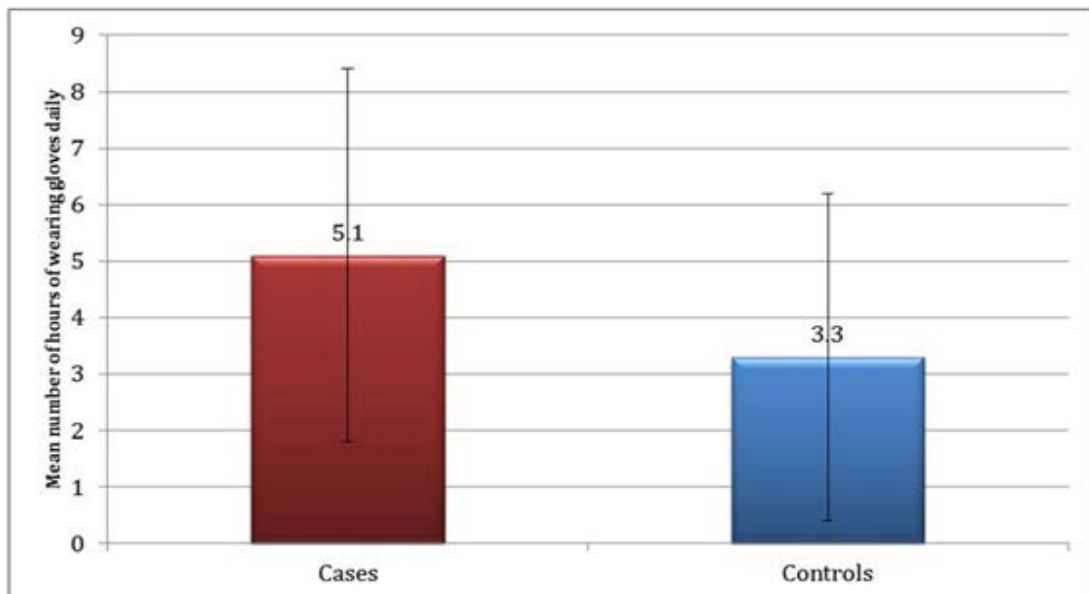


Figure 1. Comparison between cases and controls regarding the mean number of hours of wearing gloves daily

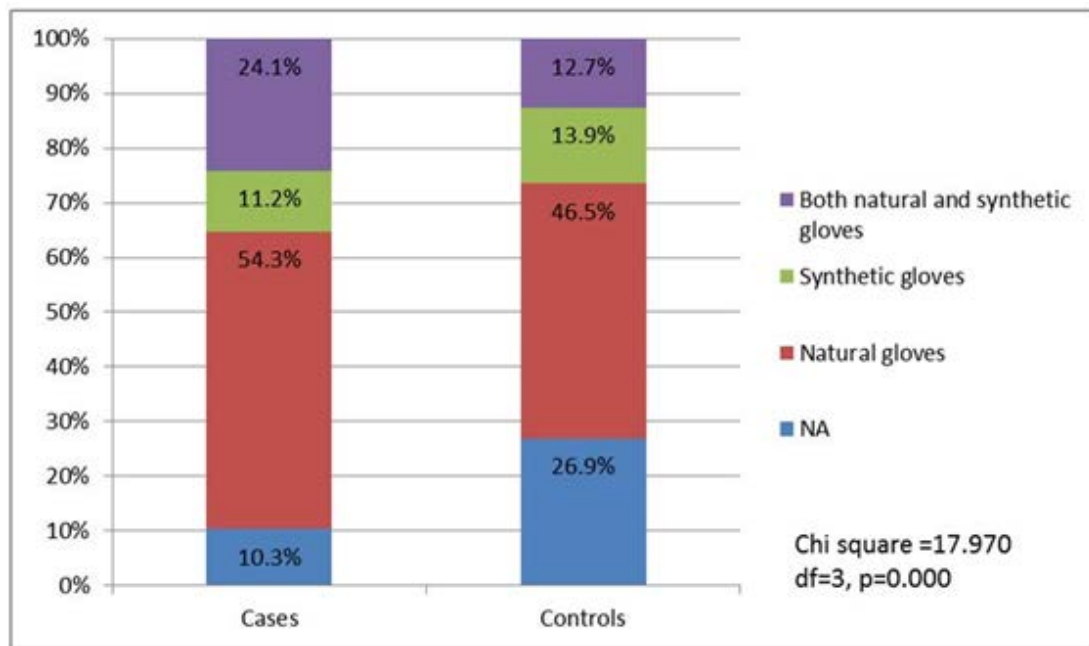


Figure 2. Comparison between cases and controls regarding use of different type of gloves

Table 3. Predictors of occupational skin diseases among health care workers

Variables	B	S.E.	Wald	df	p	Exp(B)	95% CI	
							Lower	Upper
Had itchy rash	1.754	.377	21.651	1	.000	5.778	2.760	12.095
Had allergic eye	1.091	.352	9.617	1	.002	2.977	1.494	5.933
Wet work	.873	.138	39.970	1	.000	2.395	1.827	3.140
Frequent wash of hands	.637	.171	13.900	1	.000	1.890	1.353	2.642
Number of hours of wearing gloves daily	.104	.049	4.542	1	.033	1.109	1.008	1.220

4. Discussion

In this study, we found that OSD represent a health problem among Saudi HCWs with an estimated prevalence 32% and this figure is comparable to previous reports [18,19]. One quarter of HCWs cases reported that they had skin urticaria and three quarters of cases developed skin eczema. Hands were the most affected sites in 68.1% of cases with eczema which comes in agreement with previous studies reported that hands are primarily affected in 80% of occupational skin cases, then wrists and forearms [20,21]. Skin eczema is a multifactorial inflammatory lesion that occurs due to endogenous and/or exogenous biological factors with contributing influences of behavioral, psychological or cultural aspects. It usually affects hands, wrists, distal forearms and seldom involve the whole body, depending on the degree of exposure. The common encountered eczematous symptoms include itching, erythema, vesicles, oedema, dryness, scaling, fissures and hyperkeratosis [12,16,22,23]. In our cases, the common symptoms were dry skin with scaling and redness. Most of the affected HCWs reported that their symptoms are provoked or aggravated by contact with certain chemicals and materials at work, wearing gloves during their work and using household cleansing and laundry products at home. Majority of cases and controls were females, this is probably due to female preponderance in nursing and

technician jobs. In all, 35.8% of included females HCWs were affected by OSD compared to 22.8% of males HCWs. This might happened because female are eventually more exposed to wet environment than male due to frequent hand washing in the domestic activities. Wearing gloves was found as a significant predictor for OSD among cases even after controlling of other factors, it was noted that HCWs who were wearing gloves for a longer duration daily are basically more susceptible to get OSD (Odds, 1.109, 95% CI, 1.008-1.220). Recently, It has been recommended to use a photographic guide for severity assessment of OSD as a validated tool for the self-reported data that would be helpful in unification of the severity scale among participants [24]. Anderson and his colleagues addressed that wearing occlusive gloves can lead to change in the integrity or function of the skin which can enhance chemical penetration or sensitization by influencing additional biological responses, this situation is augmented by contamination of clothing or permeation of chemicals through gloves which leads to prolonged exposures causing enhanced absorption secondary to occlusion [22]. Not only the frequency and duration of wearing gloves that potentiate dermatitis among HCWs, also the type of the glove had been postulated to play an important role; the use of natural rubber latex gloves had been claimed to cause irritant as well as T-cell mediated dermatitis [25]. Nevertheless, Bousquet and coworkers reported that the recent meta-

analysis failed to find any significant association between using latex gloves and development of dermatitis among HCWs (26). We found a remarkable difference between cases and controls as regards using natural rubber latex and synthetic gloves that may support the probable association between wearing latex gloves and development of contact dermatitis. In the current study, cases were significantly working in wet environment for longer duration and they were washing their hands more frequently than controls (Table 2). The regression model revealed that exposure to wet environment increases likelihood of having occupational skin dermatitis more than two folds (Odds, 2.395, 95% CI, 1.827-3.140). Hand hygiene is considered the single most important procedure of HCWs as it can decrease the risk of spreading health care-associated infections. However, frequent hand washing results in reduction of skin hydration and disturbance of skin barrier function [27]. Among our HCWs, frequent washing hands almost doubled the risk of developing OSD (Odds, 1.890, 95% CI, 1.353-2.642). Similar findings were reported by Flyvholm et al. in 2007 [28]. OSD is a distressing disorder, it has a negative social, psychological as well as financial impact. Researchers advised that when evaluating the economic impact of OSD, it must include direct costs for medical care and indirect costs which include loss of productivity due to lost work days & finally costs for re-training, rehabilitation and pensions [29]. Here, almost one quarter of cases (24.4%) indicated that they suffered from negative influence on their financial situation which included direct expenses on medical treatment and indirect expenses in the form of lost workdays, work capacity and/or change of their job. Three cases (3.5%) expressed a substantial negative financial effect from developing skin eczema. Moreover, one half reported that eczema badly affects their occupational work, daily housework activities and social activities. In conclusion, HCWs are at high risk of developing OSD particularly contact dermatitis affecting the hands due to daily exposure to irritants and allergens together with hand hygiene requirements.

4.1. Limitations and Strengths of the Study

Our study is the first one to be conducted on a targeted occupational population and shed the light on OSD. It has a high response rate of 85% with inclusion of a variety of medical professions. Stratified sampling with proportionate allocation was done depending on the percentage of each occupational group (physicians, dentists, nurses and technician). A well-known specified and validated questionnaire (NOSQ) allowed provision of many useful data. On the other hand, reliance on self-reported data, absence of exposure assessment and photographic guide usage for severity assessment of OSD hinder drawing a firm conclusion about the diseases causation and its severity. Moreover, there's no national statistics with which we can compare our prevalence figure directly.

4.2. Perspectives

This study confirms that OSDs are common among HCWs specifically hand eczema due to frequent hand washing, wearing protective gloves and exposure to skin

irritants such as organic solvents, detergents and disinfectants. HCWs training and education to avoid developing OSD should be initiated before placement in their job and should be periodically repeated especially for those working in high-risk units. Investigation of OSD among HCWs and identification of new biomarkers used for early detection and diagnosis of the disease provides valuable information on sensitization rates and profiles to implement targeted prevention strategies. We are in need for more studies to show the proper prevalence, underlying causative factors for OSD

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Supplementary Data

Supplementary material Table S1. Clinical history of cases with eczema

Clinical history	Site of eczema			
	Hand		Wrist/forearm	
	No	%	No	%
Age of start of eczema:				
Below 6 years	4	5.1	1	3.1
6-14 years	6	7.6	1	3.1
15-18 years	7	8.9	2	6.3
>18 years	62	78.5	28	87.5
Job when eczema started:				
Student	10	12.7	4	12.5
Nurse	46	59.0	20	62.5
Physician	12	15.4	1	3.1
Dentist	7	9.0	4	12.5
Lab technician	4	5.1	3	9.4
Frequency of eczema:				
Only once for less than 2 weeks	25	31.6	11	34.4
Only once but for 2 weeks	15	19.0	7	21.9
More than once	26	32.9	12	37.5
Nearly all the time	13	16.5	2	6.3
Last eczema:				
Current	20	25.3	8	25.0
Within past 3 months	24	30.4	10	31.3
Between 3-12 months	15	19.0	5	15.6
More than 12 months	20	25.3	9	28.1
Seasonal variation:				
No seasonal difference	42	53.2	15	46.9
Winter	25	31.6	12	37.5
Spring	2	2.5	1	3.1
Autumn	0	0.0	1	3.1
Summer	10	12.7	3	9.4

Supplementary material Table S2. Symptoms experienced by eczema patients in the past 12 months

Symptoms	Site of eczema			
	Hand		Wrist/forearm	
	No	%	No	%
No symptoms	22	27.8	6	18.8
Redness	39	49.4	14	43.8
Dry skin with scaling	47	59.5	13	40.6
Fissures or cracks	27	34.2	9	28.1
Weeping or crusts	24	30.4	5	15.6
Tinny water blisters (vesicles)	17	21.5	4	12.5
Papules	15	19.0	4	12.5
Itching	25	31.6	5	15.6
Burning, prickling or stinging	16	20.3	5	15.6
Tenderness	6	7.6	1	3.1
Aching or pain	16	20.3	4	12.5

Supplementary material Table S3. Possible factors potentiating eczema from perspectives of the eczematous patients

Possible potentiating factors	Site of eczema			
	Hand		Wrist/forearm	
	No	%	No	%
Suggested provokes of eczema:				
Gloves	37	46.8	6	18.8
Antiseptics	5	6.3	2	6.3
Soap	5	6.3	2	6.3
Disinfectants	3	3.8	0	0.0
Don't know	29	36.7	22	68.7
Contact with certain materials or chemicals at work worsen eczema:				
Yes	58	73.4	20	62.5
No/don't know	21	26.6	12	37.5
Contact with certain materials or chemicals outside work worsen eczema:				
Yes	40	50.6	10	31.3
No/don't know	39	49.4	22	68.7
Materials and practices mostly provoking eczema:				
Using household cleaning and laundry products	27	34.2	8	25.0
Using personal hygiene products like shampoo and liquid soap	25	31.6	4	12.5
Work with wet hands	10	12.7	0	0.0
Frequent hand washing	20	25.3	3	9.4
Handling of food	3	3.8	1	3.1
Other factors:				
Infection (cold, flu or fever)	5	6.3	2	6.3
Menstrual cycle	4	5.1	1	3.1
Stress mood	4	5.1	3	9.4

Supplementary material Table S4. Effect of eczema on the daily life and activities of the cases in the past 12 months

Daily activities	Effect of eczema				
	No effect	Slight effect	Moderate effect	Large effect	Total affected
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Occupational work	41(47.1)	27(31.0)	13(14.9)	6(6.9)	46(52.9)
Housework daily activities	44(50.6)	26(29.9)	8(9.2)	9(10.3)	43(49.4)
Sports and similar activities	66(75.9)	16(18.4)	4(4.6)	1(1.1)	21(24.1)
Other hobbies or activities	69(79.3)	11(12.6)	5(5.7)	2(2.3)	18(20.7)
Sleep	60(69.0)	14(16.1)	6(6.9)	7(8.0)	27(31.0)
Getting about, travel	69(79.3)	11(12.6)	4(4.6)	3(3.4)	18(20.7)
Social activities	58(66.7)	17(19.5)	9(10.3)	3(3.4)	29(33.3)
Close personal relations	68(78.2)	11(12.6)	5(5.7)	3(3.4)	19(21.8)
Sex life	75(86.2)	5(5.7)	3(3.4)	4(4.6)	12(13.8)
Mood	61(70.1)	10(11.5)	10(11.5)	6(6.9)	26(29.9)

Supplementary material Table S5. Clinical features of cases with skin urticaria

Clinical history	No. of Cases	%
Age of start of urticaria:		
15-18 years	2	6.9
>18 years	27	93.1
Job when urticaria started:		
Student	2	6.9
Nurse	22	75.9
Lab technicians	3	10.3
Dentist	2	2.9
Frequency of having itchy wheals (urticaria) on hand, wrists or forearm:		
Once	11	37.9
2-5 times	9	31.0
>5 times	9	31.0
Last time having itchy wheals (urticaria) on hand, wrists or forearm:		
During the past 7 days	8	27.6
7 days-<3 months ago	10	34.5
3-12 months	3	10.3
> one year	8	27.6
Rating of the urticaria cases for the itchy wheals (urticaria) at the time of interview on a scale 0-10. Median(IQR)		3(0-5)
Rating of the urticaria cases for the worst itchy wheals (urticaria) ever felt on a scale 0-10. Median(IQR)		5(2-7)

