

ORIGINAL ARTICLE

Hand eczema in nurses, nursing auxiliaries and cleaners—A cross-sectional study from a tertiary hospital in western India

Sanjeev B. Gupta | Aayush Gupta  | Bhavika Shah | Preeti Kothari | Sweety Darall | Dhara Boghara | Sukhnandan Sonkar | Kirti Deo

Dr D. Y. Patil Medical College—Dermatology, Venereology and Leprosy, Pune, India

Correspondence

Dr. Kirti Deo and Dr. Aayush Gupta, Dr D. Y. Patil Medical College—Dermatology, Venereology and Leprosy, Pimpri, Pune, Maharashtra 411018, India.
Email: deokirti2000@gmail.com; aayushgupta@gmail.com

Background: Healthcare workers have a high risk of developing hand eczema.

Objectives: To determine the prevalence and severity of dermatologist-determined hand eczema among healthcare workers, carry out patch testing, and correlate the findings with impairment in quality of life (QoL) and demographic and vocational factors.

Methods: Seven hundred and ten healthcare workers (279 nurses, 246 cleaners, and 185 nursing auxiliaries) were screened for the presence of hand eczema. Severity of eczema was calculated with the Hand Eczema Severity Index (HECSI), and QoL was measured with the Dermatology Life Quality Index (DLQI). Individuals with hand eczema were also patch tested.

Results: The point and 1-year prevalences of hand eczema were 7.2% and 18.9%, respectively. Hand eczema was significantly associated with atopic dermatitis. The mean HECSI score was 9.39; it was significantly higher in patients with atopic dermatitis and those with recurrent hand eczema. The mean DLQI score was 5.37. Cleaning staff had significantly greater impairment in QoL. HECSI and DLQI scores were positively correlated. Patch testing showed that thiuram mix, antibiotics and cleansers as sensitizers were over-represented in healthcare workers as compared with controls.

Conclusions: Hand eczema was particularly common in hospital cleaners and staff with atopic dermatitis. Further studies are needed to address the burden of occupational hand eczema and develop guidelines for its management at a national level.

KEYWORDS

contact dermatitis, cleaning staff, hand eczema, healthcare workers, HECSI, nurses, nursing auxiliaries, quality of life

1 | INTRODUCTION

Hand eczema is one of the most common occupational skin diseases in the world. Healthcare workers, especially nurses, nursing auxiliaries, and hospital cleaning staff, often bear the maximum burden of occupational contact dermatitis, owing to frequent “wet work” and daily contact with both irritants and allergens, leading to chronic absenteeism, increased health costs, and an impaired quality of life (QoL).^{1–5} Hand eczema may also lead to increased carriage of hazardous micro-organisms, making it a potential route for transmission of infection.⁶

The prevalence of hand eczema among hospital workers in countries other than India ranges from 6% to 80%.^{7–18} However, most studies on hand eczema have been based on self-reported surveys,

and have utilized varied outcome measures, and almost no epidemiological data on hand eczema among healthcare workers exist in India. Hence, this study was carried out to determine the prevalence and severity of dermatologist-determined hand eczema among workers in a tertiary-care hospital in western India, and to correlate the findings with QoL and demographic and vocational factors.

2 | MATERIALS AND METHODS

2.1 | Study population and design

This cross-sectional study was carried out over a period of 4 weeks (in September) after institutional ethical clearance and informed

consent had been obtained from participants, involving all nurses, nursing auxiliaries and cleaners working in a tertiary-care hospital in western India. The study participants were asked to visit the department of dermatology in batches, where a dermatologist surveyed them (utilizing a questionnaire) in a standardized manner, which included assessment of potential risk factors and demographic and vocational details. Healthcare workers (including cleaners) with hand eczema were then further examined, and the Hand Eczema Severity Index (HECSI) was used to quantify its severity. Briefly, the HECSI includes scoring of the morphological symptoms of hand eczema, that is, erythema, infiltration, vesicles, fissures, scaling, and oedema, as well as affected areas on the hands (fingertips, fingers, palms, back of the hand, and wrist).¹⁹ The score varies from a minimum of 0 to a maximum of 360.

The healthcare workers with hand eczema were also asked to fill in the Dermatology Life Quality Index (DLQI) questionnaire to measure its impact on their QoL.²⁰ The DLQI, a dermatology-specific 10-item questionnaire, covers 6 aspects of daily life experienced during the past week: (1) symptoms and feelings, (2) daily activities, (3) leisure items, (4) work and school, (5) personal relationship items, and (6) treatment. The DLQI score is calculated by summing each individual score, and ranges from 0 to 30.

Patch testing was then performed on individuals with hand eczema with the Indian baseline series (consisting of 25 haptens) with additional haptens taken from a cosmetic and fragrance series. The patch testing kits, approved by the Contact and Occupational Dermatoses Forum of India, were obtained from Systopic Laboratories, New Delhi, India. A total of 28 haptens (Table S1) were applied to the upper back of each patient with Finn chambers, and readings were performed on day (D) 2 and D4 in accordance with ICDRG criteria.²¹ Patch testing data were also compared with age-matched and sex-matched data taken from an existing occupational registry present in our department. The controls consisted of patients having hand

eczema and working in industries other than healthcare, predominantly manufacturing automobile spares.

2.2 | Statistical analyses

Quantitative variables were described as percentage, range, mean, and standard deviation. The χ^2 test was used for discrete variables, Student's *t* test was used for independent samples, and 1-way ANOVA and MANOVA were used for continuous variables. Spearman's correlation coefficient was also used to quantify the correlations of severity of hand eczema and impairment in QoL with work environment and endogenous factors. All tests were performed with SPSS version 22 (SPSS, Chicago, Illinois), as appropriate. A 2-tailed *P* value of $\leq .05$ was considered to be statistically significant.

3 | RESULTS

A total of 710 healthcare workers (136 males; 574 females) with ages ranging from 18 to 65 years (mean: 29.8 ± 8.5 years) constituted our study population. Of the participants, 279 (39.3%) were nurses, 246 (34.6%) were cleaning workers, and the rest were nursing auxiliaries (185, 26.1%) (Table 1). The departments of surgery ($n = 131$, 18.5%), medicine ($n = 110$, 15.5%), gynaecology ($n = 87$, 12.3%) and paediatrics ($n = 78$, 11.0%) employed most of the staff. The majority of the participants ($n = 388$, 54.6%) did not suffer from any skin disease, whereas 98 (13.8%), 46 (6.5%) and 19 (2.7%) individuals had melasma, acne, and tinea, respectively (Table S2).

3.1 | Hand eczema

The point and 1-year prevalences of hand eczema in our study were 7.2% ($n = 51$) and 18.9% ($n = 134$), respectively. Itching was the most

TABLE 1 Point prevalence of hand eczema in healthcare workers

	Total participants, <i>n</i> (% of total)	Hand eczema, <i>n</i> (% of total)	Significance (<i>P</i> value)	Odds ratio (95%CI)
Total	710	51		
Sex				
Male	136 (19.2)	9 (17.7)	.78	0.90 (0.43-1.89)
Female	574 (80.8)	42 (82.4)		
Mean age (years)	29.8 ± 8.5	30.3 ± 8.6	.69	
Profession				
Nurses	279 (39.3)	19 (37.3)	.76	0.91 (0.51-1.64)
Nursing auxiliaries	185 (26.1)	11 (21.6)	.45	0.77 (0.39-1.53)
Hospital cleaning staff	246 (34.7)	21 (41.2)	.31	1.35 (0.76-2.41)
Department				
Diagnostic	12 (1.7)	1 (2.0)	.88	1.18 (0.15-9.31)
Surgical	327 (46.1)	28 (54.9)	.19	1.47 (0.83-2.60)
Medical	272 (38.3)	20 (39.2)	.89	1.04 (0.58-1.87)
Non-clinical	99 (13.9)	2 (3.9)	.052	0.24 (0.06-0.99)
Atopy				
Yes	99 (13.9)	14 (27.5)	.004	2.56 (1.33-4.92)
No	611 (86.06)	37 (72.6)		

Abbreviations: CI, confidence interval; OR, odds ratio. Significance was assessed with the χ^2 test and Spearman correlation test ($P < .05$).

common complaint of individuals with hand eczema ($n = 32$, 62.8%), followed by pain ($n = 4$, 7.8%) and discharge ($n = 3$, 5.9%).

The mean HECSI score was found to be 9.39 ± 8.17 (range: 1–32), and was higher in females (9.74 ± 8.78) than in males (7.78 ± 4.32 , $P = .33$), although not significantly so. Individuals who gave a history of recurrent hand eczema ($n = 14$) had a significantly higher HECSI score (13.29 ± 8.40) than those presenting with the first episode ($n = 37$, mean = 7.92 ± 7.69 , $P = .035$). Individuals with foot eczema and/or forearm eczema in addition to hand eczema had a slightly higher HECSI score than those without (9.04 ± 8.14 , $P = .36$) (Table 3).

3.2 | QoL of workers with hand eczema

The overall mean DLQI score was 5.37 ± 4.76 (range: 0–19), and was higher in females (5.60 ± 4.95) than in males (4.33 ± 3.81). Individuals with eczematous lesions on the forearms had greater impairment in their QoL (7.20 ± 4.66 , $P = .48$) than those who did not (5.17 ± 4.78 , $P = .37$). Conversely, individuals with foot eczema in addition to hand eczema had a slightly lower DLQI score (5.36 ± 3.23) than those with just hand eczema (5.38 ± 5.27 , $P = .99$). Recurrent hand eczema was also associated with greater impairment in QoL (6.71 ± 4.83) than in those presenting with the first episode (4.86 ± 4.70 , $P = .22$) (Table 2). There was a

significant positive correlation between DLQI and HECSI scores ($r = 0.60$, $P < .001$).

3.3 | Demographics and profession

Hand eczema was slightly more common in females ($n = 42$, 7.3%) than in males ($n = 9$, 6.6%). The mean age of individuals with hand eczema was marginally greater (30.27 ± 8.59 years) than that of those without (29.78 ± 8.45 years) (Table 1). Age was not significantly correlated with severity of hand eczema or impairment in QoL. Hand eczema was seen in 9.5% of hospital cleaners (21 of 246), 6.8% of nurses (19 of 279), and 5.9% of nursing auxiliaries (11 of 185). Cleaners also had the highest HECSI score (12.18 ± 9.40), followed by nursing auxiliaries (8.50 ± 5.68) and nurses (6.63 ± 6.95). A statistically significant impairment in QoL was seen in cleaners (7.32 ± 5.58) as compared with nurses (4.05 ± 3.99) and nursing auxiliaries (3.60 ± 2.22 , $P = .035$) (Table 2). The healthcare workers were broadly categorized as working in the medical, surgical, diagnostic and non-clinical departments. There was no significant correlation between the presence or severity of hand eczema, the impairment in QoL and the working fields or duties of the staff. The majority of the affected individuals reported exacerbation of symptoms with the use of powdered gloves ($n = 19$, 37.3%), followed by cleaning solutions ($n = 13$, 25.5%), and antiseptics/soaps ($n = 10$, 19.6%); the remainder ($n = 9$, 17.6%) reported no exacerbation at all.

TABLE 2 Severity and impairment in quality of life among participants with hand eczema

	Total participants	HECSI	Significance (P value)	DLQI	Significance (P value)
Sex					
Males	9 (17.7%)	7.78 ± 4.32	.33	2.33 ± 2.12	.53
Females	42 (82.4%)	9.74 ± 8.78		3.00 ± 2.97	
Mean age (years)	30.5 ± 8.8	9.39 ± 8.17	.11 ($r = 0.23$)	2.88 ± 2.83	.89 ($r = 0.02$)
Profession					
Nurses	19	6.63 ± 6.95	.086	1.95 ± 2.46	.019
Nursing auxiliaries	10	8.50 ± 5.68		1.90 ± 1.52	
Hospital cleaning staff	22	12.18 ± 9.40		4.14 ± 3.17	
Department					
Diagnostic	1	4.00	.93	0.00	.43
Surgical	25	9.56 ± 9.02		2.56 ± 2.42	
Medical	23	9.39 ± 7.84		3.48 ± 3.29	
Non-clinical	2	10.00 ± 1.41		1.50 ± 0.71	
Atopy					
Yes	14	13.64 ± 9.50	.021	2.64 ± 2.56	.71
No	37	7.78 ± 7.11		2.97 ± 2.96	
Mean years of work	2.6 ± 3.7	9.39 ± 8.17	.75 ($r = 0.046$)	2.88 ± 2.83	.48 ($r = -0.102$)
Mean hours of work	56.55 ± 5.15	9.39 ± 8.17	.39 ($r = -0.12$)	2.88 ± 2.83	.48 ($r = 0.10$)
Work shift					
Morning	36	10.14 ± 8.80	.30	2.94 ± 0.49	.79
Evening	11	6.09 ± 2.66		2.73 ± 0.82	
Night	4	11.75 ± 11.47		2.63 ± 1.32	
History of eczema					
Yes	14	13.29 ± 8.40	.035	3.79 ± 2.75	.16
No	37	7.92 ± 7.69		2.54 ± 2.82	

Abbreviations: DLQI, Dermatology Life Quality Index; HECSI, Hand Eczema Severity Index; r , Pearson's correlation coefficient. Significant differences were calculated with the χ^2 test, 1-way ANOVA, and the Spearman correlation test ($P < .05$).

TABLE 3 Results of patch testing

Antigen	Concentration (%)	Vehicle	Positive participants (n = 32), no. (%)	Nurses (n = 11)	Nursing auxiliaries (n = 7)	Janitors (n = 14)	Controls (n = 27), no. (%)
Nickel sulfate	5	pet.	6 (18.8)	3 (+++, ++, +)	1 (IR)	2 (IR, +)	5 (18.5)
Parthenium	15	aq.	4 (12.5)	1 (++)	1 (+)	2 (+, +)	6 (22.2)
Chlorhexidine digluconate	15	aq.	3 (9.3)	1 (IR)	-	2 (++ , IR)	1 (3.7)
Fragrance mix I	8	pet.	3 (9.3)	1 (++)	1 (+)	1 (+)	3 (1.1)
Formaldehyde	1.1	aq.	3 (9.3)	-	2 (IR, +)	1 (IR)	2 (7.4)
Mercaptobenzothiazole	2	pet.	3 (9.3)	1 (++)	-	2 (+, +)	1 (3.7)
Neomycin sulfate	20	pet.	2 (6.3)	1 (++)	1 (+)	-	2 (7.4)
Potassium dichromate	0.5	pet.	2 (6.3)	-	2 (++ , +++)	-	4 (14.8)
Gentamicin	20	pet.	2 (6.3)	2 (+, ++)	-	-	1 (3.7)
p-Phenylenediamine	1	pet.	2 (6.3)	-	1 (IR)	1 (IR)	2 (7.4)
Thiuram mix	1	pet.	2 (6.3)	-	-	2 (IR, IR)	1 (3.7)
Paraben mix	15	pet.	2 (6.3)	1 (IR)	-	1 (IR)	2 (7.4)
Myroxylon pereirae (balsam of Peru)	25	pet.	1 (3.1)	-	-	1 (++)	2 (7.4)
Nitrofurazone	1	pet.	1 (3.1)	-	1 (+)	-	-
Polyethylene glycol	100	aq.	1 (4.3)	-	-	1 (+)	1 (3.7)
Benzocaine	5	pet.	1 (4.3)	1 (++)	-	-	-
Benzyl salicylate	2	pet.	1 (4.3)	-	-	1 (+)	-
Cetrimide	0.5	pet.	1 (4.3)	-	-	1 (+)	-
Ethanol	80	aq.	1 (4.3)	-	-	1 (IR)	-
Epoxy resin	1	pet.	-	-	-	-	1 (3.7)
Black rubber mix	0.6	pet.	-	-	-	-	1 (3.7)
Total positive reactions			41	12	10	19	34

Abbreviations: aq., aqua; IR, irritant reaction; pet. = petrolatum.

The mean numbers of years and hours per week in the current job were 2.60 years (range 3 months to 24 years) and 56.5 ± 5.15 hours (range: 36-63 hours). The majority of the individuals with hand eczema worked the morning shift ($n = 36$, 70.6%), followed by the evening shift ($n = 11$, 21.6%) and the night shift ($n = 4$, 7.8%). There was no significant correlation between the severity of hand eczema or impairment in QoL and hours worked per week or the number of years in the current job.

Hand eczema was found to be significantly associated with atopic dermatitis ($P = .004$), which was reported by 27.5% ($n = 14$) of those with hand eczema and by 12.9% ($n = 85$) of those without (odds ratio [OR] 2.55, 95%CI: 1.32-4.92). Atopic dermatitis was also found to be significantly related to the severity of disease (13.64 ± 9.50 vs 7.78 ± 7.11 , $P = .021$). There was no correlation between impaired QoL and the presence or absence of atopic dermatitis.

3.4 | Patch testing

The patch test results of healthcare workers as compared with age-matched and sex-matched controls working in industries other than healthcare presenting with hand eczema are shown in Table 3. A total of 41 positive reactions were observed in 32 workers. Of these, 61.0% showed allergic reactions. Three groups of substances, namely thiuram mix, antibiotics, and cleansers, were found to be more common sensitizers in healthcare workers, whereas positive patch test reactions to parthenium and metal allergens were seen less often.

4 | DISCUSSION

The 1-year prevalence of hand eczema in our study was 18.9%, which is comparable to that in studies performed on healthcare workers in countries other than India, with a prevalence of 17% to 55% commonly being reported in nurses, nursing auxiliaries, and hospital cleaning staff.^{7,22-27} However, most of these studies have reported a higher point prevalence of hand eczema (12%-18%)⁷ than our study (7.2%), with only a single Dutch study reporting a lower point prevalence than ours (4.9%).²⁸ The low point prevalence in our study could be a result of healthcare workers and cleaners with mild itching, erythema or xerosis not being diagnosed with hand eczema, owing to the examination of each participant by a dermatologist as opposed to self-reporting, which has been reported to be associated with higher prevalence estimates.²⁹ The healthy worker effect, which suggests that people change their jobs soon after the development of disease, may also explain the low point prevalence, as many professionals might have already changed their jobs immediately after the appearance of hand eczema.²⁷ While background data on hand eczema in the Indian population are not available, the 1-year prevalence was found to be almost twice that of the Swedish (9.7%)³⁰ and Dutch (12%)²⁸ general populations, reiterating the fact that healthcare workers are more prone to developing hand eczema than workers in other professions.³¹

Although the difference was not significant, our study found the prevalence and severity of hand eczema to be higher in hospital cleaners, similarly to earlier studies,¹⁷ probably because they are

involved in the maximum amount of “wet work” with cleaning products containing mixtures of many chemical ingredients.⁵ Significantly, they also suffered the greatest impact on their QoL. Whereas nurses and nursing auxiliaries suffering from hand eczema can be transferred from 1 department to the another (eg, inpatient to outpatients) to change their exposure profile, cleaners cannot, and this contributes to the greater impairment in their QoL along with more severe hand eczema.

In contrast to earlier studies, we found the prevalence of hand eczema among different departments to be the same.³² This could be attributable to the institutional practice of staff transfers in our hospital (except for cleaners), alternating “wet work” jobs with those not requiring it, decreasing the chance of sensitization to a particular chemical.

The prevalence of hand eczema was found to be slightly higher among females, in line with multiple previous studies.^{22,23} However, in contrast to earlier studies, which found hand eczema to be more common in younger workers, our study showed healthcare workers with hand eczema to be slightly older,⁷ presumably because of the inclusion in our study of cleaners and nursing auxiliaries, who, on average, were found to be older than nurses. The lack of correlation between severity of hand eczema and working hours or shift has also been shown in previous studies,⁷ and probably indicates that a certain subset of the population are intrinsically predisposed to developing hand eczema.

Our study confirmed the strong association between atopic dermatitis and hand eczema, while confirming that people with atopy are at a significant risk (OR: 2.55, 95%CI: 1.33-4.92, $P = .004$) of developing hand eczema. Atopic dermatitis was also linked to greater severity of hand eczema, in accordance with multiple prior studies, probably because of the skin barrier and immune system dysfunctions inherent to atopic skin.^{1,7,33}

The significant positive correlation between DLQI and HESCI scores seen in our study shows a close relationship between impairment in QoL and disease severity, and supports the DLQI score as a clinically relevant parameter. Although this correlation has been seen in previous studies, we could only find 2 studies performed on QoL in healthcare workers, with our study population having higher eczema severity and greater impact on their QoL than in a previous Danish study (HESCI = 8.53, DLQI = 2.00).^{7,34-37}

Although we performed patch testing on all healthcare workers and cleaners (51) with hand eczema, the number tested was not nearly high enough to enable us to draw any definite conclusions. Nevertheless, patch testing showed nickel, parthenium, rubber chemicals and biocides to be the most important allergens. Although sensitization to nickel is usually attributed to non-occupational sources such as ear piercing, nickel-containing surgical instruments do pose a risk for healthcare professionals.³⁸ Sensitization to thiuram mix (which is a good indicator of sensitization to single compounds) and mercaptobenzothiazole, used as rubber vulcanization accelerators, further supported the notion that wearing rubber gloves increases the risk of rubber allergy.³⁹ A significant proportion of sensitization was also caused by formaldehyde and chlorhexidine digluconate, which are chemicals commonly used to disinfect surfaces and surgical instruments.

This is the first Indian study to investigate the prevalence and severity of hand eczema among nurses, nursing auxiliaries, and cleaners. Its main strengths include the diagnosis of hand eczema by dermatologists, thus avoiding underestimation or overestimation resulting from self-reporting. The measurement of impairment in QoL along with HESCI scores and their correlation has been only attempted earlier by 2 studies. The inability to include physicians in our study, for administrative reasons, constitutes its major limitation. To keep our questionnaire concise, certain questions, such as frequency of hand washing and exposure to gloves, were not included in the survey, which is another shortcoming. Moreover, the measurement of hand eczema in patients from a single tertiary-care hospital cannot be regarded as being representative of the entire region, but only as a starting point for larger multicentre studies. The evaluation of hand eczema only once per person was another limitation, as seasonal fluctuations are known to influence the prevalence of hand eczema.

5 | CONCLUSION

Hand eczema is a common occupational disease among healthcare workers, and accurate epidemiological data, which are currently lacking in India, are important to gauge the burden of the disease and allow for the design of interventions aimed at reducing the frequency of hand dermatitis. A number of countries have developed national guidelines for the prevention and management of occupational skin diseases in healthcare workers, and epidemiological data would help India to follow suit. Hospital cleaners and individuals with atopic dermatitis were identified in our study as having a significantly higher risk of developing hand eczema; this, along with data from patch testing, provides a basis for future larger studies focusing on risk factors, prevention and treatment of hand dermatitis in healthcare workers. Our results also confirmed that staff members with hand eczema have significantly impaired QoL, and that the DLQI should be routinely used as a supplemental clinical measure in patients suffering from hand eczema.

CONFLICT OF INTEREST

The authors declare no potential conflict of interests.

ORCID

Aayush Gupta  <http://orcid.org/0000-0002-1455-8086>

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

How to cite this article: Gupta SB, Gupta A, Shah B, et al. Hand eczema in nurses, nursing auxiliaries and cleaners—A cross-sectional study from a tertiary hospital in western India. *Contact Dermatitis*. 2018;79:20–25. <https://doi.org/10.1111/cod.13009>

Online Supplementary Table 1 Patch testing antigens utilized

S.NO	Compound	Concentration (%)	Vehicle
1	Control (White Petrolatum)	100.0	pet.
2	Potassium dDichromate	0.5	pet.
3	Neomycin sulfate	20.0	pet.
4	Cobalt (II) chloride hexahydrate	1.0	pet.
5	Benzocaine	5.0	pet.
6	<i>p</i> -Phenylenediamine (PPD)	1.0	pet.
7	Paraben mix	15.0	pet.
	- Methyl-4-hydroxybenzoate	3.0	
	- Ethyl-4-hydroxybenzoate	3.0	
	- Propyl-4-hydroxybenzoate	3.0	
	- Butyl-4-hydroxybenzoate	3.0	
	- Benzyl-4-hydroxybenzoate	3.0	
8	Nickel sulfate hexahydrate	5.0	
9	Colophonium	20.0	pet.
10	Gentamicin sulfate	20.0	pet.
11	Mercapto mix	2.0	pet.
12	Epoxy resin	1.0	pet.
13	Fragrance mix I	8.0	pet.
	- Cinnamyl alcohol	1.0	
	- Cinnamal	1.0	
	- Hydroxycitronellal	1.0	
	- Amylcinnamaldehyde	1.0	
	- Geraniol	1.0	
	- Eugenol	1.0	
	- Isoeugenol	1.0	
	- Evernia prunastri (oakmoss absolute)	1.0	
14	Mercaptobenzothiazole(MBT)	2.0	pet.
15	Nitrofurazone	1.0	pet.
16	Chlorocresol	1.0	pet.
17	Lanolin alcohols	30.0	pet.
18	<i>Myroxylon pereirae</i> (balsam of Peru)	25.0	pet.
19	Thiuram Mix	1.0	pet.
	- Tetramethylthiuram monosulfide (TMTM)	0.25	
	- Tetramethylthiuram disulfide (TMTD)	0.25	
	- Tetraethylthiuram disulfide(TETD)	0.25	
	_Dipentamethylenethiuram disulfide (DPTD)	0.25	
20	Chinoform / clioquinol	3.0	pet.

21	Black rubber mix	0.6	pet.
	- N-isopropyl-N-phenyl-4-phenylenediamine	0.1	
	- N- cyclohexyl-N-phenyl-4-phenylenediamine	0.25	
	-N-N-diphenyl-4-phenylenediamine	0.25	
22	<i>p-tert</i> Butylphenol formaldehyde resin	1.0	pet.
23	Formaldehyde	1.1	aq.
24	Polyethylene Glycol 400(PEG 400)	100.0	aq.
25	Plant Antigens (<i>Parthenium hysterophorus</i>)	0.1	pet.
26	Benzyl salicylate	2.0	pet.
27	Cetrimide	0.5	pet.
28	Chlorhexidine digluconate	0.5	aq.

pet = petrolatum, aq = aqueous

Online Supplementary Table 2: Spectrum of dermatological disorders in healthcare workers

Dermatological disorder	Nurses	Nursing auxiliaries	Cleaning staff	Total
No disorder	146	91	151	388
Melasma	20	43	35	98
Tinea	8	3	8	19
Acne	32	10	4	46
Hand eczema	19	11	21	51
Xerosis	5	2	6	13
Alopecia	5	0	0	5
Post inflammatory hyperpigmentation	6	2	1	9
Pityriasis sicca	2	1	0	3
Pityriasis versicolor	8	1	2	11
Scabies	1	0	2	3
Urticaria	7	2	2	11
Phrynoderma	0	1	0	1
Intertrigo	2	2	0	4
Seborrheic dermatitis	0	1	1	2
Irritant contact dermatitis	0	1	4	5
Lichen planus	0	0	1	1
Periorbital hyperpigmentation	5	0	1	6
Hyperhidrosis	0	1	0	1
Acrochordons	1	3	1	5
Stasis dermatitis	0	1	0	1
Psoriasis	0	0	1	1
Vitiligo	0	1	1	2
Dermatosis papulosa nigra	5	2	0	7
Lichen simplex chronicus	1	1	0	2
Tylosis	0	1	0	1
Allergic contact dermatitis	1	0	1	2
Folliculitis	1	2	0	3
Hypomelanosis of Ito	1	0	0	1
Aphthous ulcers	0	1	0	1
Acanthosis	1	0	1	2
Hypertrophic scar	0	1	0	1
Paronychia	0	0	1	1

Dyschromia	2	0	1	3
number of participants affected				