

Healthcare workers and skin sensitization: north-eastern Italian database

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Background	Working in healthcare is regarded as a risk factor for occupational skin disease. Workers are exposed to disinfectants, soaps, detergents and latex and need to wash their hands frequently and thoroughly.
Aims	To investigate the association between healthcare work and patch test reactions to various potential sensitizers in a population of contact dermatitis patients in various dermatology and occupational medicine units in north-eastern Italy.
Methods	Patients with suspected allergic dermatitis underwent patch testing. Odds ratios (ORs) and 95% confidence intervals (CIs), adjusted by age and sex, were calculated for healthcare workers (HCWs), using white-collar workers as control group.
Results	HCWs represented 14% of the sample of 19 088 patients (68% women, 32% men). Among HCWs, both sexes had a higher risk of developing hand/forearm dermatitis (females: OR 2.1, 95% CI 1.8–2.5; males: OR 1.6, 95% CI 1.3–2.1). HCWs had an increased risk of sensitization to formaldehyde (OR 1.65; 95% CI 1.2–2.3) and to <i>p</i> -phenylenediamine (OR 1.6; CI 1.1–2.3).
Conclusions	Our study suggests a significant association between healthcare work, hand/forearm dermatitis and sensitization to formaldehyde and <i>p</i> -phenylenediamine.
Key words	Dermatitis; healthcare workers; occupational skin disease; patch test.

Introduction

Healthcare workers (HCWs) are particularly prone to occupational skin diseases as they are exposed to several potential allergens (including disinfectants, soaps, detergents, latex and rubber products) and thorough and frequent hand hygiene is often mandatory. The purpose of this study was to investigate contact dermatitis in HCWs, in particular the association between healthcare work and patch test reactions to various potential sensitizers in a population of patients suffering from contact dermatitis.

Methods

From 1997 to 2010, patients with symptoms and/or signs of suspected allergic dermatitis underwent patch testing, after completing a standardized questionnaire and clinical examination. The study population were

seen in various dermatology or occupational medicine units in north-eastern Italy (Belluno, Padua, Pordenone, Rovigo, Trento and Trieste areas) comprising the north-East Italy Contact Dermatitis Group (NEICDG). Those undergoing patch testing were categorized by profession into HCWs (clinical professions such as nurses, assistants, doctors, etc.), white-collar workers (WCWs), other workers or non-workers (pensioners, homemakers, unemployed, etc.) Patients were patch tested with the European baseline series using Finn® chambers on Scanpor® tape. Substances and clinical protocols did not change over time. All substances were applied to the upper back and removed after 48 h. The sites were examined on removal (D2) and D3/D4, according to the International Contact Dermatitis Research Group (ICDRG) guidelines. Reactions of +, ++ and +++ grade were considered positive. Continuous variables were summarized using mean and standard deviation as a measure of central tendency and dispersion, respectively.

The difference between means was tested using a *t*-test, while the difference between categorical data cross-tabulated into contingency tables was tested by the χ^2 statistics. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated using WCWs as control group. ORs were adjusted and/or stratified for confounding variables including age and sex. A *P* < 0.05 was considered significant. No ethical approval was required: all subjects were patients undergoing patch testing for diagnostic purposes and gave informed consent.

Results

In total, 19 088 patients underwent patch testing in the study period. 2821 patients were excluded, mainly due to incomplete data collection. 16 267 subjects were included in the final study (Table 1). Of whom 68% (10 989) were women and 32% (5278) men. HCWs made up 16% of the female population and the 9% of the male population. HCWs were older than WCWs (mean age 36.3 versus 32.6; *P* < 0.001) and females were younger than males (mean age 35.5 versus 38.9). In our sample, the prevalence of respiratory atopy (allergic asthma and rhinitis) and atopic eczema was higher among WCWs than HCWs: 32% versus 27% (*P* < 0.001) and 11% versus 5% (*P* < 0.001), respectively, with a similar trend in both sexes. Dermatitis was localized to the hands and forearms in 47% of male HCWs and in 51% of female HCWs compared with 38% and 34% of WCWs (MOAHLFA index is reported in Table 1). Contact sensitization prevalence was higher in HCWs compared to WCWs (relative risk 1.09, 95% CI 1.05–1.14, *P* < 0.001). Twenty-nine per cent of HCWs were sensitized to one substance, while 34% were sensitized to two or more substances.

Using WCWs as a control group, female HCWs had an OR of 2.1 (95% CI 1.8–2.5) for developing hand and forearm dermatitis, while for males the OR was 1.6 (95% CI 1.3–2.1). Working in the healthcare sector had

an increased risk of 2.0 compared with WCWs, and the difference was statistically significant (95% CI 1.7–2.2).

Patch test sensitization was studied in HCWs with occupational contact dermatitis (Table 2), using white-collar workers as a control group. HCWs had an increased risk of sensitization to formaldehyde (OR 1.7; 95% CI 1.2–2.3) and *p*-phenylenediamine (OR 1.6; CI 1.1–2.3) and a significantly lower risk of sensitization to MDBGN (methylidibromo glutaronitrile) (OR 0.5; 95% CI 0.3–0.9).

Discussion

In our study population, the hands and forearms were the most common site of dermatitis in HCWs in accordance with the findings of Nettis [1], Templet [2] and Larese and Bagnato [3]. There was a lower prevalence of atopic eczema compared to non-HCWs which could be the result of selection bias, as people with atopic eczema may choose different occupations to avoid skin problems.

The prevalence of positive patch test reactions in HCWs has been reported to range from 17 to 63% [1,4,5]. In our database, we found a 63% rate of patch test positivity in HCWs, higher than found in other categories, suggesting an increased risk of sensitization in this occupational group.

Our study suggests an association between HCW dermatitis and formaldehyde sensitization, in accordance with other studies which reported that HCWs [5,6] were more likely to be allergic to formaldehyde than non-HCWs. Conversely, some European studies failed to find an association between work in healthcare and sensitization to this substance [3,7]. However, our results are lower than data reported by Suneja-Belsito [5], probably as a result of the reduction in use of this sensitizer in Italian hospitals.

HCWs were also statistically more likely than WCWs to be allergic to *p*-phenylenediamine. This could be related to personal use of hair colouring in this occupational group

Table 1. Characteristics of the study population (MOAHLFA index)

	Male				Female				Total			
	HCWs		WCWs		HCWs		WCWs		HCWs		WCWs	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
O (Occupational)	70	23**	31	4	241	22**	69	4	311	22**	100	4
A (Atopic eczema)	165	5	122	11**	68	5	264	11**	84	5	386	11**
H (Hand and forearm)	164	47*	360	38	631	51*	729	34	795	50**	1089	35
L (Leg)	23	7	84	9	51	4	109	5	74	5	193	6*
F (Face)	50	14	149	16	235	19	599	28**	285	18	748	24**
A (Age 40+)	217	45**	452	33	545	32	884	29	762	35*	1336	31

MOAHLFA index represents the proportion of males and the characteristics represented on the table.

χ^2 statistic (HCWs versus WCWs): **P* < 0.05; ***P* < 0.001.

Table 2. Potential sensitizers associated with sensitization in HCWs (OR adjusted by age and sex)

Substance	n	%	OR adj	95% CI
Formaldehyde	49	5	1.7	1.2 2.3
p-phenylenediamine	44	4	1.6	1.1 2.3
Nickel sulphate	342	32	1.1	0.98 1.3
Thiuram mix	29	3	1.4	0.9 2.2
Thimerosal	82	8	1.2	0.9 1.5
Potassium dichromate	84	8	1.1	0.9 1.4
Balsam of Peru	75	7	1.1	0.8 1.4
Carbamates	41	4	1.1	0.8 1.6
Diaminodiphenylmethane	32	3	1.2	0.8 1.8
Cobalt chloride	111	10	1.0	0.8 1.2
Disperse Blue	31	3	1.1	0.7 1.6
Colophony	20	2	1.2	0.7 1.9
Ethylenediamine	18	2	1.0	0.6 1.9
Fragrance mix	65	6	0.8	0.6 1.1
Disperse Yellow	10	0.9	1.2	0.6 2.5
Neomycin sulphate	20	1.9	0.9	0.6 1.5
MCI/MI	38	4	0.8	0.5 1.1
Anhydrous lanolin	15	1.4	0.9	0.5 1.6
Formaldehyde resins	15	1.4	0.8	0.5 1.5
Betaine	13	4	0.7	0.4 1.3
Primine	9	0.8	0.8	0.4 1.8
IPPD	7	0.7	0.8	0.4 1.9
Quaternium-15	9	0.8	0.8	0.4 1.5
2-mercaptobenzothiazole	6	0.6	0.8	0.3 1.9
MDBGN	15	1.5	0.5	0.3 0.9
Quinoline mix	5	0.5	0.8	0.3 2.1
Benzocaine	3	0.3	0.5	0.2 1.7
Epoxy resins	2	0.2	0.3	0.1 1.4

MCI/MI, methylchloroisothiazolinone/methylisothiazolinone; IPPD, N-isopropyl-N'-phenyl-p-phenylenediamine; MDBGN, methyldibromo glutaronitrile. The OR and the 95% CI have been calculated using white-collar workers as the reference category.
Bold values: statistically significant results.

but could also be due to occupational contact with rubber products containing cross-reacting dyes [8].

Our study found a moderate increase in the prevalence of nickel sensitization in HCWs compared to WCWs. Schubert [9] studying nickel dermatitis in HCWs reported that in most cases sensitization is acquired before working life or is attributable to non-occupational sources such as earrings, wristwatches and clothing buckles. We also postulate that frequent contact with metal objects in skin that is dry or damaged (by disinfectants and repetitive hand washing) could increase nickel permeation and the resulting risk of sensitization [10].

There are some limitations to this study. Although based on a large sample, the study population included patients who attended health services for suspected allergic dermatitis, and for this reason our results may be affected by selection bias. Another possible limitation relates to its multicentric design that may affect the data recording in different centres, although all participants accepted a standardized protocol.

Despite these limitations, our study results could aid better understanding of contact dermatitis and other skin diseases in this occupational group.

Key points

- Healthcare workers are an occupational group at risk of occupational skin disease.
- This study presents data from one of the larger patch test databases in Italy.
- We found an association between formaldehyde and p-phenylenediamine and hand/forearm dermatitis in healthcare workers.

Acknowledgements

We are grateful to all participating members of the north-East Italy Contact Dermatitis Group (NEICDG): S. Chiara Hospital, Trento; S. Maria degli Angeli Hospital, Pordenone; Hospital of Rovigo; S. Martino Hospital, Belluno; and Poliambulatorio Euganea Medica, Padua.

Conflicts of interest

None declared.

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