

A survey of occupational hand eczema in Denmark

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Occupational hand eczema (OHE) is the most frequently recognized work-related disease in Denmark and the annual cost to society is high. Understanding of the epidemiology of OHE is essential to be able to give appropriate recommendations for its prevention. The study comprised 758 persons, 490 females and 268 males with recognized OHE in the period October 2001 to November 2002. Data were obtained prospectively from the National Board of Industrial Injuries Registry and from a self-administered questionnaire (response rate, 82%). The most frequently recognized diagnosis was irritant contact dermatitis (ICD), mainly caused by wet occupations. The proportion of occupational ICD was equal for males and females, 59.7% and 63.1%, respectively. The estimated rates of OHE were high for bakers, hairdressers and dental surgery assistants, and a high proportion of apprentices were found among hairdressers. The prevalence of atopic dermatitis was low (16.4%) compared to previous studies among hand eczema patients. The prevalence of occupational allergic contact dermatitis in the study population was substantially higher among males than females, and the most frequent causes among males were allergy to chromium (leather exposure), rubber additives (gloves) and nickel due to exposure from work tools and metalworking industry.

Key words: allergic contact dermatitis; atopic dermatitis; contact urticaria, irritant contact dermatitis; occupational hand eczema; prevention; socio-economic impact. © Blackwell Munksgaard, 2004.

Accepted for publication 7 August 2004

Occupational skin diseases (OSD) are the most frequently recognized work-related diseases in Denmark, and occupational hand eczema (OHE) comprises 90–95% of all OSD cases (1). Several studies show that almost ½ of all OHE cases develop a chronic condition with persistent dermatitis, sick leave and sometimes job change. The annual cost to society is high and the need for prevention to reduce the number of OHE is clear (1–4).

Descriptive data concerning OHE are necessary to characterize the disease when strategies for prevention is planned, even in situations where the aetiology may be well described. The aim of this study was to characterize OHE in Denmark and thereby contribute to prevention of the disease.

Materials and Methods

The study population

The study population comprised all new cases of OHE, who were 18 years or above at the time of registration of the case, from the Danish National Board of Industrial Injuries Registry (DNBIIR)

in the period October 2001 to November 2002 (58 weeks). This population was enrolled as a study cohort to evaluate the prognosis of OHE according to various clinical, occupational and psychosocial variables. In this paper, we present cross-sectional data at baseline for the study. Cases were identified by receiving a list of all new cases every week from the DNBIIR. Information available from the DNBIIR for each person included patch and prick test results, diagnosis and subdiagnosis of OHE, severity assessment of OHE and socio-economic status. To achieve additional information, all participants received a self-administered questionnaire by mail within 1–2 weeks after case registration. The questionnaire asked about disease duration, atopic dermatitis (using the UK working party criteria) (5), occupation and psychosocial variables.

The DNBIIR Registry

The registry comprises all notified and recognized cases of occupational diseases in Denmark. Doctors are obliged by law to notify all suspected or

Table 1. Study definitions

Occupational contact dermatitis (OCD)	Inflammatory skin response caused or aggravated by occupational exposure
Occupational hand eczema (OHE)	Inflammatory skin response caused or aggravated by occupational exposure and located to the hands
Occupational allergic contact dermatitis (OACD)	A positive patch test result for an occupational exposure
Occupational irritant contact dermatitis (OICD)	No positive patch test result with occupational relevance, but relevant occupational exposure to irritant(s)
Occupational contact urticaria (OCU)	Clinical diagnosis based on patient records, relevant exposure and prick test
Non-occupational allergic contact dermatitis (NOACD)	A positive patch test result for a non-occupational exposure
Atopic dermatitis (AD)	
Definition 1	Based on information about past flexural eczema or currently diagnosed AD by a dermatologist.
Definition 2	UK working party criteria (5)
Disease duration at notification	The time from onset of symptoms until notification to the Danish National Board of Industrial Injuries

known occupational diseases. Before recognition of a case with OHE, each notified case has been examined by a dermatologist and patch testing has been performed. A case can be recognized with or without payment of economic compensation, which only is paid if a permanent injury persists. A reduction in earning capacity will lead to an additional economic compensation. Both types of compensation are paid independently of the current work situation.

The questionnaire

Administration. The questionnaire was administered by mail 1–2 weeks after the assessment of recognition and compensation in the DNBII. A reminder was sent after 2 weeks, and after an additional period of 2 weeks, non-responders received a reminding telephone call.

To increase the return rate, we used previous recommended techniques such as advance warning (a notification card was sent 3 days prior to the questionnaire), a covering letter with the questionnaire and a lottery ticket with the possibility to win a vacation (6).

Development, validity and reliability of the questionnaire. Prior to the study, the questionnaire was evaluated and revised on the basis of structured interviews with hand eczema outpatients from the Department of Dermatology, Gentofte Hospital, and then re-evaluated in a test/re-test pilot study. In the pilot study, all items were considered to be relevant and easy to comprehend by the participants and the questionnaire was considered to be functioning well and to have satisfactory validity, reliability and response rate (data not shown).

Definitions. Tables 1 and 2 gives the definitions used in this study. The overall severity score (range 0–2) depends on the clinical assessment of

the severity of the skin response (erythema, scaling, number of vesicles/fissures and hyperkeratosis), based on the clinical information that was admitted to the DNBII as well as the frequency of disease relapse. As it is possible to have more than 1 diagnosis, cases were categorized into 5 main groups as follows:

- (1) Occupational allergic contact dermatitis (OACD)
- (2) Occupational irritant contact dermatitis (OICD)
- (3) Occupational contact urticaria (OCU)
- (4) OICD + OACD
- (5) OICD + OCU

Statistical methods

An independent research unit entered the data obtained from the registry and the questionnaires twice. The statistical analyses were made in STATA version 8.1. Analyses comprised prevalence proportions (PPs), Chi-square tests, one-way ANOVA test and logistic regression models. All *P*-values are 2-sided, and a 5% level of statistical significance was used.

Results

Sex, age and diagnoses

The complete study population comprised 758 individuals, 490 females and 268 males (female/

Table 2. Overall severity score for occupational hand eczema

Disease relapse	1–2×/year	3–4×/year	>4×/year
Intensity of skin response ^a			
None	0	1	1
Mild	1	1	1
Moderate	1	2	2
Severe	2	2	2

0 = none or minimal eczema; 1 = mild/moderate eczema; 2 = severe eczema.

^aVesicles, erythema, oedema, fissures, scaling and hyperkeratosis.

Table 3. The distribution of sex, age and socio-economic status according to responders and non-responders

	Responders, <i>n</i> = 621 (%)	Non-responders, <i>n</i> = 137 (%)	Total, <i>n</i> = 758 (%)
Sex			
Males	213 (34.3)	55 (40.1)	268 (35.4)
Females	408 (65.7)	82 (59.9)	490 (64.6)
Age		^a	
18–24	132 (21.3)	23 (16.9)	155 (20.5)
25–29	106 (17.1)	28 (20.6)	134 (17.7)
30–39	183 (29.5)	43 (31.6)	226 (29.9)
40–49	98 (15.8)	24 (17.7)	122 (16.1)
50+	102 (16.4)	18 (13.2)	120 (15.9)
Mean age _{females}	35.1 years	36.5 years	35.3 years
Mean age _{males}	37.1 years	33.3 years	36.3 years
Mean age _{total}	35.8 years	35.2 years	35.6 years
Median age _{total}	34.2 years	32.9 years	34.0 years
Socio-economic status ^b			
Students, trainees	113 (18.3)	22 (16.1)	135 (17.9)
Employee high level	9 (1.5)	1 (0.7)	10 (1.3)
Employee medium level	76 (12.3)	7 (5.1)	83 (11.0)
Employee basic level	264 (42.8)	65 (47.5)	329 (43.4)
Employee, other	154 (24.8)	42 (30.7)	196 (25.9)
Total	616 (100)	137 (100)	753 (100)

^aOne missing value.^bResponders and non-responders according to socio-economic status (Socio97. Socio-economic Classification, 1st edition, 1997. Statistics Denmark). One early retired and 4 missing values were withdrawn from Chi-square test analysis. Chi-square test for the distribution of socio-economic status is equal between responders and non-responders. *P* = 0.144

male ratio = 1.8). 621 persons returned the questionnaire (response rate = 82%). There were no major differences in age, sex or socio-economic status between responders and non-responders (Table 3).

The PP of OICD was similar among both sexes, while the PP of OACD was significantly higher among males. 65% of all females and 48% of all males had contact allergy to 1 or more allergens (OACD + NOACD). 36 patients (4.8%) were diagnosed as OCU (22 cases due to latex exposure

and 17 cases due to food allergen exposure). 21 patients (2.8%) were diagnosed as a combination of OCU and OICD (10 cases due to latex exposure and 13 cases due to food exposure).

The total PP of AD was 16.4% (11.3% based on information from the questionnaire using the UK working party criteria) and the total PP for NOACD was 31.4%, with a significantly higher PP among females for both diagnoses (Table 4). NOACD was mainly due to nickel and fragrance (Table 5).

Occupation

The most frequent occupations to cause OHE in the study population are listed in Tables 6 and 7. The list reflects the marked differences of occupation

Table 4. The distribution of diagnoses and subdiagnoses by sex for all individuals

Diagnosis	Males (%)	Females (%)	Total (%)	<i>P</i> -value ^a
OICD	160 (59.7)	309 (63.1)	469 (61.9)	
OACD	72 (26.9)	89 (18.2)	161 (21.2)	
OCU	9 (3.4)	27 (5.5)	36 (4.8)	
OICD + OACD	20 (7.5)	51 (10.4)	71 (9.4)	0.014
OICD + OCU	7 (2.6)	14 (2.9)	21 (2.8)	
–AD	234 (87.3)	400 (81.6)	634 (83.6)	
+AD	34 (12.7)	90 (18.4)	124 (16.4)	0.037
–NOACD	227 (84.7)	293 (59.8)	520 (68.6)	
+NOACD	41 (15.3)	197 (40.2)	238 (31.4)	< 0.001
Total	268 (100)	490 (100)	758 (100)	

AD = atopic dermatitis; NOACD = non-occupational allergic contact dermatitis; OACD = occupational allergic contact dermatitis; OCU, occupational contact urticaria; OICD = occupational irritant contact dermatitis.

^aChi-square test for equal distribution between sexes.

Table 5. Non-occupational allergic contact dermatitis (NOACD) according to sex for all individuals

NOACD	Males (<i>n</i> = 268)	Females (<i>n</i> = 490)	Total (<i>n</i> = 758)
Nickel/ cobalt	14 (5.2)	134 (27.3)	148 (19.5)
Fragrance/ balsam of Peru	15 (5.6)	33 (6.7)	48 (6.3)
Chromium	3 (1.1)	10 (2.0)	13 (1.7)
Biocides	3 (1.1)	9 (1.8)	12 (1.6)
Other	10 (3.7)	13 (2.7)	23 (3.0)
Total	45 (16.8)	199 (40.6)	244 (32.2)

Chi-square test for equal distribution of NOACD between sexes. *P* < 0.01

*It is possible to have more than one NOACD.

Table 6. The distribution of occupation according to sex and the number of person-years and estimated incidence rates for the responders group

Occupation	Males (%)	Females (%)	Total (%)	No. of employees in Denmark ^a	Person-years ^b of hand eczema	Estimated rates (cases per 1000 person-years)
Wet occupations						
Healthcare workers	3 (3.2)	130 (31.9)	133 (21.4)	174 950	195 131	0.68
Cleaners	4 (1.9)	46 (11.3)	50 (8.1)	77 774	86 747	0.58
Hairdressers	1 (0.5)	34 (8.3)	35 (5.6)	5591 ^c	6236	5.61
Dental surgery assistants	1 (0.5)	19 (4.7)	20 (3.2)	4290	4785	4.18
Laboratory technicians	0 (0)	10 (2.5)	10 (1.6)	—	—	—
Doctors, dentists, veterinarians	5 (2.4)	2 (0.5)	7 (1.3)	16 600	18 515	0.38
Food occupations						
Bakers	20 (9.4)	14 (3.4)	34 (5.5)	3643	4063	8.37
Kitchen workers, cooks	16 (7.5)	54 (13.2)	70 (11.3)	19 213	21 430	3.27
Butchers	5 (2.6)	6 (1.5)	11 (1.8)	4682	5222	2.11
Other occupations						
Factory worker	34 (16.0)	27 (6.6)	61 (9.8)	—	—	—
Manual worker	16 (7.5)	3 (0.7)	19 (3.1)	—	—	—
Machinists	15 (7.0)	0 (0)	15 (2.4)	—	—	—
Construction workers	10 (4.7)	4 (1.0)	14 (2.3)	—	—	—
Cashiers	0 (0)	14 (3.4)	14 (2.3)	84 110	93 815	0.15
Carpenters	7 (3.3)	1 (0.3)	8 (1.3)	40 652	45 343	0.18
Printers	6 (2.8)	2 (0.5)	8 (1.3)	—	—	—
Office workers	2 (0.9)	6 (1.5)	8 (1.3)	—	—	—
Other tradesmen	52 (24.4)	3 (0.7)	55 (8.9)	—	—	—
Mixed occupations	16 (7.5)	33 (8.1)	49 (7.9)	—	—	—
Total (%)	213 (100)	408 (100)	621 (100)	—	—	—

^aInformation obtained from the Official Danish Statistics, January 1st 2002.

^bAdjusted for 58 weeks.

^cInformation derives from the union of hairdressers and beauticians 2002 – data not available.

Table 7. The distribution of diagnoses and subdiagnoses according to occupations for the responders group

Occupation	OICD (%)	OACD (%)	OCU (%)	OICD + OACD (%)	OICD + OCU (%)	Total (%)	AD (%)	NOACD (%)
Wet occupations								
Healthcare workers	87 (65.4)	18 (13.5)	12 (9.0)	10 (7.5)	6 (4.5)	133 (100)	27 (20.3)	50 (37.6)
Cleaners	40 (80.0)	3 (6.0)	0 (0.0)	7 (14.0)	0 (0.0)	50 (100)	9 (18.0)	22 (44.0)
Hairdressers	16 (45.7)	9 (25.7)	0 (0.0)	10 (28.6)	0 (0.0)	35 (100)	7 (20.0)	9 (25.7)
Dental surgery assistants	10 (50.0)	5 (25.0)	3 (15.0)	2 (10.0)	0 (0.0)	20 (100)	6 (30.0)	7 (35.0)
Laboratory technicians	9 (90.0)	1 (10.0)	0 (0.0)	0 (0.0)	0 (0.0)	10 (100)	4 (40.0)	5 (50.0)
Doctors, dentists, veterinarians	1 (14.3)	3 (42.9)	2 (28.6)	1 (14.3)	0 (0.0)	7 (100)	1 (14.3)	0 (0.0)
Food occupations								
Bakers	16 (47.1)	9 (26.5)	4 (11.8)	3 (8.8)	2 (5.9)	34 (100)	5 (14.7)	5 (14.7)
Kitchen workers, cooks	49 (70.0)	5 (7.1)	4 (5.7)	5 (7.1)	7 (10.0)	70 (100)	11 (13.6)	21 (25.9)
Butchers	7 (63.6)	0 (0.0)	2 (18.2)	2 (18.2)	0 (0.0)	11 (100)	2 (18.2)	3 (27.3)
Other occupations								
Factory worker	38 (62.3)	20 (32.8)	2 (3.3)	1 (1.6)	0 (0.0)	61 (100)	3 (4.9)	22 (36.1)
Manual worker	10 (52.6)	6 (31.6)	0 (0.0)	3 (15.8)	0 (0.0)	19 (100)	5 (26.3)	1 (5.3)
Machinists	7 (46.7)	1 (6.7)	0 (0.0)	7 (46.7)	0 (0.0)	15 (100)	0 (0.0)	2 (13.3)
Construction workers	7 (50.0)	7 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	14 (100)	1 (7.1)	2 (14.3)
Cashiers	10 (71.4)	3 (21.4)	0 (0.0)	0 (0.0)	1 (7.1)	14 (100)	1 (7.1)	4 (28.6)
Carpenters	3 (37.5)	5 (62.5)	0 (0.0)	0 (0.0)	0 (0.0)	8 (100)	0 (0.0)	1 (12.5)
Printers	4 (50.0)	4 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	8 (100)	1 (12.5)	3 (37.5)
Office workers	4 (50.0)	4 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	8 (100)	3 (37.5)	1 (12.5)
Other tradesmen	37 (67.3)	16 (29.1)	0 (0.0)	2 (3.6)	0 (0.0)	55 (100)	7 (12.7)	8 (14.6)
Mixed occupations	33 (67.4)	12 (24.5)	0 (0.0)	3 (6.1)	1 (2.0)	49 (100)	10 (20.4)	21 (42.9)
Total (%)	388 (62.5)	131 (21.1)	29 (4.7)	56 (9.0)	17 (2.7)	621 (100)	103 (16.6)	187 (30.1)

AD = atopic dermatitis; NOACD = non-occupational allergic contact dermatitis; OACD = occupational allergic contact dermatitis; OCU, occupational contact urticaria; OICD = occupational irritant contact dermatitis.

Table 8. Occupational allergic contact dermatitis stratified by sex and exposure (for all individuals)

Allergen*	Exposure	Males (%), n = 268	Females (%), n = 490	Total (%), n = 758
Rubber additives ^a	Gloves (56), other (7)	18 (6.7)	44 (9.0)	62 (8.2)
Biocides ^b	Cleansing agents (8), oil (8), moisturizers (6), other (21)	11 (4.1)	31 (6.3)	42 (5.5)
Nickel/ cobalt	Metal production (13), tools (13), keys (5), other (10)	14 (5.2)	24 (4.9)	38 (5.0)
Chromium	Leather (9), oil (5), cement (4), other (4)	18 (6.7)	2 (0.4)	20 (2.6)
Dyes, bleaching agents	PPD (12), ammonium persulfate (4), toluenediamine (2), glycerol monothioglycolate (2), nitroparaphenylenediamine (1), contra colour (1)	2 (0.7)	17 (3.5)	19 (2.5)
Epoxy	Windmills (8), paint (6), glue (2), other (1)	13 (4.9)	3 (0.6)	16 (2.1)
Food allergens ^a	Spices (4), flour (3), other (6)	8 (3.0)	4 (0.8)	12 (1.6)
Fragrance	Cleansing agents (4), cosmetics (6), other (2)	0 (0)	11 (2.2)	11 (1.2)
Acrylic resins	Glue (3), fillings (4), other (3)	5 (1.9)	5 (1.0)	10 (1.3)
Plants	Teak (4), other (3)	4 (1.5)	3 (0.6)	7 (0.9)
Colophonium	Tape (2), other (5)	2 (0.7)	4 (0.8)	6 (0.8)
Other	Not specified	14 (5.2)	12 (2.4)	26 (3.4)

*It is possible to have more than one exposure.

^aOnly type IV allergic reactions are given.

^bComprises of formaldehyde (chloro)methyl-isothiazolinone, Euxyl k400, quaternium 15 and 1 unspecified biocide.

between females and males, e.g. 130 females and only 3 males were healthcare workers. The most frequent male occupations were factory worker and bakers (the group 'other tradesmen' is a mixed group of different trade occupations, each below 3%) and for females it was healthcare workers and kitchen workers/cooks.

The estimated rates of OHE according to occupation are calculated on the basis of numbers of all individuals in Denmark, as of 1 January 2002, in the various occupations and adjusted for 58 weeks. Data were provided from Statistics Denmark but unfortunately not available for all occupations. Table 6 summarizes that the rates of OHE were high for bakers, hairdressers, dental surgery assistants, kitchen workers/cooks and butchers. OICD was most commonly found in wet occupations but was also frequent in cashiers.

OACD was predominantly diagnosed in carpenters, construction workers, printers and office workers. AD, as a subdiagnosis, was found with the highest frequency in laboratory assistants, but also in office workers (Table 7).

Recognized exposures of OHE are listed in Tables 8 and 9. The most frequent exposures causing OACD in males were chromium and rubber additives, and for females, it was rubber additives and biocides. For males, the most frequent exposure to cause OICD was oils, while it was wet work for females.

Education and socio-economic status

A significantly higher level of education was found for females compared to males and a higher PP of females were in training. We also

Table 9. Occupational irritant contact dermatitis stratified by exposure and sex (for all individuals)

Irritant ^a	Exposure	Males, n = 268 (%)	Females, n = 490 (%)	Total, n = 758 (%)
Wet work	Water, soap	34 (12.7)	292 (59.6)	326 (43.0)
Food	Flour (27), fish (7), vegetables (18) fruit (3), meat (11), other (2)	38 (14.2)	52 (10.6)	90 (11.9)
Gloves	NS	8 (3.0)	72 (14.7)	80 (10.6)
Oils	NS	73 (27.2)	5 (1.0)	78 (10.3)
Mechanical irritation	Paper (11), metal (8), wood (4), other (24)	32 (11.9)	15 (3.1)	47 (6.2)
Chemicals	Acid, alkaline (3), detergents (15), paint (8)	22 (8.2)	12 (2.4)	34 (4.4)
Other	NS	16 (6.0)	14 (2.9)	30 (4.0)
Disinfectants	NS	1 (0.4)	4 (0.8)	5 (0.7)
Physical conditions	NS	1 (0.4)	0 (0)	1 (0.1)

NS= not specified.

^aIt is possible to have more than one exposure.

observed a marked variation in the percentage of students/trainees in the different occupations. Hairdressers with recognized OHE had the highest proportion of apprenticeships (71%), followed by cooks/kitchen workers (52%), butchers (36%) and bakers (29%).

Severity and disease duration

The mean disease duration was 4.4 years for males (median 2.0 years) and 4.9 years for females (median 2.0 years). Disease duration was not associated with occupation although a marked variation was registered (1-way ANOVA analysis), data not shown. Cooks/kitchen workers were found to have a mean disease duration of 4.7 years, and 27.1% had severe hand eczema, compared to healthcare workers with a mean duration of 4.9 years and 14.3% with severe hand eczema. Construction workers were found to have long disease duration of 8.2 years and 14.3% had severe eczema.

Discussion

Incidence rates

The estimated rates of OHE in the various occupations are higher in our study compared to the rates in the Saarland in Germany (7), but the ranking between occupations is similar, with hairdressers and food-related occupations in the top 5 list.

ICD

The most frequently recognized diagnosis was ICD, mainly caused by wet occupations. The proportion of occupational ICD was similar for males and females, 59.7% and 63.1%, respectively, even though females were over-represented in wet occupations. The major cause of OICD was water and soap for females and oils for males. These results confirm earlier findings (8).

Allergic contact dermatitis

The most frequently recognized occupational allergens in the female population were rubber additives and biocides, reflecting the allergen exposure in wet occupations.

Males showed a somewhat different pattern, with a significantly higher prevalence of OACD compared to females. The most frequent causes of recognized OACD for males were allergy to chromium and rubber additives, due to leather and rubber glove exposure, followed by nickel due to exposure from the metalworking industry and

work tools. Epoxy and specific items from the workplace (chemicals not included in test series) were also common causes of OACD in males. The different pattern between females and males probably reflects the differences in occupational exposure more than an actual sex difference. It is well known that both nickel and chromium allergy are of mainly occupational origin in males, while in females, nickel allergy primarily derives from contact with nickel-releasing consumer items such as earrings (9, 10).

Cement exposure used to be the major cause of chromium allergy in Denmark (11). Danish legislation introduced in 1981 (12), decreasing the content of hexavalent chromium in cement, has changed this situation. In this study, 4 cases of chromium allergy due to cement were observed. No further details about the source of this cement was available, but from previous studies it is known that such cases are either due to imported cement or exposure before the introduction of the legislation (13). In contrast, it was shown that chromium is still a leading allergen in the construction industry in Northern Bavaria, Germany (where legislation was not introduced until recently), with no significant decline over a 10-year period (14). In Denmark, chromium is still a leading occupational allergen, now primarily due to use of leather items such as gloves.

Nickel allergy from work tools and metalworking were frequent causes in both sexes. It has been shown that nickel in significant amount may be released from tools (15) and metalworkers are known to have an increased risk of nickel allergy (16, 17). In a recent study of OSD comprising mainly hand eczema cases, nickel was found to be the most common sensitizer, but showing an occupational relevance in only 11% of the cases sensitized (9). This is in accordance with our results, where 19.5% had a nickel/cobalt allergy of no occupational relevance, 27% of females and 5.2% of males, respectively. The prevalence of nickel allergy is more than twice as high as the prevalence reported in the background population in Denmark, where 11.1% of females and 2.2% of males in the age group 15–69 years were found to be allergic to nickel (18). Recent studies on hand eczema patients report the frequency of nickel allergy to be 29.1% in females and 2.1% in males (19).

Such differences indicate that nickel allergy, even without occupational relevance, may play a role in the pathogenesis of OHE. It may be that nickel allergy in general increases the risk of OHE regardless of exposures. It is also possible that persons with NOACD are exposed to allergens in their personal life, which may influence the risk

and course of OHE. Previously, it has been suggested that any damage to the epidermis may lead to a higher risk of developing OHE (20) and that continuous exposure to nickel at skin sites other than the hands may increase the risk of hand eczema (21). In this study, we found little or no association between NOACD and socio-economic status, diagnosis, duration or severity, and future research is warranted to elucidate the influence of non-occupational sources, especially in the area of nickel allergy.

Atopic Dermatitis

The prevalence of AD in the study population (16.4%) was similar to the prevalence in the background population (22), but considerably lower compared to epidemiological studies of patients with hand eczema, where the prevalence has been estimated at between 22% and 37% (19, 22–24). Since the diagnosis of AD will lead to a reduction in the compensation paid by the DNBII, it may be expected that this would lead to underreporting of the disease. However, using the UK working party criteria (data from the questionnaire are collected after the compensation was paid) to estimate AD, we found an even lower prevalence of AD (11.3%), which argues against AD being underreported.

The low prevalence of AD may be explained by the preventive effect of discouraging persons with AD to enter risk occupations such as wet- or food-related occupations, which would be an attractive interpretation; however, healthy worker selection probably also plays a role.

The high proportion of AD in office workers is more likely to be due to a very small study group (3 persons with AD out of 8 office workers) than to a truly high prevalence.

Education and socio-economic status

The finding that females were significantly better educated than males, and a preponderance of female trainees compared to males, probably reflects the differences in occupation between females and males.

The high proportion of apprentices in hairdressers indicates that hairdressers are at high risk of OHE with short induction time, due to massive exposure to irritants and allergens during their trainee period (25). Healthy worker selection may mask some occupational associations, especially if occupational exposure acts over a short time span, and the worker may leave the work before a recognized disease is established.

Strengths and biases

The strengths of this study are the large sample size, the high response rate to the questionnaire (RR = 82%) and the complete database from the DNBIIR, with detailed information on age, sex, socio-economic status, allergy and AD of all cases. In addition, the original data from the registry were collected prospectively and independently of the aims of this study.

One of the limitations of this study is that the numbers of notified and thereby recognized cases may not necessarily reflect the true number of patients with the disease, and mild cases of short duration may be missed (26, 27). Minor complaints such as transient dryness, occasional fissures and abrasions are often regarded as inevitable and a natural part of manual occupations. In the present study, only recognized cases of OHE were included and the estimated rates should be seen strictly in this context. However, physicians and patients with OHE are most likely interested in reporting disease because of potential financial compensation for the diseased, which means that this bias is believed to be of minor importance. Furthermore, in this study, 32.9% had no or minimal eczema, which also argues against a major underestimation of very mild cases.

Main observations

- (1) In the study population of 758 persons with recognized OHE, the mean age was 35.6 years and the female: male ratio 1.8.
- (2) Occupational ICD was the most frequent diagnosis in both males and females.
- (3) 59% of all females were in wet occupations.
- (4) The quantitatively dominant group was healthcare workers.
- (5) The estimated incidence rates were high among bakers, hairdressers, dental surgery assistants and kitchen workers/cooks.
- (6) A high proportion of apprentices with OHE was found among hairdressers and kitchen workers/cooks.
- (7) Contact allergy was more frequent in females, while occupational relevance was detected significantly more frequently in males than in females, caused primarily by chromate, rubber additives, nickel and epoxy.
- (8) The prevalence of atopic dermatitis was less frequent than expected in a hand eczema population.

Based on these main observations, we recommend that pre-employment counselling of

patients with atopic dermatitis should be maintained, since the observed low prevalence of AD in our study may very well be related to such counselling. Pre-employment counselling has also been recommended in previous studies (23, 28). It is also advisable to introduce skin care programmes and skin policies at the workplace, especially in wet and food-related occupations (29, 30). Furthermore, we encourage more focus on elimination, replacement or avoidance of skin contact with harmful allergens, and extensive monitoring of high-risk occupations such as food-related occupations, hairdressers and dental surgery assistants.

More research is needed to enhance our understanding of the potential effect of previous contact sensitization or simultaneous allergen exposure on the development of OHE.

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