

Surveillance scheme for occupational skin disease in the Saarland, FRG

First report from BKH-S

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Occupational skin disease (OSD) is a significant public health concern. To keep OSDs under surveillance, a register of OSDs (BKH-S) was implemented in 1999 in the Saarland, FRG. We conducted a population-based register study to analyse all initial reports of OSDs reported to the BKH-S. 336 cases were prospectively assessed from July 1999 to June 2001. In 78% ($n = 263$) of the cases an occupational cause for the skin disease was stated, 91% ($n = 240$) of which fell within 16 occupational groups. This is equivalent to 6.8 cases per 10,000 workers per year within these occupational groups. Notably, young age groups (median age 35 years) were affected with a female predominance. The most frequent final diagnosis was irritant contact dermatitis (75%) followed by allergic contact dermatitis (34%) and atopic dermatitis (19%). The overall prevalence of occupationally relevant delayed-type reactors was 21% and of immediate-type reactors 17%. Work-related delayed-type sensitizations to potassium dichromate ($n = 8$) and immediate-type sensitizations to natural rubber latex ($n = 11$) were the most frequently observed. Questionnaire results showed frequent occupational skin contact with wet work (59%), detergents (48%), and disinfectants (38%). The second valid surveillance scheme for OSD in the FRG has been introduced and can be made available for further analysis.

Key words: allergic contact dermatitis; BKH-S; epidemiology; irritant contact dermatitis; occupational relevance; occupational skin disease (OSD); patch testing; population-based register study; prick testing; surveillance scheme. © Blackwell Munksgaard, 2002.

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Occupational skin disease (OSD) has become an issue of increasing importance world-wide, due not only to cost-intensification for employers but also to impairment of employees' quality of life (1). Due to the fact that OSD is to varying extents preventable, its national surveillance is a presupposition for management and prevention (2–8).

In Germany, realization of registers are based on local regulations being left to the individual Federal states. Different approaches, regulations and regional laws for reports to the register affect the results of registration. Population-based cancer registers in the FRG, for example, differ with respect to data entry and have been found not to reach the same level of completeness (9). Up to now, only the register of OSDs in Northern Bavaria (BKH-N) implemented in 1990 existed in the FRG. This data, observed over a 10-year period, has been previously reported (8, 10).

To survey the occurrence of OSD and sensitization by work-related substances in the Saarland, a register for OSDs was founded in cooperation with the State Department of Consumer and Health Protection and Occupational Safety. As there is only one competent Health and Safety Authority, data from this register should be an accurate reflection of the epidemiology of *reported* OSDs in this Federal state. Since the register was established at the beginning of 1999, all initial reports of OSDs have been recorded prospectively and standardized. As the records of the German Federal Employment Office (*Bundesanstalt für Arbeit*) provide data on the average status of occupation in relation to the employed population of obligatory social security insured persons for each Federal state, annual incidence rates of OSDs in various occupations could be calculated. In this population-based register study, data from 1 July 1999 to

30 June 2001 were analysed and reported for the first time.

Materials and Methods

Legal basis

According to no. 5101 of the list of occupational diseases as contained in the appendix of the German ordinance on industrial disease (*Berufskrankheiten-Verordnung*), the Federal Ministry of Labour and Social Affairs (*Bundesministerium für Arbeit und Sozialordnung*) has defined OSDs as 'severe or recurrent skin diseases that force the discontinuation of any activity that causes or that could be causing the development, the aggravation, or the recurrence of the skin disease'.

Reporting to the BKH-S

In Germany, physicians and employers are obliged by law to fill out an initial (medical) report of an OSD if they have a suspicion that a skin disorder is work-related. The insured person himself, the labour exchange (*Arbeitsamt*) and the health insurance scheme (*Krankenkasse*) can also report this suspicion. The report should be sent to the workers' compensation board (*Berufsgenossenschaft*) or to a government occupational physician (equivalent to a medical inspector of the Health & Safety Executive). In this reporting scheme the registration of OSDs is relatively high because physicians, labour exchanges and health insurance schemes have a genuine interest in recording OSDs. By doing so, the costs of treatment, rehabilitation and compensation can be passed on to the competent workers' compensation board, which is legally obligated to provide benefits and service. The workers' compensation board is required to inform the government occupational physician of indicated cases with a suspected OSD.

Case assessment

The data of the BKH-S is based upon availability of patient records, current clinical dermatological examinations, allergy testing, lab findings, and workplace inspections by the government occupational physician. After evaluation of the necessary information, as stated, the final diagnoses and assessments in each case were made by government occupational physicians who deal with OSDs (done by C.B.-K.). An OSD was assessed if the occupation was a determining factor or co-factor for the development or worsening of the dermatological disease. The registered data is considered to have particular quality due to the fact that it is

based on the expertise of the participating dermatologists who were the reporting and treating physicians, as well as the expertise of expert consultants. The concluding assessments of the government occupational physicians are also well thought out, due to the fact that their decisions entail legal consequences for the insured persons.

Patch and prick testing

In the context of workers' compensation claims, insured persons were patch and/or prick tested by dermatologists using standard series in accordance with standard methodology. Additionally, specific screening series and less frequent substances brought by the insured person were tested depending on his/her work routine. Each positive test reaction was reported based on the final interpretation and assessed for its occupational relevance by the government occupational physician. The physician's fundamental knowledge of workplace exposure helped in the assessment of the causes of reactions. In the reports, all occupationally relevant sensitizations were also clinically relevant.

Questionnaire

A standardized 3-page questionnaire was administered to each insured person for self-assessment and used to support the assessment of the government occupational physician. Information gathered includes occupational and non-occupational activities, previous course of the illness, previous diagnostic measures, atopy history, occupational and non-occupational exposure to irritants and allergens, as well as the use of skin protecting measures. From the questionnaire the question 'Do you have skin contact with the following substances or chemicals at the workplace?' with its response options 'often', 'rarely' and 'never' was evaluated. Only 'often' was counted as a positive response; 'rarely' and 'never' were counted as negative response.

Statistics

We used the program package SASTM 8.1 (SAS Institute Inc., Cary, NC, USA) to analyse data. Due to non-normality of univariate distributions we used robust measures (median; Q₁ 25% quantile, Q₃ 75% quantile) for description. The incidence rates were defined and calculated as the number of OSDs per 10,000 workers per year. Estimations of the levels of employment were taken from employment rates on 30 June 2000. We assumed constant incidence rates within the 2-year study period.

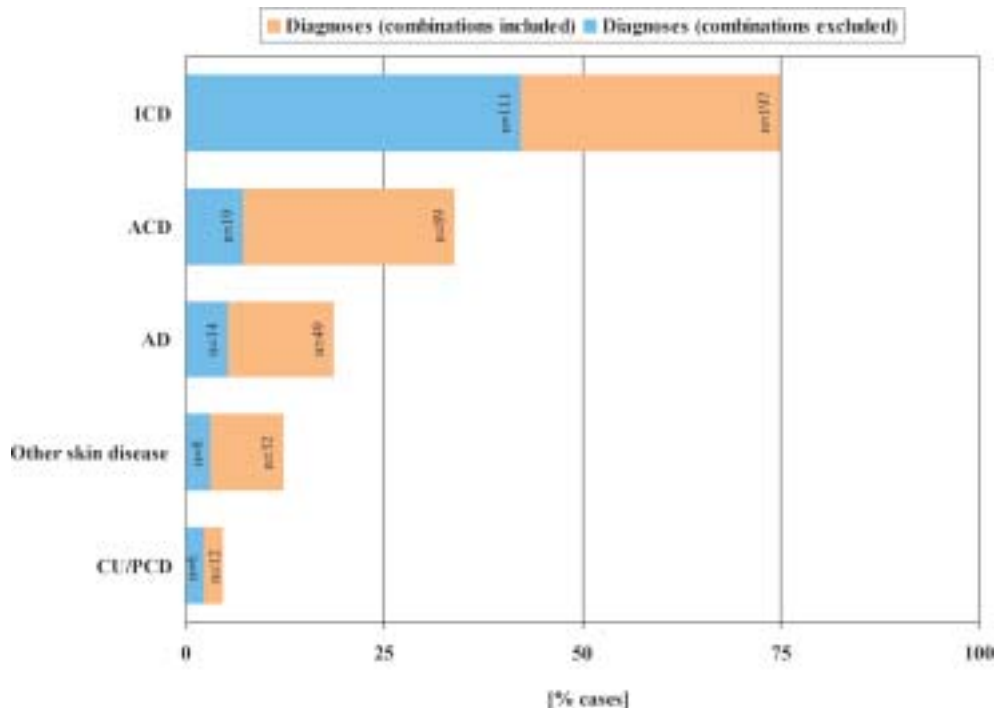


Fig. 1. Distribution of final diagnoses in the 263 cases with confirmed occupational causation (multiple diagnoses possible).

Results

Participants

From July 1999 to June 2001, a total of 336 notifications of suspected cases of OSD were assessed by a government occupational physician and recorded in the register. Reporting was made in descending order by dermatologists in 278 cases (83%), labour exchange in 29 cases (9%), health insurance scheme in 14 cases (4%), insured persons themselves in 9 cases (3%), physicians (except dermatologist) in 4 cases (1%), and employers in 2 cases (1%). The MOAHLFA index (11) of the total cohort was: men (M) = 42%; occupational causation (O) = 78%; atopic dermatitis (A) = 23%; hand dermatitis (H) = 86%; leg dermatitis (L) = 21%; face dermatitis (F) = 25%; and age over 40 years (A) = 40%. The median age was 35.5 years (Q_1 26 years, Q_3 47 years). Out of 336 cases, 144 (43%) evinced an atopic skin diathesis with ≥ 10 atopy score points according to Diepgen et al. (12, 13) including all cases ($n = 78$) with a manifest atopic dermatitis at the time of medicolegal assessment.

Stated cases of OSD

The final diagnoses in the 263 cases with confirmed occupational causation are shown in Fig. 1. Irritant contact dermatitis (ICD) was diagnosed most often followed by allergic contact dermatitis (ACD), atopic dermatitis (AD), other skin disease,

and contact urticaria (CU) or protein contact dermatitis (PCD), respectively. Additionally, 158 cases (60%) with single clinical history and findings consistent with one of these diagnoses are proportionally pictured. The remainder of 105 cases (40%) presented combinations of two or more diagnoses.

Out of 263 cases, 240 (91%) occurred in the 16 occupational groups examined (Table 1); the remainder of 23 cases (9%) were not evaluated further because of inhomogeneity of occupations and small sample size. Over the 2-year period in the 16 occupational groups, 175,953 workers were registered as determined by obligatory insurance participation. This results in 6.8 new work-related skin diseases per 10,000 workers per year in the Saarland, assuming constant incidence rates within the 2 years. The median age of these OSD cases was 35 years (Q_1 25 years, Q_3 45.5 years) and the male to female ratio was 1:1.6. In hairdressers and personal hygiene workers, nurses and physician assistants, and social care workers OSDs were observed in the relatively young and predominantly in female workers.

Relevance of test reactions

A sensitization based solely on a positive patch and/or prick test result is of little significance in occupational dermatology when the occupational and clinical relevance remains undetermined. Every positive reactor to patch and/or prick testing

Table 1. Annual incidence rates and demographic characteristics of the cases with a stated OSD within 16 occupational groups categorized to 4 industries (in descending order by incidence rates)

ID	Occupational industries and groups	Insured persons (n)	Stated cases of OSD (n)	Annual incidence rate (per 10,000 workers)	Median age (years)	Men (n)	Women (n)
1	Hairdressers, personal hygiene workers	2180	21	48.2	22.0	1	20
2	Cleaners	11,888	33	13.9	49.0	7	26
Health and social service		33,375	60	9.0	29.5	5	55
I.3	Nurses, physician assistants	17,003	43	12.6	26.0	1	42
I.4	Health care workers (except ID 3)	8368	12	7.2	47.0	4	8
I.5	Social care workers	8004	5	3.1	26.0	0	5
Food industry		27,490	47	8.5	33.0	15	32
II.6	Bakers, pastry cooks	1527	10	32.7	29.0	8	2
II.7	Cooks, food preparation workers	4536	17	18.7	38.0	3	14
II.8	Butchers, food processors (except ID 6, 7)	2761	6	10.9	32.5	4	2
II.9	Salesmen	18,666	14	3.8	29.5	0	14
Metal industry and mining		69,975	55	3.9	36.0	46	9
III.10	Miners	4793	10	10.4	44.0	10	0
III.11	Locksmiths, mechanics	26,944	25	4.6	36.0	20	5
III.12	Metal processors	14,177	13	4.6	34.0	12	1
III.13	Electricians, assemblers	24,061	7	1.5	33.0	4	3
Construction industry		31,045	24	3.9	34.5	20	4
IV.14	Construction and cement workers	11,612	12	5.2	43.5	10	2
IV.15	Interior decorators, carpenters, painters	9459	6	3.2	36.0	6	0
IV.16	Unskilled workers	9974	6	3.0	30.0	4	2
Σ	Total of 16 occupational groups	175,953	240	6.8	35.0	94	146

*No time trend was assumed.

was assessed in relation to his/her exposure history in the work environment by a government occupational physician. In Fig. 2 the relative frequencies of reactors with at least one positive sensitization as well as those felt to be clinically and occupationally relevant are listed within main occupational industries and groups. In 209 (87%) out of 240 cases with OSDs where patch testing was performed, 116 (56%) positive reactors were identified, 67 (32%) of those with clinical and 44 (21%) with occupational and clinical relevance. An occupational relevance above average of 21% was observed in hairdressers and personal hygiene workers (65%), construction workers (26%), and metal workers and miners (23%). In 100 (42%) out of 240 cases with OSDs where prick testing was performed, 96 (96%) positive reactors were identified, 43 (43%) of these displaying clinical and 17 (17%) clinical and occupational relevance. An occupational relevance above average of 17% was observed in health and social care workers (42%), and food preparation workers (29%).

Work-related allergens

In Table 2 all allergens positive seen and assessed to be occupationally relevant are listed by main occupational industries and groups. The allergens were on standard and supplementary screening

series. A ranking list of these allergens is shown in Table 3. Natural rubber latex (NRL), potassium dichromate, ammonium persulphate (APS), thiuram mix, and glyceryl monothioglycolate (GMTG) were most frequently assessed to be occupationally relevant. Sensitizations to nickel sulphate and fragrance mix were most frequently observed, but they rarely played a relevant role in cases with OSD.

Work-related irritants

Table 4 shows the work-related usage of dangerous substances for the skin, based on the questionnaire. An overall response rate of 75% ($n = 180/240$) was obtained within the main occupational industries and groups. Most frequently mentioned was exposure to wet work, 59% (non-specific distribution), detergents, 48% (non-specific distribution), and disinfectants, 38% (mainly health and social care workers).

BKH-S facing BKH-N

Figure 3 presents summarized results of the 2 registers of OSDs in the FRG, BKH-S and BKH-N. Although both registers mirror data of their own Federal state, they are comparable because of equal criteria of medicolegal assessment and the

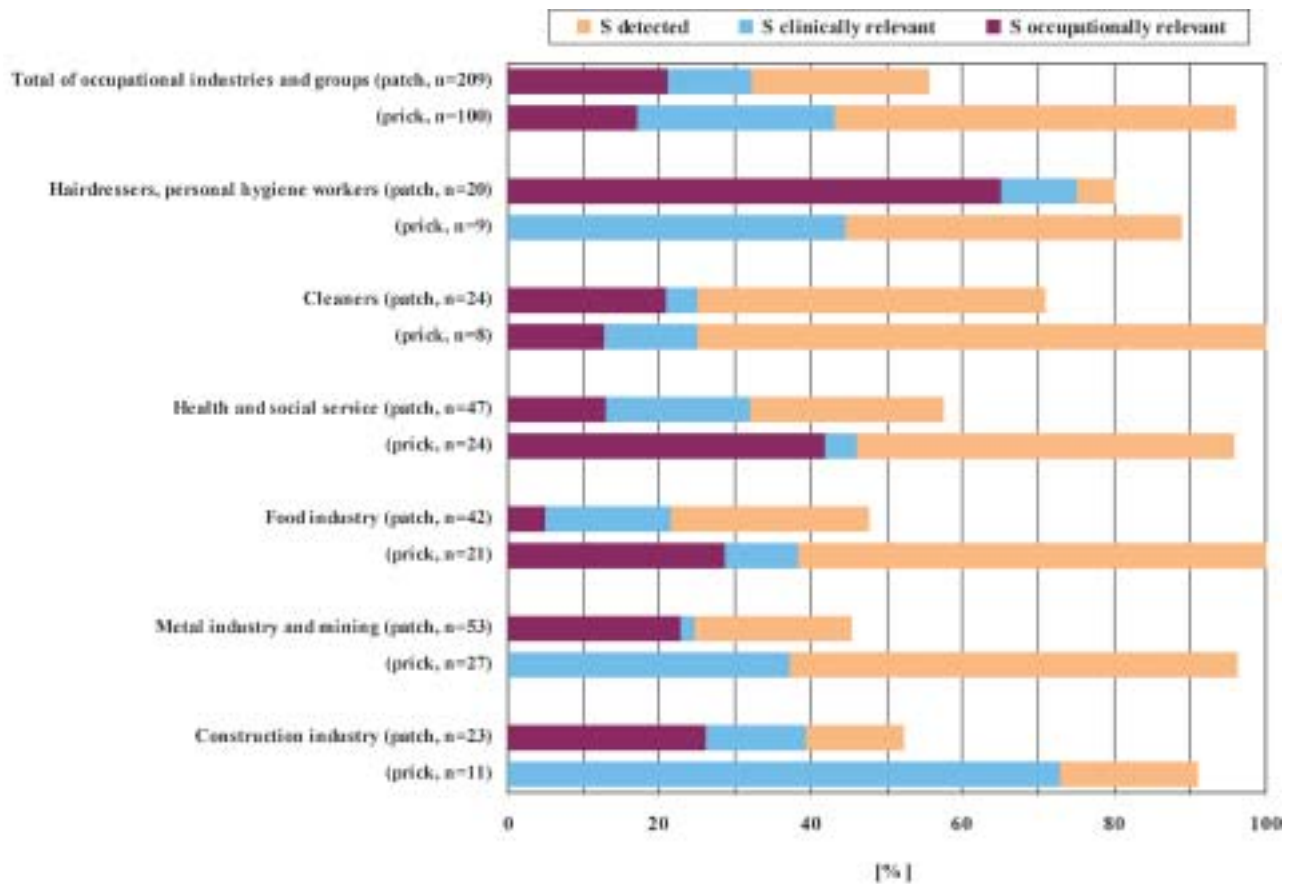


Fig. 2. Relative frequencies of positive patch and prick test reactors with at least one sensitization (S) and its clinical and occupational relevance.

same classification of occupations based on the standardized coding of the German Federal Employment Office (14, 15).

Discussion

Data from different western industrial countries show an estimated incidence rate of OSD of between 5 and 19 cases per 10,000 full-time workers per year (16). However, national registers of OSDs are not entirely comparable, due to differences in the sample populations, definitions of diagnoses, medical examination methods, and reporting (2–8). Standardized case definitions and rules for the coding in these registers would improve national and international comparability and feasibility of data exchange (9). So far, the epidemiology of OSD in one population can only cautiously be applied to other populations (17).

In this population-based register study using data taken from the BKH-S between July 1999 and June 2001, we observed an overall incidence rate of 6.8 cases per 10,000 workers per year within 16 occupational groups. The overall annual incidence rate was in line with the rate (6.7) previously re-

ported for the BKH-N (8, 10). Therefore, a *reported* incidence rate of OSD of approximately 7 cases per 10,000 workers per year may currently reflect a close point estimation for the total German working population. However, there is general consensus that there is a high estimated number of unknown cases of OSD due to undetected, unreported, undiagnosed, misdiagnosed, inaccessible and/or untreated cases (4–6, 18, 19).

Exceedingly high-risk occupational groups for an OSD with an annual incidence rate of at least 7 cases per 10,000 workers (20) were, in our data (in descending order): hairdressers and personal hygiene workers, bakers and pastry cooks, cooks and food preparation workers, cleaners, nurses and physician assistants, butchers and food processors, miners, and health care workers. Hairdressing has once again been exposed as one of the most hazardous occupations for the skin, and hairdressers are an ideal target group for preventive measures (8, 10, 21). However, for the BKH-N the annual incidence rate of hairdressers with OSD decreased significantly between 1990 and 1999 (22).

In both registers, the male to female ratios

Table 2. Allergens causing OSD detected by patch and prick testing by main occupational industries and groups ((n), if frequency ?1)

Occupational industries and groups	Type I allergens based on prick testing	Type IV allergens based on patch testing
<i>Hairdressers, personal hygiene workers</i>		ammonium persulphate (6), glyceryl monothioglycolate (5), p-phenylenediamine (2), p-toluenediamine (2), p-aminoazobenzene, ammonium thioglycolate, balsam of Peru, cocamidopropyl betaine, N-cyclohexylbenzothiazyl sulphenamide, cyclohexyl thiophthalimide, hydroquinone monobenzylether, N-isopropyl-N-phenyl-p-phenylenediamine, mercapto mix, mercaptobenzothiazole, morpholinyl mercaptobenzothiazole, nickel sulphate, toluenesulphonamide formaldehyde resin
<i>Cleaners</i>	natural rubber latex	1,3-diphenylguanidine, epoxy resin, fragrance mix, glutaraldehyde, Lyrall®, thiuram mix
<i>Health and social service</i>	natural rubber latex (10)	fragrance mix (2), balsam of Peru, glutaraldehyde, Lyrall®, methyl dibromo glutaronitrile + phenoxyethanol, methyl methacrylate, nickel sulphate, tetraethylthiuram disulphide, tetramethylthiuram disulphide, tetramethylthiuram monosulphide, thiuram mix
<i>Food industry</i>	flours (3), animal proteins, legumes, pollen, spices	fragrance mix, sorbic acid
<i>Metal industry and mining</i>		colophony (3), potassium dichromate (3), thiuram mix (3), abietic acid (2), benzoylperoxide, p-tert-butylphenolformaldehyde resin, cresyl glycidyl ether, 4,4'-diaminodiphenylmethane, diphenylmethane-4,4'-diisocyanate, epoxy resin, ethyleneglycol dimethacrylate, 2-hydroxyethyl methacrylate, N-isopropyl-N-phenyl-p-phenylenediamine, methyl(chloro)isothiazolinone, methyl methacrylate, octylisothiazolinone, paraben mix, tetraethylthiuram disulphide, tetramethylthiuram disulphide, triethanolamine
<i>Construction industry</i>		potassium dichromate (5), cobalt chloride (2), abietic acid, colophony, 4,4'-diaminodiphenylmethane, epoxy resin

Table 3. Work-related allergens with at least two occupationally relevant reactions (in descending order by occurrence)

Type IV and Type I allergens	No. positive reactions		
	detected	clinically relevant	occupationally relevant
<i>natural rubber latex</i>	12	11	11
potassium dichromate	13	9	8
ammonium persulphate	6	6	6
thiuram mix	7	5	5
glyceryl monothioglycolate	5	5	5
fragrance mix	31	16	4
colophony	8	4	4
epoxy resin	5	3	3
abietic acid	4	3	3
<i>flours</i>	4	3	3
nickel sulphate	40	24	2
balsam of Peru	17	6	2
cobalt chloride	16	3	2
p-phenylenediamine	6	2	2
glutaraldehyde	3	2	2
Lyrall®	3	3	2
4,4'-diaminodiphenylmethane	2	2	2
N-isopropyl-N-phenyl-p-phenylenediamine	2	2	2
methyl methacrylate	2	2	2
tetraethylthiuram disulphide	2	2	2
tetramethylthiuram disulphide	2	2	2
p-toluenediamine	2	2	2

Table 4. Skin contact with substances or chemicals at the workplace by main occupational industries and groups (based on the questionnaire, response 'often')

Irritants	Total (overall response rate 75%) (n = 180) (%)	Hairdressers, personal hygiene workers (n = 11) (%)	Cleaners (n = 29) (%)	Health and social service (n = 42) (%)	Food industry (n = 35) (%)	Metal industry and mining (n = 44) (%)	Construction industry (n = 19) (%)
Wet work (> 2 h per dayshift)	59	55	72	64	63	48	47
Detergents	48	45	72	60	66	23	16
Disinfectants	38	18	48	83	29	11	11
Mineral oils, lubricants	18	0	0	5	0	64	16
Dusts (cement, metal, stone, etc.)	18	0	7	0	6	52	31
Solvents (turpentine, petrol, acetone, etc.)	16	0	3	21	0	34	21
Water soluble cutting fluids	15	0	3	2	6	50	5
Adhesives, varnish, paints	11	9	0	5	6	23	26
Building materials (cement, concrete, etc.)	10	9	0	2	0	9	63

within occupational industries and groups were similar. The median ages were also comparable, except for food industry workers, with a difference of 10 years. It remains elusive whether this is due to differences in branches of food industry.

The largest percentage of OSDs consists of OCD mainly affecting the hands (16, 23, 24). In the present study, OCD made up 92% ($n = 241/263$) of all cases of OSDs. Types of OCD include ICD, ACD, CU and PCD. Our results confirm the findings of numerous studies in which ICD appeared the most common type of OCD (24–31). ICD usually develops as a result of wet work and exposure to irritating chemicals at the workplace. Noteworthy is the wide range of domestic exposure such as household and hobby work, which is a possible confounding factor (32). In our questionnaire, most frequently mentioned was exposure to wet work (defined as exposure of the hands for more than 1/4 of a dayshift duration (33)), detergents and disinfectants. Wet work and detergents seemed to be relevant for nearly all occupational industries and groups. As a result, working in wet environments and cleaning of tools and workplaces are non-specific rather than specific occupational tasks for blue-collar workers. In the health and social service and food industry this reflects most likely strict German regulations of work hygiene. ICD in construction workers is mainly provoked by chronic contact with wet cement because of its hygroscopic and alkaline properties (34). In metal workers, ICD is primarily caused by contact with mineral oils, lubricants and water soluble cutting fluids (26, 31). Despite the limitations of a ques-

tionnaire, we particularly focus attention on detergents which were the most frequently used chemicals in various workplaces. Primarily, it seems to be the chemical aggressiveness of detergents, that, in combination with wet work, causes most of the skin irritation (24, 35, 36). However, we believe that a far larger proportion of work-related ICD could be prevented by using less and milder detergents and through the promotion of proper skin care measures and correct usage of such agents.

In our study, occupationally relevant delayed-type allergy was shown in 65% of the hairdressers and personal hygiene workers' cases, but only in 5% of the food industry cases. It should be taken into consideration that the spectrum of allergens in hairdressers and personal hygiene workers as well as construction and cement workers is much better analysed than in workers of the food industry, for example. Therefore, there may be more undiagnosed work-related sensitizations in the latter occupational group than realized. In accordance with the results of Kanerva et al. (18), chromium was an important occupational contact agent in construction workers, metal workers and miners in our data. Thiurams are the most potent sensitizers of the rubber additives (37–39); they are frequently used accelerators. 5 cases were caused by rubber glove contact allergy, where thiurams are the predominant allergens. GMTG in permanent wave solutions and APS in hair bleaches were the leading allergens causing ACD in hairdressers (40, 41), this although GMTG is banned from the German market based on the agreement between hair cosmetics manufacturers and the hairdressers' guild in 1995 (40, 42).

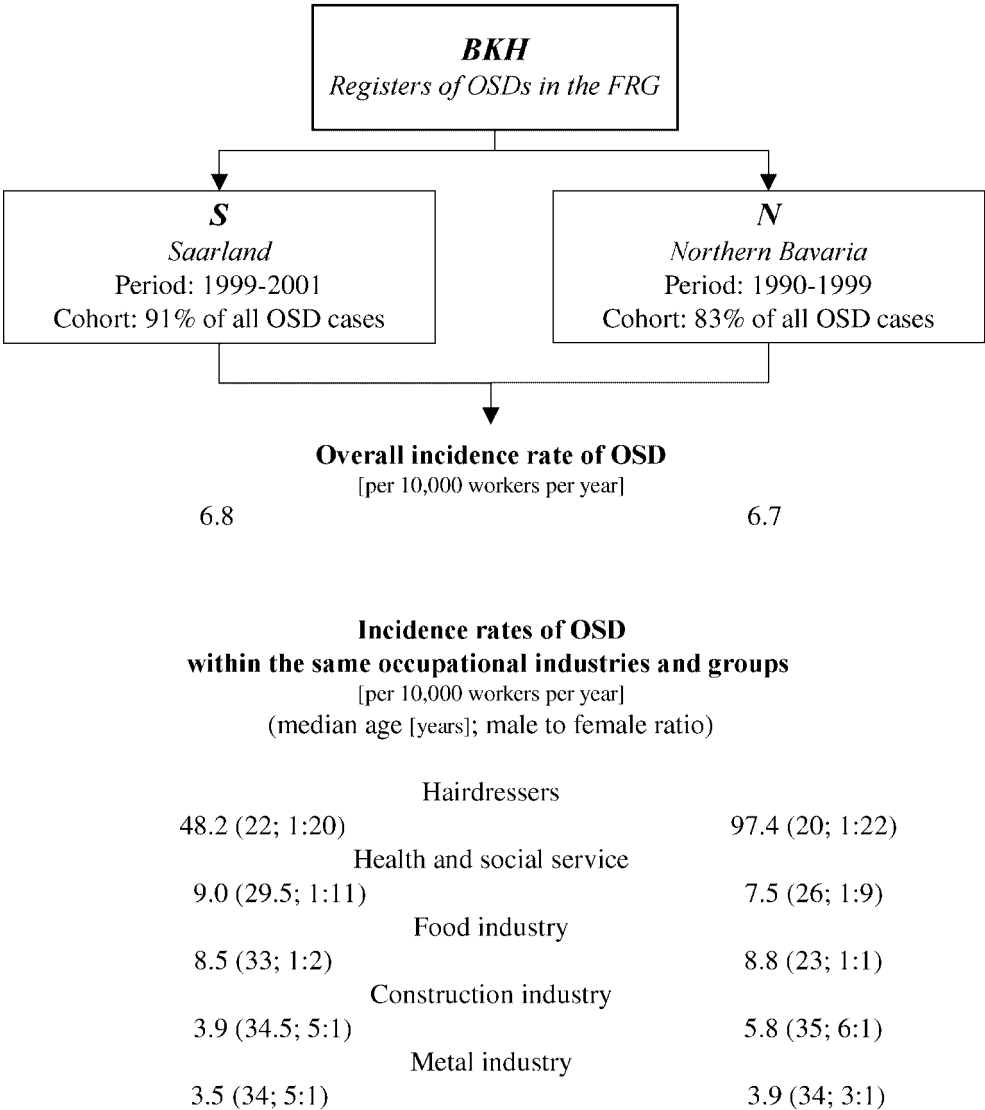


Fig. 3. Comparison of summarized results of the 2 register studies of OSDs in the FRG (BKH-N results were previously reported (8, 10)).

A further fact finding of the study is that health and social care workers and food industry workers, in particular, presenting with skin complaints, should be additionally assessed with prick testing. If they had been patch tested only, their problem would have been missed (43–45). Despite negative patch testing, contact allergy presenting as CU or PCD may occur. Occupationally relevant immediate-type sensitization was found in 42% of the health and social care workers and in 29% of the food industry workers. NRL is known as a hazardous allergen in relevant fields of work, which commonly causes not only CU but also PCD (43). We reaffirmed the importance of this occupational allergen by its 92% work-related reactors, primarily seen in health and social care workers and mostly due to the usage of powdered NRL gloves (44, 45).

Conclusions

This is the first report of the surveillance scheme for OSD in the Saarland, BKH-S. We found an annual incidence rate of 6.8 cases per 10,000 workers within 16 occupational groups, with hairdressing being once more the most hazardous one. Based on a comparison with long-term data of the BKH-N, we assume for Germany the current reported incidence rate of OSD to be 7 cases per 10,000 workers per year. The largest percentage of OSDs were diagnosed as ICD, suggesting that irritants must be regarded as a major factor of OSD. In the complete assessment of individuals presenting with possibly work-related dermatitis, testing for both delayed-type and immediate-type allergies is important. Particularly in cases with morphological signs of urticarial dermatitis, it is strongly

recommended to perform prick tests according to the workers' exposure history.

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