

Trends in Occupational Airway Diseases in German Hairdressers: Frequency and Causes

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Background Hairdressers are exposed to several allergens and irritants known to cause obstructive airway diseases (OAD). In the early 1990s, high incidence rates of OAD were observed in German hairdressers. It was expected that modification of formulations would resolve the problem of high OAD rates in hairdressers.

Methods The numbers of confirmed cases are reported of allergen-, latex- and irritant-induced OAD in German hairdressers, as registered by the responsible compensation board during 1998 and 2007. Hairdressing components reported as causative for OAD in hairdressers were analyzed. The incidence rates of OAD in hairdressers were compared with rates in healthcare professionals, as both occupations had high rates of OAD in the 1990s.

Results From 1998 until 2003, the total number of confirmed cases of allergen-, latex- and irritant-induced OAD stayed at a plateau of 60 cases annually in hairdressers, after which a downward trend was apparent. The number of irritant-induced OAD cases did not fall during this overall downward trend. Hair dyes and acid perms were most often identified as the substances causing OAD in hairdressers. In healthcare professionals, the downward trend in OAD is more pronounced than in hairdressers, mainly due to a decrease in latex-induced cases.

Conclusions The number of allergen- and irritant-induced cases of OAD in German hairdressers is still high. Exposure to known airway irritants is still occurring in spite of modification of the formulations. Continuous medical surveillance of hairdressers is recommended, in order to detect individual susceptibility, especially in apprentices. Am. J. Ind. Med. © 2011 Wiley-Liss, Inc.

KEY WORDS: occupational disease; obstructive airway disease; causes; surveillance; hairdressers

INTRODUCTION

Obstructive airway diseases (OAD) make up a large part of the occupationally acquired diseases in industrialized countries [Balmes et al., 2003]. The predominant diseases grouped under this category are asthma, chronic bronchitis, chronic obstructive pulmonary disease, and pulmonary emphysema. Recognition of work-relatedness for OAD is difficult, because these diseases are of multifactorial origin. As there are strong non-occupational risk factors, their association with occupational exposure is often difficult to discern and establish. As asthma and asthma-like disorders are common diseases in the general population, even a small increase in the percentage of

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prevalence due to occupational exposure is expected to have a major public health impact [Balmes et al., 2003]. Occupational exposure to around 400 airway-sensitizing and airway-irritating substances has been demonstrated [van Kampen et al., 1998, 1999]. Hairdressing chemicals were identified by time trend analyses in German and Finnish occupational-related surveillance systems as one of the main substances causing allergic and irritant occupational respiratory diseases [Piipari and Keskinen, 2005; van Kampen et al., 2008].

By analyzing the frequency and causes of OAD in different national surveillance schemes, it was demonstrated that hairdressers, bakers, and healthcare workers are the occupational groups at the greatest risk for OAD [Latza and Baur, 2005]. The epidemiology of OAD in hairdressers has been studied for already 30 years [Pepys et al., 1976; IARC, 1993] and it has been shown in several population and clinical studies that hairdressers are at high risk of occupational OAD [Schwaiblmair et al., 1997; Leino et al., 1998; Albin et al., 2002; Ameille et al., 2003; Moscato and Galdi, 2006]. But neither the risk factors (individual versus environmental), the causal substances, nor the underlying mechanism in inducing OAD are completely clear.

In Germany in the late 1990s, national occupational safety regulations for airway-sensitizing substances came into force. These technical rules on hazardous substances (TRGS 540, 907, and 908) had advocated the replacement of sensitizing substances (e.g., acid permanent wave solutions) and modification of formulations to reduce exposure (e.g., dust-free bleaching formulas) [Ausschuss für Gefahrstoffe, 1997a,b, 1998]. It was expected that formulation changes would resolve the problem of high OAD rates among hairdressers. However, this has yet to be demonstrated by surveillance data.

Occupational health surveillance systems are expected to determine the magnitude of an occupational disease burden and to examine temporal trends in the occupational disease [Kendall, 2005]. It is assumed that the most complete data come from countries with compulsory reporting of suspected occupational disease and/or from compensation schemes which report to state authorities [Latza and Baur, 2005]. Germany has a surveillance system that is based on legal regulations, with compulsory reporting of suspected occupational disease stratified by industrial sectors, occupations, and causative substances. Notifications of suspected occupational disease are reported to the workers' compensation board, which is responsible for the insurance of work-related accidents and occupational diseases, compensation, and preventive measures. The industry and trade sector is covered by the German Social Accident Insurance (DGUV), which consisted in 2009 of 13 compensation boards and 27 public-sector accident insurers [Deutsche Gesetzliche Unfallversicherung,

2009b]. Employees in hairdressing salons are insured mandatorily in the Berufsgenossenschaft für Gesundheitsdienst und Wohlfahrtspflege (BGW), the statutory accident insurance company for prevention in the health and welfare services sector. The BGW is the workers' compensation board for all non-public healthcare and welfare providers.

It is the objective of this study to report changes in the annual incidence rate of OAD in hairdressers over a 10-year period (time trend) and to identify the main causative substances by analyzing the surveillance data of the responsible accident insurance company. Furthermore, hairdressers are compared to healthcare professionals, as both occupational groups had high rates of OAD in the 1990s.

METHODS

In Germany, reporting of suspected occupational diseases to the responsible compensation board is regulated by law (Code of Social Law (SGB VII) 1996) and is compulsory for physicians. It has to be proved by the accident insurance agency in an adjudication procedure that the insured person is indeed suffering from the occupational disease. If a relationship between the occupational activity and the disease is likely and if German legal definitions are fulfilled, the notification of a suspected case of occupational disease is considered to have been confirmed; otherwise it has to be rejected. Confirmation of a suspected case of occupational disease requires exposure assessment, disease assessment, and a medical expert opinion that a causal link is probable. For the majority of occupationally acquired diseases, confirmed cases are recognized as occupational disease. However, for some diseases, a distinction is made between confirmation and recognition. For these diseases, such as OAD, the confirmation of the occupational causation must coincide with additional insurance conditions; for example, the disease must have forced the employee to refrain from all endangering occupational activities [Deutsche Gesetzliche Unfallversicherung, 2010b]. Because stopping the causative working activity is a prerequisite for some diseases being recognized as an occupational disease, the group "occupational disease confirmed" was introduced in the definitions. Therefore, claims with fulfillment of the legal requirements (recognized cases), are a subset of all cases in which an occupational disease is confirmed (confirmed cases). For all questions concerning prevention and medical rehabilitation, the group of confirmed cases is important and was therefore analyzed in this article.

Two out of 18 legal categories of occupational respiratory diseases listed in the German regulations [Occupational Disease Act, 1997] were included in this

TABLE I. Definitions of the Obstructive Airway Diseases (OAD) and Summary Group Name Analyzed in This Article

Occupational disease		
List number	Legal name	Summary group name by etiology
No. 430101	Obstructive respiratory tract diseases (including rhinopathy) caused by allergenic substances except natural rubber latex	Allergen-induced OAD
No. 430102	Obstructive respiratory tract diseases caused by (natural rubber) latex	Latex-induced OAD
No. 4302	Obstructive respiratory tract diseases caused by chemical irritants or substances with a toxic effect	Irritant-induced OAD

manuscript: those occupational diseases caused by allergenic substances and those caused by irritant or toxic substances (Table I). Diseases with occupational allergic rhinitis have been included in the category of allergen-induced occupational diseases since 1988. The other categories of occupational respiratory diseases were not considered in this manuscript, as the numbers were small. For the occupational groups insured in the BGW, a further subdivision has been inserted by the BGW in order to distinguish between OAD due to latex and OAD due to other allergens (Table I).

The analyses in this manuscript are based on the compensation claims registered by the BGW during 1998 and 2007. Registry data of the BGW include the number of claims for the total group of hairdressers, but only for the group of healthcare workers employed in the non-public sector. Details regarding diagnosis, working sector, occupation and causative substance were collected by technical experts during exposure assessment and are registered according to the classification list of the central information system for occupational diseases [Deutsche Gesetzliche Unfallversicherung, 2009a]. Claims selected for the secondary data analysis had to fulfill the following

criteria: diagnosis corresponding to the chosen numbers of the occupational disease (Table I), and work sector corresponding to the list number of hair craft (category I) or working sectors in the health service (categories II–V) (Table II).

The exposure situation is described in this article by two classification schemes: workplace and occupational group (Table II). The most important workplace in hair craft is the hairdressing salon. Workplaces in health services were constructed by pooling similar working sectors. The occupational group was classified, in order to allow for occupational activity. All employees with the occupation of hairdresser were classified as “hairdressers”—regardless of the working sector, all occupations directly associated with medical and nursing activities as “health-care professionals,” and the remainders as “other occupations in the health service.” Around 100 causative substances were registered for the selected cases and are classified into eight categories: latex, preservatives/disinfectants, hairdressing chemicals/cosmetics, dust/powder, varnishes/paints, food, synthetics, and hair material. An additional category comprised all substances reported fewer than 10 times. If exposure to more than one

TABLE II. Classification of Workplace and Occupational Group

Workplace	Working sectors
I. Hairdressing salon	Hair craft
II. Hospital/care facility	Hospitals, psychiatry, rehabilitation hospitals, pathology, dialyses centers, nursing homes, outpatient nursing services
III. Doctors' surgery	All specialties except dental medicine
IV. Dental operator	Dental practices, orthodontists, paramedics
V. Veterinary practice	Large and small animal practices/clinics, other veterinary business
VI. Other sectors in healthcare sector	Therapeutic practices, advice and care, administration, beauty and wellness, professional rehabilitation, facilities for the handicapped, sheltered workshop, schools providing vocational education, pharmacies; not considered in this article
Occupational group	Occupations
Hairdressers	Employees working as hairdressers regardless of the workplace
Healthcare professionals	Medical, dental and veterinary doctors; assistants in medical, dental and veterinary practice; other health associate professionals; nursing and midwifery associate professionals; home-based personal care workers; dental technicians
Other occupations in the healthcare sector	All occupations in the healthcare sector not directly associated with healthcare (e.g., kitchen worker, cleaning worker, gardener, manager, facility manager, administration officer, teaching); not considered in this article

TABLE III. Numbers of Suspected and Confirmed Cases of Allergen-, Latex-, and Irritant-Induced OAD and Annual Mean Incidence Rates Per 100,000 Employees (FTE^a) According to Workplaces and Occupational Groups in Hair Craft and Healthcare Over 10 Years, 1998–2007

Allergen-, latex-, and irritant-induced OAD	Workplaces ^b					Occupational groups ^b	
	Hairdressing salon	Hospital/care facility	Doctors' surgery	Dental operatory	Veterinary practice	Hairdressers	Healthcare professionals
Number suspected	2,947	1,631	360	889	272	3,059	2,870
Number confirmed	547	527	147	297	120	558	1,020
% Confirmed	19	32	41	33	44	18	36
Annual mean FTE over 10 years ^c	167,695	1,030,551	345,095	194,960	15,093	— ^d	— ^d
Annual mean of confirmed cases per 100,000 FTE over 10 years	32.6	5.1	4.3	15.2	79.5	— ^d	— ^d

^aEquivalent of the number of average working hours of a full-time employee.^bFor pooled working sectors and occupations see Table II.^cRelated to the number of persons insured in the BGW between 1998 and 2007.^dNumber of full-time employees not available.

substance has taken place, only the first causative substance was cited.

Analyses are descriptive; no statistical tests were performed. Results are reported by absolute numbers, percentages, and incidence of confirmed cases per 100,000 insured employees, expressed as full-time equivalents (FTE). The term “FTE” is defined as the equivalent of the number of average working hours of a full-time employee. Incidence rates are presented as annual rates and as annual mean rates averaged over 10 years.

RESULTS

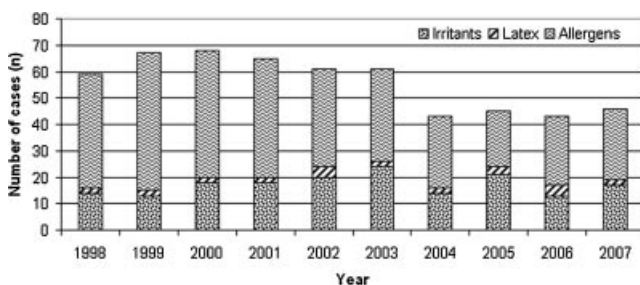
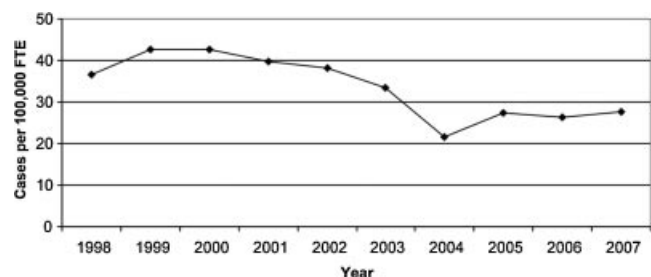
A total of 3,059 claims for allergen-, latex-, or irritant-induced OAD were reported by hairdressers to the BGW between 1998 and 2007 (Table III). Around 18% of the suspected OAD cases in hairdressers had been confirmed as an occupational disease. The conditions of recognition were met for 41% of the hairdressers with an OAD confirmed as an occupational disease. Around 96% of the hairdressers were working in hairdressing salons and 4% in other working sectors (e.g., hospitals or nursing homes). The annual mean incidence rate of confirmed

OAD for employees in hairdressing salons was 32.6 per 100,000 FTE over 10 years.

For healthcare professionals registered by the BGW, the total number of claims for allergen-, latex-, or irritant-induced OAD was about the same as for the hairdressers during the 10-year period, though the percentage of OAD cases that were confirmed as an occupational disease was twice as high as for hairdressers (Table III). The three most affected healthcare occupations for confirmed OAD cases were doctors' assistants, nursing professionals and medical doctors, with 37%, 36%, and 32%, respectively. The annual mean incidence rates of confirmed OAD induced by allergens, latex, or irritants ranged in the selected workplaces in the health service between 4.3 (doctors' surgery) and 79.5 cases (veterinary practice) per 100,000 FTE over 10 years.

Trends in Allergen-, Latex-, and Irritant-Induced OAD

For hairdressers, there was almost no change in the annual number of allergen-, latex-, and irritant-induced OAD between 1998 and 2003, with around 60 confirmed

**FIGURE 1.** Numbers of confirmed cases of obstructive airway disease induced by allergens, latex, and irritants in German hairdressers insured in the Berufsgenossenschaft für Gesundheitsdienst und Wohlfahrtspflege (BGW), 1998–2007.**FIGURE 2.** Annual incidence of confirmed cases of allergen-, latex-, and irritant-induced obstructive airway disease in German hairdressers insured in the Berufsgenossenschaft für Gesundheitsdienst und Wohlfahrtspflege (BGW), 1998–2007.

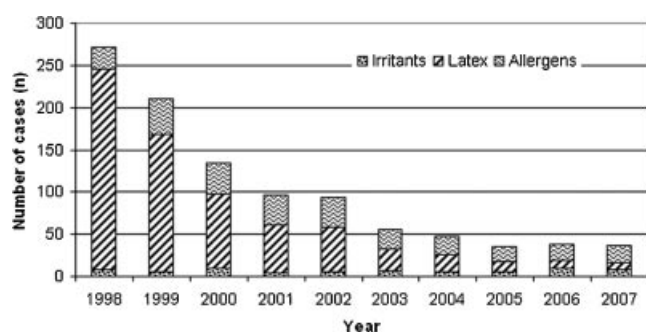


FIGURE 3. Numbers of confirmed cases of obstructive airway disease induced by allergens, latex, and irritants in German healthcare professionals insured in the Berufsgenossenschaft für Gesundheitsdienst und Wohlfahrtspflege (BGW), 1998–2007.

cases annually (Fig. 1). In 2004, the annual number of confirmed cases decreased by approximately 30% and stayed at this level. The decrease in the number of OAD in hairdressers is the result of a decrease in the number of allergen-induced cases, whereas for the number of irritant-induced OAD no consistent time trend was observed, with around 17 cases annually. Latex-induced OAD cases were of no relevance for hairdressers, with two cases annually on average. The annual incidence rates of confirmed OAD induced by allergens, latex or irritants increased from 1998 until 2002 from 37 to 43 cases per 100,000 FTE in hairdressing, but have since decreased to 26 OAD cases per 100,000 FTE, with the lowest rate in 2004 (Fig. 2).

For healthcare professionals, the downward time trend in OAD confirmed as an occupational disease is more pronounced than with hairdressers—with a decline by approximately 88% in the period from 1998 until 2005 (Fig. 3). The decline in OAD in healthcare professionals is mainly due to a decrease in latex-induced cases, and, since 2003, to a decrease in allergen-induced cases. No change

was observed for irritant-induced OAD in healthcare professionals, with around 10 confirmed cases annually on average.

Causative Substances

Hairdressing chemicals accounted for 89% of all confirmed cases of OAD (Table IV). The four most frequently identifiable substances causative for OAD in hairdressers were hair dyes, acid perms, hair fixing agents/hairspray (including ammonium thioglycolate) and perfume (Fig. 4). The majority of the OAD cases (around 38%) were associated with hair dyes, but the absolute number has fallen, as has the total number of OAD cases in hairdressers. The annual number of OAD cases caused by acid perms has also decreased. For the hair fixing agents and perfume, no consistent time trend was seen for the annual numbers of OAD, but the percentage has increased over the 10-year period. In the group of healthcare professionals more than 60% of the confirmed OAD were caused by latex (Table IV). The second most frequently identifiable products causing allergen- and irritant-induced OAD in healthcare professionals were preservatives, disinfectants, and body care.

DISCUSSION

Analyses of different types of national surveillance schemes in Finland, the UK, and Germany have shown that numbers of occupationally acquired respiratory diseases have decreased since the mid-1990s [Piipari and Keskinen, 2005; McNamee et al., 2008; van Kampen et al., 2008]. For the German industrial sector, the maximum rates of allergen- and irritant-induced OAD were reached in the early 1990s, with 18.4 and 7.1 suspected

TABLE IV. Causative Substance for Cases With Confirmed Allergen-, Latex-, and Irritant-Induced OAD Among Hairdressers and Healthcare Professionals, 1998–2007

Causative substance	Hairdressers (n = 558)		Healthcare professionals ^a (n = 1,020)	
	n	%	n	%
Latex/gloves	21	4	656	64
Preservatives/disinfectants	13	2	102	10
Hairdressing chemicals/body care	495	89	72	7
Dust/powder	8	1	32	3
Varnishes/paints	0	0	3	<1
Food	3	<1	1	<1
Synthetics ^b	4	1	23	2
Hair from animal or human	2	<1	92	9
Various ^c	12	2	39	4

^aFor included occupations see Table II.

^bIncluding polyethylene, polypropylene, polystyrene.

^cIncluding pharmaceuticals and halogens amongst others.

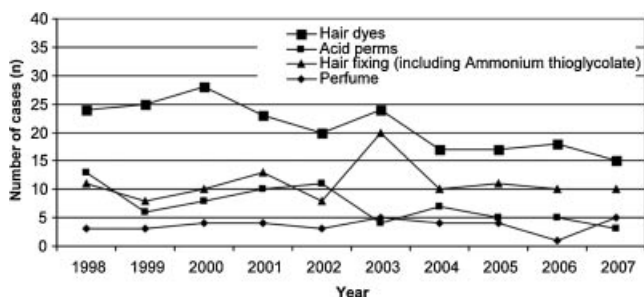


FIGURE 4. Numbers of confirmed cases of obstructive airway disease induced by hairdressing chemicals in German hairdressers insured in the Berufsgenossenschaft für Gesundheitsdienst und Wohlfahrtspflege (BGW), 1998–2007.

cases per 100,000 FTE, respectively [van Kampen et al., 2008]. In this article, we have examined time trends in incident cases of occupationally acquired OAD in two particular occupations, hairdressers, and healthcare professionals. For both occupational groups, concerns were raised as early as the 1990s about respiratory hazards from exposure to allergens and irritants at the workplace [Vandenplas et al., 1995; Leino et al., 1997; Kogevinas et al., 1999; Leino et al., 1999; Delclos et al., 2007].

Estimation of Incidence Rates

Although the direction of the change in the total number of OAD was similar in the two occupational groups, the magnitude of the annual change was different. The decrease in the number of total OAD cases in healthcare professionals is explained by the sharp decreases in latex-induced cases, reflecting the decreasing use of powdered latex gloves, as reported in previously published data [Allmers et al., 2004; Latza et al., 2005; Arif et al., 2009; Vandenplas et al., 2009]. As the numbers of incident OAD cases in our study are calculated on the basis of cases reported from the non-public healthcare sector, they cannot be generalized for all healthcare professionals in Germany.

In hairdressers, the annual number of confirmed OAD induced by allergens, latex, and irritants has also decreased, though this was less pronounced than with healthcare professionals. Still, hairdressers in Germany have a higher risk of contracting OAD than workers in other industrial sectors in Germany and also compared to other countries [Latza and Baur, 2005]. The annual incidence of confirmed OAD in German hairdressers, as observed in our study, had hardly changed from a previous period (1991–2000) analyzed by Latza et al. [2002]. The decline of confirmed OAD in hairdressers is only due to a decrease in the allergen-induced cases. The finding that latex is of no relevance for OAD in hairdressers is supported by diagnostic tests [Moscato et al., 2005]. The abrupt change in the years 2003 and 2004 in the frequency

and incidence of OAD and also in the numbers of causative substances is most probably due to a delay in data entry, as the software for routine documentation procedures had been standardized in the previous year.

Causative Substances

Even though latex has accounted for fewer newly reported OAD in healthcare professionals in recent years in Germany, the number of healthcare workers with persisting latex-related symptoms is still considerable [Nienhaus et al., 2008]. The exposure situation in German hairdressing salons is—in spite of the national regulations—still characterized by a great diversity of allergic, irritant, and toxic substances. Although it has been shown in one study that exposure levels of single compounds released by hairdressing products were below occupational limits [Ronda et al., 2009], exposure assessment should consider the total exposure, because hairdressers are exposed to many compounds at the same time [Mounier-Geyssant et al., 2006; Ronda et al., 2009].

For German hairdressers, significant changes related to acid perms had probably already occurred in the early 1990s, when acid perms containing glyceryl monothioglycolate were banned by the TRGS 540 [Ausschuss für Gefahrstoffe, 1997a]. Diagnostic tests revealed that the proportion of hairdressers reacting positively to glyceryl monothioglycolate fell from initially 45% in 1992 to less than 20% in 1998 [Uter et al., 2000]. However, small manufacturers might not have joined this campaign, so that occupational exposure to glyceryl monothioglycolate is still possible and might be the explanation for the few cases still annually reported. As a substitute for acid perms, less sensitizing compounds, for example, ammonium thioglycolate, were advocated by the TRGS 540. As ammonium thioglycolate is assigned by the classification list to the category of hair fixing agents, a differentiated time trend analysis of this agent was not possible.

According to the surveillance data, hair dyes were the most important agents causing OAD in hairdressers. This agrees with experimental investigations analyzing the airborne exposure in hairdressing salons [Ronda et al., 2009]. However, diagnostic tests revealed that hair dyes were causal for only 8% of the cases with occupational asthma [Moscato et al., 2005], and that instead persulfate salts were the major causal agents involved in around 80% of occupational asthma in hairdressers. Hair bleaching products like persulfate salts were not identifiable by our statistics, as the classification list allows coding of persulfate salts as a potential cause of skin diseases but not of airway diseases. The reasons for this distinction are obscure, as both inhalational and dermal reactions have been described for persulfate salts [Leino et al., 1998;

Moscato and Galdi, 2006]. A reason for this shortcoming in persulfate salts coding might be that dust-free formulations for hair bleaching were strongly advocated by German regulations (TRGS 540) and that persulfate salts in hair bleaches were classified as safe by the final report of the Cosmetic Ingredient Review [Pang and Fiume, 2001]. As hair bleaching is still recorded during exposure assessment as a cause of airway diseases, it is likely that these formulations are registered in the statistics as hair dyes, which might explain the unexpectedly high number of OAD due to hair dyes.

Even if not all substances causative for OAD in hairdressers are described completely by the compensation statistics, the annual incidence rates of confirmed OAD induced by allergens and irritants are high in this occupational group, and also in comparison to other occupational groups exposed to airborne chemicals, such as healthcare professionals. With regard to future trends of OAD in hairdressers, it has to be considered that the profession of hairdressing is very popular with adolescents, among whom increasing asthma prevalence has been observed [Anandan et al., 2010]. As individual risk factors might increase the susceptibility to OAD caused by workplace allergens [Moscato and Galdi, 2006], careful medical surveillance of hairdressing apprentices is recommended, including an early search for allergic diseases and provision of information about potential occupational risks [John et al., 2000; Iwatsubo et al., 2003].

LIMITATIONS

As our results are based on secondary registry data, some biases have to be addressed. Although German physicians are obliged to report any suspected case of an occupational disease, the presented data may underestimate the true numbers of cases of OAD. Furthermore, although compensation statistics provide information on occupational causation of a disease, misclassification of causative substances cannot be excluded, as exposure assessment is rarely based on diagnostic procedures or on exposure levels in the workplace. Additionally, misclassification of diseases cannot be excluded, particularly for irritant-induced OAD, for which there are no generally accepted diagnostic criteria [van Kampen et al., 2008]. Misclassification of causative substances is also possible with registry data, for which standardization of data entry may lead to loss of accuracy. Such compromises may be inevitable in any long-term data collection system [McNamee et al., 2008].

It should be mentioned that the number of persons used to calculate the term “FTE” is only assigned to workplaces and not to occupational groups, with the consequence that rates are related to workers in the denominator with different work-related exposure. Another

limitation is that OAD cases and insured workers from the public healthcare sector were not included in the analyses. In the absence of statistics about numbers of healthcare professionals in the non-public healthcare sector, the magnitude of the discrepancy can only be estimated. On the assumption that the reporting and classification are uniform in both sectors, and a total of 78% of healthcare professionals with a confirmed occupational disease were insured in the BGW in 2007 [Deutsche Gesetzliche Unfallversicherung, 2010a], it may be concluded that our data underestimate OAD in healthcare professions by about 22%. Nevertheless, as our article concentrates on time trends rather than on absolute numbers, this underestimation should not compromise our findings.

CONCLUSION

German hairdressers are still at high risk of allergen- and irritant-induced OAD. As the identification of causal substances by compensation statistics is rather imprecise, future exposure studies should evaluate the complex exposure situation in hairdressing salons. Continuous medical surveillance of hairdressing apprentices is recommended in order to detect individual risk factors and thus to prevent acquisition or deterioration of OAD from occupational exposure.

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