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Frequencies of occupational allergic diseases and gender differences in Finland

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Abstract In Finland occupational diseases are registered by diagnosis, causative agent, age, occupation, field of work, and gender. This report analyzes in detail the 1991 statistics on gender differences in occupational allergic diseases. A total of 1314 cases of occupational allergic diseases were reported, comprising 14.2% of all registered occupational diseases. The following allergic occupational diseases were encountered: allergic contact dermatitis (412 cases), bronchial asthma (352), allergic rhinitis (319), contact urticaria/protein contact dermatitis (146), and allergic alveolitis (85). The number of cases of allergic alveolitis (men, 42 cases; women, 43 cases) and bronchial asthma (176 men/176 women) was about equal in both genders. Women were overrepresented in allergic rhinitis (195 women/124 men), allergic contact dermatitis (247 women/165 men), and contact urticaria/protein contact dermatitis (109 women/37 men). According to current knowledge, there are no great gender differences in the development of asthma or allergic rhinitis. The greater number of women with occupational respiratory allergy and immediate skin allergy may indicate that women in Finland are more exposed to type I allergens than men. The greater number of cases of allergic contact dermatitis in women may reveal women's predisposition to delayed-type allergy, or women's greater occupational exposure to contact allergens.

Key words Asthma · Allergic alveolitis · Allergic rhinitis · Contact dermatitis · Contact urticaria · Sex

Introduction

Epidemiological surveys indicate that bronchial asthma, allergic rhinitis, and allergy skin tests are similar in both genders [3, 4, 8], although atopy and asthma are more common in male infants [26]. On prick testing women have larger wheal responses than men [21]. Earlier studies indicated that the skin of women is more sensitive to irritants than that of men [30] and accordingly a greater skin penetration could predispose to allergic contact dermatitis. However, sex differences as regards skin irritants were not confirmed in more recent studies [2, 33]. The disposition to develop delayed-type allergy and allergic contact dermatitis is less well understood. Leyden and Kligman [19] did not find differences between men and women whereas Jordan and King [10] and Rees et al. [24] found that women develop allergic contact dermatitis more easily than men. This could explain why autoimmune diseases predominantly affect females [23]. All in all, probably no great gender difference in the frequency of immediate allergy is to be expected in studies based on statistics, although women may more frequently have allergic contact dermatitis.

The registration of occupational allergic diseases (OADs) has been started only recently in some countries (e.g., Great Britain [17, 22]) but in Finland they have been registered for decades. On the whole, data on gender differences in the statistics on OADs are scarce. This article presents comparisons of gender differences in OADs in the 1987–1991 Finnish statistics [29]. Detailed information on all the causes of OADs for the year 1991 are given.

Materials and methods

The Department of Social Research of the Ministry of Social Affairs and Health started compiling statistics on occupational diseases in 1926. Since 1974 the Act on the Supervision of Labour Protection has obliged doctors to report every case of occupational disease. In 1975 the Finnish Institute of Occupational Health assumed the responsibility for compiling these statistics. The insurance companies provide the Register with data on every case reported to them, irrespective of the final decision with regard to compensation. Statistics on new cases of occupational diseases are published annually [14, 29]. In this study the data on OADs from the Register have been analyzed in more detail than in the Finnish version, which contains data on all occupational diseases [29].

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OADs mainly comprise allergic respiratory and skin diseases, and these are covered in the present report. Allergic skin diseases include allergic contact dermatitis (ACD), contact urticaria (CU), and protein contact dermatitis (PCD). In the following CU and the related PCD are dealt with together under the heading of contact urticaria. Occupational allergic respiratory diseases include bronchial asthma (BA), allergic rhinitis (AR), and allergic alveolitis (AA). Only single cases of OADs such as generalized urticaria from peroral or respiratory exposure, laryngitis, pharyngitis [13], or conjunctivitis (without accompanied respiratory symptoms) are detected in Finland per year, and they are not included in the present statistics.

Results and discussion

Occupational diseases in Finland in 1991

A total of 8828 cases of occupational diseases were registered in all of Finland, which has a population of about 5 million and a total work force of 2340000 (1206000 men/1134000 women; data from 1991). Of these, 1314 (14.2%) were allergic (Table 1). The percentage of allergic occupational diseases was much higher in women (770 out of 3184 = 24.2%) than in men (544 out of 5644 = 9.6%).

Table 1 Number of cases of occupational diseases in Finland in 1991

	Men	Women	Total
All occupational diseases	5644	3184	8828
Allergic diseases	544	770	1314
Allergic respiratory diseases	342	414	756
Allergic alveolitis	42	43	85
Asthma	176	176	352
Allergic rhinitis	124	195	319
Allergic skin diseases	202	356	558
Allergic contact dermatitis	165	247	412
Contact urticaria	37	109	146

Occupational allergic respiratory diseases (OARDs)

The number of cases of AA and BA was about equal in men and women, while AR, ACD, and CU were much more frequent in women than in men (Table 1). The number of cases of AA and BA was equal in men and women, but because of the greater number of cases of AR in women, the total number of OARDs was greater in women. When the workers were divided by age into 5-year groups (workers aged 15–19, 20–24 up to 60–64 years), women had greater number of OARDs in all the 5-year groups, except the age groups of 20 to 24, and 25 to 29 years, respectively. The mean age for developing an OARD was higher for women (42.0 years) than for men (38.9 years).

Allergic alveolitis. AA as an occupational disease in Finland is mainly caused by mold dust ("farmer's lung") which typically develops in agricultural workers (82 out of 85 cases). Farmer's lung was about equally common among men (35 cases) and women (38 cases). One case was caused by hexamethylenediisocyanate and one by a ray fungus (a non-defined actinomyces); in one case the causative agent was not given.

Bronchial asthma. The two most common causes of BA are cows (cow epithelium) in farming, and flour dust in the food manufacturing industry and farming (Table 2). In farming the frequency of BA was similar among men (85 cases) and women (86 cases). The number of cases of BA in the food manufacturing industry, however, was nearly twice as great in women (39 cases) as in men (20 cases).

Table 2 The most frequent causes of occupational asthma in 1991

	Men	Women	All
Cow epithelium	48	64	112
Flour (undefined)	15	15	30
Barley flour	10	10	20
Wheat flour	4	12	16
Rye flour	6	9	15
Storage mites	8	5	13
Animal epithelium (animal not specified)	6	5	11
Diphenylmethanediisocyanate	8	2	10
Other (less than 10 cases)	71	54	125
Total	176	176	352

This probably reflects the fact that the genders are differently exposed in the food manufacturing industry; a greater number of women are exposed to flour dust, although the total workforce in the whole food manufacturing industry is about equal (13000 men/11000 women). The opposite situation was evident for some other industries; thus male cases predominated in both the metal industry (16 vs 0 cases) and the construction industry (10 vs 1 cases). In education, on the other hand, six women developed BA whereas there were no cases in men.

In the past few years the number of cases caused by animal epithelium has exceeded that caused by flour dust (Table 2). Most of the cases caused by animal epithelium are farmers' asthma from cow epithelium (112 cases). Earlier, several cases of asthma among fur farmers and fur sewers were encountered annually in Finland but the number of workers in this industry has decreased markedly during recent years, and consequently fewer cases are detected [28]. Flour dust causes asthma both in farmers and in bakers. Altogether, barley, wheat, rye, oat, and non-defined flour dust caused 71 cases of asthma. Storage mites are another hazard in farming (13 cases).

Low-molecular-weight chemicals (LMWCs) may cause asthma, which may be IgE-mediated [15, 31, 32]. The most common LMWCs causing asthma are the isocyanates; ten cases were caused by diphenylmethanediisocyanate, seven cases by hexamethylenediisocyanates,

Table 3 The most frequent causes of occupational AR in 1991

	Men	Women	All
Cow epithelium	43	63	106
Wheat flour	5	21	26
Storage mites	11	12	23
Flour (non-defined)	9	11	20
Oat flour	9	6	15
Animal epithelium (animal not given)	2	8	10
Other (less than 10 cases)	45	74	119
Total	124	195	319

Table 4 The ten most common occupations with ACD in 1991

	Men	Women	All
1. Cleaners	1	27	28
2. Hair dressers, beauticians, etc.	0	25	25
3. Machine repairers	13	1	14
3. Electrical equipment collectors	2	12	14
5. House builders	13	0	13
5. Dental assistants	0	13	13
7. Sales staff	0	10	10
7. Domestic animal husbandry	3	7	10
9. Nurses	0	9	9
9. Chemical process work	6	3	9

Table 5 The most frequent causes of ACD in 1991

	Men	Women	All
Rubber chemicals (RC)	34	52	86
Nickel and its derivatives	2	36	38
Epoxy resins	20	8	28
Formaldehyde	5	18	23
Thiuram sulfides (RC)	8	10	18
Chromate/six valency	16	0	16
Other chemicals	5	11	16
Isothiazolinones	3	9	12
Colophony	8	3	11
Other (less than 10 cases)	64	100	164
Total	165	247	412

and two cases by toluenediisocyanate. In four cases the causative isocyanate was not reported to the Register. Phthalic anhydrides used to be one of the most frequent causes of LMWC-induced asthma, but in 1991 only two cases caused by methylhexahydrophthalic anhydride [15, 32] and one case caused by phthalic anhydride were detected. Acrylates are a new group of chemicals causing occupational asthma [20, 25]; in 1991 two cases were caused by acrylates and one case by an acrylate lacquer. Metals, e.g. in welding fumes [18], cause some cases of asthma each year. A special cause of occupational asthma in Finland is obeche (five cases), an exotic wood used for sauna benches. Carpenters are exposed to obeche dust when sauna benches are sanded down. Polyfunctional aziridine, used in two-component lacquers, paints, and dyes, is a new cause of occupational asthma [1, 11], but in 1991 only one case was detected.

Allergic rhinitis. AR is mainly caused by the same two agents as BA, namely cow epithelium in farming and flour dust in the food manufacturing industry (Table 3). For an unknown reason, AR in the agricultural sector was much more frequent in women (98 cases) than in men (67 cases). The situation is different for BA, for which the numbers were equal in men and women. The number of cases in the food manufacturing industry (mainly caused by flour) was about the same in men (19 cases) and in women (21 cases). As could be expected, AR was much more common in women in service occupations (27 cases) compared with men (two cases), because more women work in service occupations.

Occupational allergic skin diseases

Allergic skin diseases were much more common in women (356 cases) than in men (202 cases). Also in each 5-year age group women predominated (from 15 years to 64 years). The only exception was the single male case with occupational skin disease in the age group of 65–69 years. The mean age for developing an occupational skin disease was nearly the same for women (37.5 years) and men (37.3 years).

Allergic contact dermatitis. The three most common occupational sectors where ACD developed were: industry, 138 cases out of 412 (33.5%); farming, 54 cases (13.1%); and health and social services, 53 cases (12.9%). Women predominated in all these three sectors. The proportions were: industry, women 76 cases/men 62 cases; agriculture, women 33/men 20; health and social services, women 48/men 5. The most common occupational groups with ACD are summarized in Table 4, showing the great variations in ACD in the different occupations.

The most common causes of ACD for men and women are given in Table 5. The statistics may reflect different exposure, but the women's higher number of ACD may be due to their predisposition to develop delayed allergy [10, 19]. Rubber chemicals were the most common cause of ACD, and rubber chemical allergy was more common among women. It is possible that women use more protective rubber gloves, e.g., in hospitals and in cleaning work. As rubber chemical allergy is most commonly caused by protective gloves [6], women have more rubber chemical allergy. Nickel allergy is about 10 times more common in women than in men in the general population [5]. It is generally considered that this is due to the use of nickel-containing ("cheap") jewelry which is used more by women than by men. The relatively high number of nickel allergy cases reflects the change in the Finnish law: since 1988 preexisting diseases that have been aggravated by work also may be considered occupational. Accordingly, it is probable that some of the nickel allergy cases represent preexisting allergy. Allergy to epoxy resin is

Table 6 The most common occupations with CU in 1991

	Men	Women	All
1. Farmers	17	48	65
2. Bakers, confectioners	8	6	14
3. Domestic animal husbandry	3	7	10
4. Cooks, chefs, cold buffet managers	1	8	9
5. Nurses	0	5	5

Table 7 Number of cases of and causes of occupational CU and PCD in 1991

	Men	Women	Together
Cow epithelium	17	53	70
Natural rubber (latex)	3	22	25
Wheat flour	4	3	7
Rye flour	4	2	6
Other flour (non-defined)	1	5	6
2-Ethylhexylacrylate	0	5	5
Spices	0	3	3
Oat flour	1	1	2
Ornamental plant	0	2	2
Chicken (epithelium)	0	2	2
Rabbit (epithelium)	1	1	2
Fish and fish meal	0	2	2
Cellulase (enzyme)	0	2	2
Foods (handling)	0	2	2
Furfuryl aldehyde	1	0	1
Grains/grain dust	1	0	1
Obeche	1	0	1
Vegetables	0	1	1
Onions	0	1	1
Pig	0	1	1
Milk, milk powder	1	0	1
Other dust	1	0	1
Other chemicals	0	1	1
Storage mites	1	0	1
Total	37	109	146

more common in men because they are exposed more than women to epoxies in industry [9]. Formaldehyde is used in preservatives, and the greater number of allergy cases among women may be caused by, for example, exposure in cleaning and in the textile industry [7]. The most common cause of chromate allergy is exposure to cement [7] and, accordingly, chromate allergy was registered only in men in 1991. Isothiazolinones constitute another group of preservatives to which women may be more exposed, e.g., in cleaning work, although we and others have recently encountered several cases of isothiazolinone allergy from cutting fluids.

Contact urticaria. The largest groups and the male/female ratios in industry were as follows: agriculture 76 (20 males/56 females), industry 41 (11 males/30 females) and health and social services 19 (2 males/17 females). The five occupations with the most cases of CU are given in Table 6.

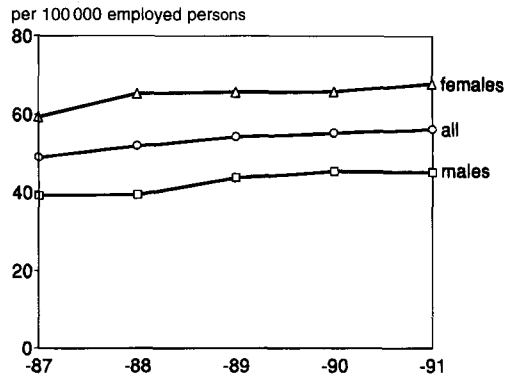

Fig. 1 Occupational allergies by gender in 1987–1991

Fig. 2 Occupational allergic respiratory diseases by gender in 1987–1991

Fig. 3 Occupational asthma by gender in 1987–1991

The main cause of CU was cow epithelium (Table 7). Women usually have the main responsibility for milking, feeding, and cleaning cows in Finland and, accordingly, women have a higher prevalence of CU (as well as of BA and AR, see Tables 2, 3) from cow epithelium. Latex (natural rubber) has become an important cause of occupational diseases, especially in hospital and health care work [27]. As more women are involved in these occupations, they also display a higher number of occupational diseases caused by latex. Flour caused about the same number of cases of CU in women ($n = 11$) and men ($n = 10$).

Fig. 4 Occupational allergic alveolitis by gender in 1987–1991

Fig. 5 Occupational allergic rhinitis by gender in 1987–1991

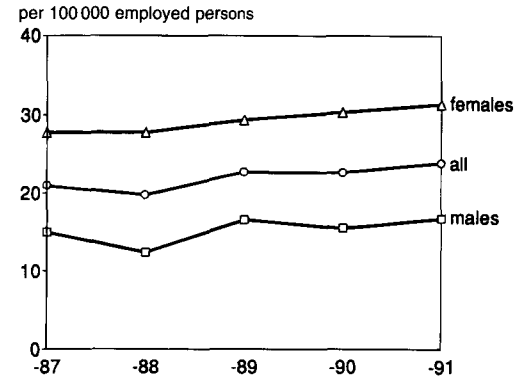

Fig. 6 Occupational allergic skin diseases by gender in 1987–1991

Fig. 7 Occupational allergic contact dermatitis by gender in 1987–1991

Fig. 8 Occupational contact urticaria by gender in 1987–1991

Occupational allergy by gender in Finland in 1987–1991

We have previously reported on occupational AR and dermatoses in this journal [12, 16]. The most frequent causes of occupational ACD at our Institute during 1974–1983 were metals (chromium, nickel, and cobalt), plastic materials (including epoxy resin), and rubber chemicals [12]. Accordingly, great changes in the causative agents of ACD have not taken place. On the other hand, during 1974–1983 CU/PCD was seldomly diagnosed; only 21 cases (= 3.7% of all occupational allergic dermatoses) of occupational CU were diagnosed, whereas 542 cases (= 96.3%) of occupational ACD were detected [12]. This is in sharp contrast to the statistics of 1991; 146 cases (= 26.2% of the occupational allergic dermatoses) of CU (Table 1) were diagnosed and 412 cases of occupational ACD (= 73.8%). The increase in occupational CU is probably due to better diagnostics, but a true increase in occupational CU, e.g., from latex, has probably occurred.

The number of persons with occupational allergy increased yearly during 1987–1990, but in 1991 the number decreased slightly (Figs. 1–8). The number of cases of AA was higher in women until 1991, when the numbers were about equal. BA was more prevalent in women in 1988, equal in 1991, and more prevalent in men in 1987, 1989, and 1990. AR, ACD, and CU have constantly been more prevalent in women.

In summary, the higher number of AR and CU may indicate that women have a greater exposure, whereas the higher number of cases of ACD in women may reflect women's predisposition to develop delayed allergy [10, 24]. Women also tend to seek more medical help than men [4]; this is probably also true for occupational diseases, and accordingly they would be more liable to be diagnosed as having an OAD. It would be interesting to calculate the incidences of OADs in more detail. The number of patients in each group were, however, so small that we believe significant conclusions cannot currently be drawn.

We are planning to compile the patient groups, allergens, allergic diseases, and gender during 1991–1994 and then hope to make more detailed calculations of incidences.

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