

Occupationally Related Contact Dermatitis in North American Food Service Workers Referred for Patch Testing, 1994 to 2010

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Background: Contact dermatoses are common in food service workers (FSWs).

Objectives: This study aims to (1) determine the prevalence of occupationally related contact dermatitis among FSWs patch tested by the North American Contact Dermatitis Group (NACDG) and (2) characterize responsible allergens and irritants as well as sources.

Methods: Cross-sectional analysis of patients patch tested by the NACDG, 1994 to 2010, was conducted.

Results: Of 35,872 patients patch tested, 1237 (3.4%) were FSWs. Occupationally related skin disease was significantly more common in FSWs when compared with employed non-FSWs. Food service workers were significantly more likely to have hand ($P < 0.0001$) and arm ($P < 0.0006$) involvement. The rates for irritant and allergic contact dermatitis in FSWs were 30.6% and 54.7%, respectively. Although the final diagnosis of irritant contact dermatitis was statistically higher in FSWs as compared with non-FSWs, allergic contact dermatitis was lower in FSWs as compared with non-FSWs. The most frequent currently relevant and occupationally related allergens were thiuram mix (32.5%) and carba mix (28.9%). Gloves were the most common source of responsible allergens. The NACDG standard tray missed at least 1 occupationally related allergen in 38 patients (4.3%).

Conclusions: Among FSWs patch tested by the NACDG between 1994 and 2010, the most common allergens were thiuram mix and carba mix. Gloves were the most common source of responsible allergens.

In 2010, more than 15 million US workers were documented to have dermatitis.¹ In particular, the food service industry is among the most common high-risk occupations for the development of occupational skin diseases.^{2–8} Because of “wet work,” irritant contact dermatitis (ICD) and hand involvement is common among food service workers (FSWs).^{2,5,8,9} Relevant irritants include soaps, detergents, and disinfectants. Contact allergens vary by investigation

but are reported to include metals, rubber compounds, and preservatives.^{2,4,7,9,10}

Occupational contact dermatitis in FSWs can have a chronic course requiring long periods of treatment and work disability, which increase the risk of unemployment and poor quality of life.^{4,11–13} Although reports have evaluated occupational skin disease in bakers, cooks, caterers, butchers, and kitchen and restaurant

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TABLE 1. Food Service Workers Subgroups Referred for Patch Testing

Food Service Industrial Subgroups (n = 1016),* 1996–2010	n
Eating and drinking places	475
Grocery stores	162
Groceries	59
Miscellaneous food preparation/kindred product	47
Bakery products	38
Beverage industries	37
Food industry, not specified	30
Food store (NEC)	30
Dairy products	29
Meat products	24
Retail bakeries	22
Sugar and confectionery products	20
Canned, frozen, and preserved fruits and vegetables	13
Grain mill products	12
Alcoholic beverages	9
Dairy products stores	4
Liquor stores	5
Food Service Occupational Subgroups (n = 634)* 1996–2010	n
Cooks	187
Waiters and waitresses	98
Managers, food serving and lodging establishments	89
Miscellaneous food preparation occupations	80
Bartenders	32
Supervisors, food preparation and service occupations	29
Kitchen workers, food preparation	28
Waiters'/waitresses' assistants	26
Bakers	22
Butchers and meat cutters	18
Food counter, fountain and related occupations	10
Cooks, private household	7
Food batchmakers	7
Roasting and baking machine operators	1
Food Service Subgroups and Workers 1994–1996 (n = 30)	n
Food service	8
Cook	5
Bartender	3
Waitress	3
Catering	2
Cafeteria	2
Baker assistant	1
Cake décor	1
Grocery	1
Candy maker	1
Baker	1
Line cook	1
Chef	1

Simpler codes were used from 1994 to 1996.

*Total from the 3 groups above is 1237 (100%) or more because each subject was assigned both an occupation code and industry code in 1996 to 2010.

NEC indicates not elsewhere classified.

employees, a comprehensive evaluation of occupational skin diseases in North American FSWs has not previously been conducted. This study (1) estimates the prevalence of occupation-related allergic contact dermatitis (ACD) among FSWs patch tested by the North American Contact Dermatitis Group (NACDG) between 1994 and 2010, (2) characterizes responsible allergens and sources in FSWs, and (3) estimates the prevalence of ICD among FSWs.

METHODS

North American Contact Dermatitis Group Database

This analysis of deidentified data was approved by the Minneapolis Veterans Administration Medical Center's Subcommittee on Human Studies. Between July 1, 1994, and December 31, 2010, 35,872 patients were patch tested by the NACDG to a baseline standard series of 50 to 70 allergens. Methods of patch testing, relevance of reactions, and final diagnoses were determined according to published methods.^{14–16} Data collected included demographic information (age, sex, and race), sites of dermatitis (up to 3 sites), occupation, final diagnoses (up to 3 diagnoses), and patch test results. From 1996 to 1998, a 1-digit source code was determined for each positive NACDG standard allergen. Beginning in 1998, a 3-digit source code was determined for positive NACDG standard allergens, and starting in 2000, 3-digit source codes were also recorded for other relevant allergens not on the NACDG standard series. From 1996 on, 3-digit occupation and industrial codes were determined by an expert in occupational classification using the 1990 US Department of Commerce Census Industrial and Occupational Classification Codes.^{17–19} Clinical relevance was coded as “definite,” “probable,” “possible,” “past,” “unknown,” “not applicable,” or “not tested,” according to published NACDG criteria.^{17–19} Patch tests coded as “definite,” “probable,” or “possible” were considered

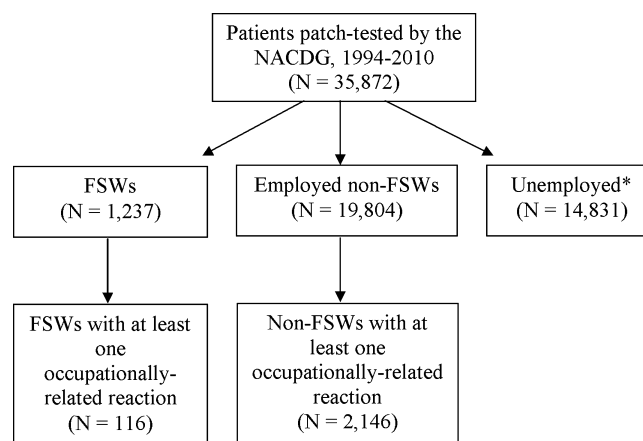


Figure 1. Study population subgroups. * Students, retired, unemployed, homemaker, no coded occupation.

TABLE 2. Demographics of FSWs and Non-FSWs Referred for Patch Testing

Demographic	FSWs (n = 1237)	Employed Non-FSWs (n = 19,804)	P
Male, n (%)	462 (37.4)	7634 (38.6)	0.4
Occupation related, n (%)	331 (26.8)	4573 (23.1)	0.0031
Age >40 y, n (%)	620 (50.1)	12540 (63.3)	<0.0001
White, n (%)	1039 (84.0)	17,234 (87.0)	0.002
Atopy, n (%)			
Eczema	262 (21.2)	3566 (18.0)	0.005
Hay fever	315 (25.5)	5588 (28.2)	0.04
Asthma	328 (26.5)	2636 (13.3)	<0.0001
Eczema, hay fever, or asthma	500 (40.4)	7904 (39.9)	0.7228
Site, n (%)*			
Hand	552 (44.6)	7157 (36.1)	<0.0001
Other	249 (20.1)	5658 (28.5)	<0.0001
Arm	248 (20.0)	3230 (16.3)	0.0006
Scattered generalized	199 (16.1)	3505 (17.7)	0.1489
Face	190 (15.4)	4259 (21.5)	<0.0001
Foot	128 (10.4)	1548 (7.8)	0.0014
Leg	97 (7.8)	1854 (9.4)	0.0737
Trunk	93 (7.5)	2031 (10.3)	0.0019
Neck	70 (5.7)	1691 (8.5)	0.0009
Eyelids	58 (4.7)	1757 (8.9)	<0.0001
Final diagnosis, n (%)*			
ACD	676 (54.7)	11484 (58.0)	0.021
ICD	378 (30.6)	4633 (23.4)	0.0001
Atopic dermatitis	209 (16.9)	2452 (12.4)	<0.0001
Other dermatitis	165 (13.3)	3088 (15.6)	0.0334
Other dermatoses	109 (8.8)	2139 (10.8)	0.028
Psoriasis	60 (4.9)	899 (4.5)	0.6109
Contact urticaria	25 (2.0)	188 (1.0)	0.0003
Nummular eczema	23 (1.9)	385 (1.9)	0.834
Pompholyx	18 (1.5)	200 (1.0)	0.1335
Seborrheic dermatitis	17 (1.4)	438 (2.2)	0.0495
Photo dermatitis	15 (1.2)	280 (1.4)	0.5592
Stasis dermatitis	7 (0.6)	105 (0.5)	0.8671

*Total percentage may exceed 100% as up to 3 sites or diagnosis could be identified for each subject.

currently relevant. Occupational relevance was based on clinical history and known occupational exposure. For each positive reaction, clinical relevance, occupational relatedness, and allergen source were identified.

Study Design

This analysis focused on subjects with 3-digit industrial and/or occupational codes corresponding to FSWs (Table 1). Non-FSWs were defined as all employed subjects other than FSWs. Unemployed persons, students, homemakers, retired persons, and those without a coded occupation were excluded from this analysis (Fig. 1). In analyzing individual allergens and their sources, only positive allergic patch-test reactions determined to be of both current clinical significance and related to occupation were included.

Data Analysis

All data were manually entered into a computerized database at a central location and checked for quality assurance at the time of collection (Access 2003; Microsoft Corp, Redmond, Wash). Data from FSWs were compared with those from non-FSWs with Pearson χ^2 tests or Fisher exact test, 2 tailed, when appropriate (SAS 9.2; SAS, Cary, NC). A *P* value of less than or equal to 0.05 was considered statistically significant. Because of the exploratory nature of this analysis, no statistical adjustments were performed for multiple tests.

RESULTS

Demographics

Of the 35,872 patients patch tested, 1237 (3.4%) were identified as FSWs, and 19,804 (55.2%) were coded as employed non-FSWs

TABLE 3. Most Frequent* Occupation-Related Allergens in FSWs and Non-FSWs Referred for Patch Testing

Allergen	FSWs, n/n (%)	Non-FSWs, n/n (%)	P
Thiuram mix, 1% pet	37/114 (32.5)	492/2433 (20.2)	0.0016
Carba mix, 3.0% pet	33/114 (28.9)	436/2433 (17.9)	0.003
Nickel sulfate, 2.5% pet	20/114 (17.5)	324/2429 (13.3)	0.1995
Cobalt chloride, 1% pet	11/116 (9.5)	272/2485 (10.9)	0.6209
Quaternium-15, 2% pet	9/112 (8.0)	257/2434 (10.6)	0.3934
Formaldehyde, 1% aq	8/113 (7.1)	313/2434 (12.9)	0.0703
Mercapto mix, 1.0% pet	7/114 (6.1)	114/2434 (4.7)	0.4748
Chloroxylonol (PCMX), 1% pet	7/116 (6.0)	51/2486 (2.1)	0.0045
Compositae mix, 6% pet	6/74 (8.1)	41/1456 (2.8)	0.0081
Neomycin sulfate, 20% pet	6/114 (5.3)	215/2432 (8.8)	0.1849
Fragrance mix, 8% pet	6/116 (5.2)	176/2486 (7.1)	0.4312
Mercaptobenzothiazole, 1.0% pet	5/114 (4.4)	142/2433 (5.8)	0.6810
Potassium dichromate, 0.25% pet	5/114 (4.4)	216/2433 (8.9)	0.1229
Balsam of Peru, 25.0% pet	5/114 (4.4)	210/2434 (8.6)	0.1220
Bacitracin, 20% pet	5/116 (4.3)	148/2486 (6.0)	0.6841
Cocamide DEA, 0.5% pet	3/75 (4.0)	30/1456 (2.1)	0.2171
Cinnamic aldehyde, 1% pet	3/100 (3.0)	41/2130 (1.9)	0.4458
Colophony, 20.0% pet	3/114 (2.6)	125/2433 (5.1)	0.3749
Lanolin alcohol, 30.0% pet	3/114 (2.6)	110/2433 (4.5)	0.4839
Sesquiterpene lactone mix, 0.1% pet	3/115 (2.6)	33/2486 (1.3)	0.2112
Mixed dialkyl thioureas, 1.0% pet	3/116 (2.6)	59/2486 (2.4)	0.7549

*Allergens 1% or greater prevalence in FSWs.

DEA indicates diethanolamine.

(Fig. 1). Table 2 summarizes patient characteristics for FSWs and non-FSWs. A final diagnosis of either ICD, atopic dermatitis, or contact urticaria was statistically significantly more common among FSWs as compared with non-FSWs. In contrast, a final diagnosis of ACD, other dermatosis, and other dermatitis was significantly lower in FSWs when compared with non-FSWs. Occupationally related skin disease was significantly more common in FSWs. Hand, arm, foot, and other body site involvement were significantly more common in FSWs.

North American Contact Dermatitis Group Allergen Frequencies in Occupationally Related Allergic FSWs and non-FSWs

Frequencies of occupationally related allergens for FSWs and non-FSWs are in Table 3. Thiuram mix and carba mix were the most common occupationally related allergens, and the frequency of allergy to these allergens was significantly higher among FSWs than non-FSWs. Allergy to chloroxylonol (PCMX) and Compositae mix were also significantly more common in FSWs.

North American Contact Dermatitis Group Allergen Sources

The sources of occupationally related allergens for patients patch tested between 1998 and 2010 are summarized in Table 4. Gloves (n = 62) were the primary source of allergens for FSWs followed by antibiotics (n = 9) and fruits, nuts, and vegetables (n = 7). Table 5 lists sources for the 10 most common occupationally related

allergens in FSWs. As expected, gloves were the most common source of rubber allergens.

TABLE 4. Most Frequent Sources of Occupationally Related Allergens in FSWs, 1998 to 2010

Sources	n
Gloves	62
Antibiotics	9
Fruits, nuts, vegetables	7
Hair care products	6
Cosmetics	6
Personal care products, NOS	5
Non-skin soaps and detergents	5
Tools	5
Liquid, lotion, and bar soaps	4
Heating, cooling, cooking, cleaning machine	4
Food products	4
Non-skin soaps, NOS	4
Equipment	3
Skin soaps and cleansers	3
Metallic elements, dusts, powders, fumes	2
Safety equipment, miscellaneous	2
Disinfectants	2
Shoes, boots, sandals, slippers	2
Plants, trees, vegetation	2
Bakery products, candy, snack foods	2
Unknown	15

NOS indicates not otherwise specified.

TABLE 5. Sources of the Top 10 Most Frequent Occupationally Related Allergens in FSWs, 1998 to 2010

Allergen	Sources for FSWs (n)
Thiuram mix, 1% pet	Gloves (30)
Carba mix, 3.0% pet	Gloves (25)
Nickel sulfate, 2.5% pet	Tools (3); structural elements (doors, windows, fencing, etc) (1); Other (3); metallic elements, dusts, powders, fumes (2); Equipment, instruments, miscellaneous supplies (2); Heating, cooling, cooking, and cleaning machinery and appliances (2); Vehicles (air, rail, road, water) (1); coins, currency (1); Asphalt and tars (1)
Cobalt chloride 1% pet	Other (1); Heating, cooling, cooking, and cleaning machinery and appliances (3); Tools (2); equipment, instruments, miscellaneous supplies (1)
Quaternium-15, 2% pet	Cosmetic (2); soaps and detergents (1); hair care products (1); Personal care products, NOS (2); Unknown (1)
Formaldehyde, 1% aq	Non-skin soaps and detergents (2); unknown (1); disinfectants (1); Liquid, lotion and bar soaps, and cleaners (1)
Mercapto mix, 1.0% pet	Gloves (4)
Chloroxylenol (PCMX), 1% pet	Non-skin soaps and detergents (1); Non-skin soaps, NOS (2); Skin soaps and cleansers (2); Liquid, lotion and bar soaps, and cleaners (1)
Compositae mix, 6% pet	Food products, fresh or processed (1); Plants, trees, vegetation (living) (2); Fruits, nuts, vegetables (3)
Neomycin sulfate, 20% pet	Unknown (1); antibiotics (5)

NOS indicates not otherwise specified.

Relevant Occupational Irritants in FSWs and Non-FSWs

Food service workers were 1.5 times more likely to have a relevant occupational irritant as compared with non-FSWs (Table 6). The most common sources of relevant occupational irritants in FSWs were skin soaps and detergents (n = 55), followed by water (n = 17), non-skin soaps (n = 16), and food products (n = 13; Table 7).

Non-NACDG Allergens in FSWs and Non-FSWs

Food service workers were significantly less likely to have an occupationally related non-NACDG allergen identified as compared with non-FSWs (Table 6). The most common sources of non-NACDG allergens in FSWs were bakery products, candy, and snacks (n = 4), followed by food products, not otherwise specified (n = 3), and dairy products (n = 3; Table 8).

DISCUSSION

There are several important findings in this retrospective analysis of FSWs patch tested by the NACDG over a 16-year period. First, occupationally related skin disease was significantly more common in FSWs when compared with employed non-FSWs. Second, final diagnosis of ICD was higher, but ACD was lower, in FSWs as compared with non-FSWs. Third, hand and arm involvement was significantly higher in FSWs than in non-FSWs. Fourth, occupationally related reactions to thiuram mix and carba mix were statistically higher in FSWs when compared with non-FSWs. Gloves were identified as the most common occupational source of these allergens. Finally, FSWs were significantly less likely to have an occupationally related non-NACDG allergen identified as compared with non-FSWs.

Food service workers were statistically more likely to have occupationally related skin disease. Food service workers are prone to occupational contact dermatitis because of the amount of wet work and exposures to rubber ingredients, disinfectants, preservatives, and foods.^{4,6,10,20} Previous studies have shown that ICD is the most common type of occupational contact dermatitis in FSWs, and the higher rate of occupationally related skin disease is also likely due to the higher rate of ICD in this group.^{2,7,9,21}

The body sites of dermatitis were significantly different in FSWs as compared with non-FSWs. Notably, FSWs were statistically more likely to have hand and arm involvement and less likely to have a generalized dermatitis or involvement of the trunk. Separate NACDG analyses of the other wet work occupations

TABLE 6. Relevant Occupational Irritants and Non-NACDG Allergens in FSWs and Non-FSWs From 2000 to 2010

Site	FSWs (n = 1237), n (%)	Employed Non-FSWs (n = 19,804), n (%)	RR P Value
Relevant occupational irritants	177 (19.9)	1768 (13.1)	1.51 (1.32–1.74) <0.0001
Relevant occupational non-NACDG allergens*	38 (4.3)	942 (7.0)	0.61 (0.44–0.84) 0.0018

*Names of non-NACDG allergens were not collected.

TABLE 7. Most Common* Sources of Other Occupationally Related Irritants in FSWs, 2000 to 2010

Sources	n
Skin soaps and detergents	55
Water	17
Non-skin soaps and cleansers	16
Food products	13
Non-skin soaps, NOS	11
Liquid, lotion and bar soaps	6
Disinfectants	5
Bakery products, candy, snack foods	4
Fruits, nuts, vegetables	4
Solvents, oils, lubricants, fuels	2
Solvents, degreasers, petrol distillates	2
Lubricating oils and greases	2
Dairy products	2
Meat, poultry	2
Drain and oven cleaners	2
Personal care products, NOS	2
Gloves	2
Shoes, boots, sandals, slippers	2
Unknown	12

*Sources 1% or greater prevalence in FSWs.

NOS indicates not otherwise specified.

(health care workers and hairdressers) also found higher hand involvement.^{15,22} Furthermore, hands were described as the most common site involved in food-related occupations in prior studies,^{2,3,5,6,10} and healing of hand dermatitis was reported to be lower in FSWs.^{4,11} This is of particular interest because patients with chronic hand dermatitis have been found to have significantly lower quality of life and more functional impairment.¹²

Food service workers were also statistically more likely to have a final diagnosis of ICD, atopic dermatitis, and contact urticaria than non-FSWs. In FSWs, a final diagnosis of ACD (54.7%) was more common than ICD (30.6%). This value likely underestimates the frequency of ICD in FSWs because the patients referred for patch testing are primarily suspected of having ACD and have often undergone management of ICD before patch test referral.

Irritant contact dermatitis has been reported as the most common type of occupational contact dermatitis, and of patients with ICD, those working in the food service industry are often most commonly affected.⁹ Factors frequently involved in ICD include wet work and exposure to detergents, disinfectants, and other abrasive chemicals.^{2,7,9} Our study found that FSWs were 1.5 times more likely to have a relevant occupational irritant as compared with non-FSWs (19.9% vs 13.1%, $P < 0.001$). The most common sources were soaps and water.

Contact urticaria is a frequent disorder among FSWs.^{8,23–25} In our study, contact urticaria was seen in 2% of FSWs and was statistically higher in this group when compared with non-FSWs ($P = 0.0003$). Fruits, vegetables, meat, fish, food additives, and a variety of other protein and chemicals are known to cause contact

urticaria in FSWs, and food-related skin prick testing is important in evaluating in FSWs with hand dermatitis.^{8,24}

Rubber chemicals were the most common occupational allergens in FSWs, and gloves were the most common source. Gloves used in the food service industry contain chemical accelerators such as thiurams, mercaptobenzothiazoles, and carbamates. Antioxidants and stabilizers may also be added to natural rubber latex and synthetic gloves.²⁶ Rubber contact dermatitis is a common cause of occupationally related contact dermatitis, in general,²⁷ and our findings are consistent with other studies that found that thiurams are the most frequent relevant allergen for patients with suspected glove or rubber allergy.^{28–30} Although FSWs were significantly less likely to have an occupationally related non-NACDG allergen identified as compared with non-FSWs (risk ratio, 0.61; $P = 0.0018$), 38 patients would have at least 1 allergen missed by the NACDG panel alone. When non-NACDG allergens were identified as occupationally related in FSWs, the most common sources were related to food products, including bakery products, candy, snacks, and dairy products.

Limitations

There are several limitations to this study. First, this was a cross-sectional study, and thus, the data are descriptive and cannot define causal relationships. A large prospective study would be

TABLE 8. Sources of Non-NACDG Allergens in FSWs in 2000 to 2010

Sources	n
Bakery products, candy, snack foods	4
Food products, NOS	3
Dairy products	3
Gloves	3
Flowers	2
Fruits, nuts, vegetables	2
Non-skin soaps and detergents	2
Disinfectants	2
Pesticides, horticultural and agricultural chemicals	1
Adhesives, glues, bond agents	1
Miscellaneous chemical mixtures	1
Metal, woodwork, special material machines	1
Fish and shellfish	1
Meat, poultry	1
Houseplants, decorative plants	1
Non-skin soaps, not otherwise specified	1
Sterilizing solutions	1
Personal care products, NOS	1
Hair care products	1
Cosmetics	1
Liquid, lotion and bar soaps	1
Clothing, NOS	1
Footwear	1
Shirts, pants, blouses, dresses, skirts	1
Unknown	1

NOS indicates not otherwise specified.

necessary to fully understand the development of ACD in FSWs. Second, the patients here represent a referral population and therefore may not be generalizable to other populations of FSWs. Furthermore, our cohort is likely not representative of all FSWs because more severe cases and/or insured FSWs were likely referred for patch testing to tertiary occupational dermatitis clinics. Third, detailed information on sources and causes of protein contact dermatitis and contact urticaria are not collected. Fourth, there is no long-term follow-up data on course of dermatitis from this patient population. Finally, specific names of non-NACDG allergens are not collected.

CONCLUSIONS

Among patients patch tested by members of the NACDG between 1994 and 2010, occupationally related skin disease was significantly more common in FSWs when compared with non-FSWs. The final diagnosis of ICD was statistically higher, but ACD was lower in FSWs as compared with non-FSWs. Involvement of the hands and arms were higher in FSWs than in non-FSWs. Rubber accelerators were the most common occupationally related allergens found in FSWs, and gloves were the most common source. Thirty-eight FSWs reacted to non-NACDG allergens, although the rate (4.3%) was lower than in non-FSWs (7.0%).

REFERENCES

- Luckhaupt SE, Dahlhamer JM, Ward BW, et al. Prevalence of dermatitis in the working population, United States, 2010 National Health Interview Survey. *Am J Ind Med* 2012;e-publish.
- Bauer A, Geier J, Elsner P. Type IV allergy in the food processing industry: sensitization profiles in bakers, cooks and butchers. *Contact Dermatitis* 2002;46:228–235.
- Gawkrodger DJ, Lloyd MH, Hunter JA. Occupational skin disease in hospital cleaning and kitchen workers. *Contact Dermatitis* 1986;15:132–135.
- Malkonen T, Jolanki R, Alanko K, et al. A 6-month follow-up study of 1048 patients diagnosed with an occupational skin disease. *Contact Dermatitis* 2009;61:261–268.
- Soder S, Diepgen TL, Radulescu M, et al. Occupational skin diseases in cleaning and kitchen employees: course and quality of life after measures of secondary individual prevention. *J Dtsch Dermatol Ges* 2007;5:670–676.
- Steiner MF, Dick FD, Scaife AR, et al. High prevalence of skin symptoms among bakery workers. *Occup Med (Lond)* 2011;61:280–282.
- Tacke J, Schmidt A, Fartasch M, et al. Occupational contact dermatitis in bakers, confectioners and cooks. A population-based study. *Contact Dermatitis* 1995;33:112–117.
- Vester L, Thyssen JP, Menne T, et al. Occupational food-related hand dermatoses seen over a 10-year period. *Contact Dermatitis* 2012;66:264–270.
- Dickel H, Kuss O, Schmidt A, et al. Importance of irritant contact dermatitis in occupational skin disease. *Am J Clin Dermatol* 2002;3:283–289.
- Weisshaar E, Radulescu M, Soder S, et al. Secondary individual prevention of occupational skin diseases in health care workers, cleaners and kitchen employees: aims, experiences and descriptive results. *Int Arch Occup Environ Health* 2007;80:477–484.
- Cvetkovski RS, Zachariae R, Jensen H, et al. Prognosis of occupational hand eczema: a follow-up study. *Arch Dermatol* 2006;142:305–311.
- Fowler JF, Ghosh A, Sung J, et al. Impact of chronic hand dermatitis on quality of life, work productivity, activity impairment, and medical costs. *J Am Acad Dermatol* 2006;54:448–457.
- Meding B, Lantto R, Lindahl G, et al. Occupational skin disease in Sweden—a 12-year follow-up. *Contact Dermatitis* 2005;53:308–313.
- Warshaw EM, Raju SI, Fowler JF Jr, et al. Positive patch test reactions in older individuals: retrospective analysis from the North American Contact Dermatitis Group, 1994–2008. *J Am Acad Dermatol* 2012;66:229–240.
- Warshaw EM, Schram SE, Maibach HI, et al. Occupation-related contact dermatitis in North American health care workers referred for patch testing: cross-sectional data, 1998 to 2004. *Dermatitis* 2008;19:261–274.
- Warshaw EM, Ahmed RL, Belsito DV, et al. Contact dermatitis of the hands: cross-sectional analyses of North American Contact Dermatitis Group Data, 1994–2004. *J Am Acad Dermatol* 2007;57:301–314.
- Pratt MD, Belsito DV, DeLeo VA, et al. North American Contact Dermatitis Group patch-test results, 2001–2002 study period. *Dermatitis* 2004;15:176–183.
- Warshaw EM, Belsito DV, DeLeo VA, et al. North American Contact Dermatitis Group patch-test results, 2003–2004 study period. *Dermatitis* 2008;19:129–136.
- Zug KA, Warshaw EM, Fowler JF Jr, et al. Patch-test results of the North American Contact Dermatitis Group 2005–2006. *Dermatitis* 2009;20:149–160.
- Diepgen TL. Occupational skin-disease data in Europe. *Int Arch Occup Environ Health* 2003;76:331–338.
- Teo S, Teik-Jin GA, Siang LH, et al. Occupational dermatoses in restaurant, catering and fast-food outlets in Singapore. *Occup Med (Lond)* 2009;59:466–471.
- Warshaw E, Wang M, Maibach H, et al. Occupational allergic contact dermatitis in hairdressers/cosmetologists: retrospective analysis of North American Contact Dermatitis Group data, 1994–2010. *Dermatitis* In review. 2012;23:258–268.
- Doutre MS. Occupational contact urticaria and protein contact dermatitis. *Eur J Dermatol* 2005;15:419–424.
- Gimenez-Arnau A, Maurer M, De La CJ, et al. Immediate contact skin reactions, an update of contact urticaria, contact urticaria syndrome and protein contact dermatitis—“A Never Ending Story”. *Eur J Dermatol* 2010;20:552–562.
- Kanerva L, Toikkanen J, Jolanki R, et al. Statistical data on occupational contact urticaria. *Contact Dermatitis* 1996;35:229–233.
- Mellstrom GA, Bowman MA. In: Boman A, Estlander T, Wahlberg JE, Maibach HI, eds. *Protective gloves for occupational use*. 2nd ed. Boca Raton, FL: CRC Press; 2005:15–28.
- Meyer JD, Chen Y, Holt DL, et al. Occupational contact dermatitis in the UK: a surveillance report from EPIDERM and OPRA. *Occup Med (Lond)* 2000;50:265–273.
- Geier J, Lessmann H, Uter W, et al. Occupational rubber glove allergy: results of the Information Network of Departments of Dermatology (IVDK), 1995–2001. *Contact Dermatitis* 2003;48:39–44.
- Nettis E, Assennato G, Ferrannini A, et al. Type I allergy to natural rubber latex and type IV allergy to rubber chemicals in health care workers with glove-related skin symptoms. *Clin Exp Allergy* 2002;32:441–447.
- von Hintzenstern J, Heese A, Koch HU, et al. Frequency, spectrum and occupational relevance of type IV allergies to rubber chemicals. *Contact Dermatitis* 1991;24:244–252.