Contact dermatitis in the cleaning industry

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Purpose of review
The review summarizes recent findings on contact dermatitis in the cleaning industry.

Recent findings
Contact dermatitis is still an important issue in cleaning. Recent studies identified cleaning work sites and tasks, as well as specific cleaning products, which incur a risk increase for occupational contact dermatitis in cleaning. Workers involved in cleaning outdoors prevalence ratio [PR 1.85, 95% confidence interval (CI) 1.16–2.96], cleaning common areas of residential buildings (PR 1.77, 95% CI 1.11–2.84), schools (PR 1.84, 95% CI 1.15–2.93) and cleaning building sites (PR 1.87, 95% CI 1.18–2.95) showed significantly higher rates of contact dermatitis. Relevant allergens in cleaning are rubber chemicals and disinfectants. Leading allergens are thiurams (11.6%, 95% CI 9.1–14.1) and formaldehyde (3.4%, 95% CI 2.0–4.7), but contact with metal allergens might also be important. The most likely allergen sources for sensitization against rubber chemicals are protective gloves. High sensitization rates for disinfectants might result from the fact that employees in cleaning often use single-use medical examination gloves while cleaning. These gloves are not resistant to chemicals, which may break through the gloves within a short period of time, depending on glove material and thickness. No differences in sensitization rates and sensitization profiles were seen in cleaners of younger (≤40 years) and older (>40 years) age.

Summary
Prevalence of occupational contact dermatitis is still high in cleaning. Irritant contact dermatitis is prevailing, but allergic contact dermatitis is quite frequent, too. Up to now, prevention strategies in cleaning seem to be insufficient.

Keywords
allergic contact dermatitis, cleaning agents, cleaning industry, disinfectants, irritant contact dermatitis, rubber chemicals

INTRODUCTION

Most jobs in the cleaning industry carry a high risk of acquiring occupational contact dermatitis of the hands caused by repetitive contact with water, hazardous cleaning and disinfecting agents, as well as the need to wear occlusive gloves for long periods during the working day. Hand dermatitis prevalence in cleaning is reported in 10–28% of employees. The majority of cleaners suffer from occupational irritant contact dermatitis (60–75% of the cases), but allergic contact dermatitis (21–32% of the cases) is reported to be quite common, too [1–7,8▪▪]. In several studies [1–3,6,7,9] from the eighties and nineties, occupationally related sensitizations were found to rubber chemicals, disinfectants, fragrances, preservatives and metal allergens. Recent studies [8▪▪,10,11] on occupational contact dermatitis in the cleaning industry give an update on sensitization profiles and risk factors for occupational contact dermatitis.

INDIVIDUAL RISK FACTORS FOR CONTACT DERMATITIS IN CLEANING

The most important endogenous risk factors for irritant and allergic contact dermatitis in skin risk occupations, like cleaning, are atopy, filaggrin loss-of function mutations and enzyme polymorphisms [12–16]. A comprehensive review on the topic was recently published by Holness [17▪].

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KEY POINTS

- Hand dermatitis in cleaning was reported to be especially associated with cleaning outdoors, cleaning common areas of residential buildings, schools and cleaning building sites.
- Increasing numbers of worksite types and cleansing products used seem to increase the risk of contact dermatitis in cleaning.
- Patch test surveillance systems revealed rubber chemicals and disinfectants to be relevant allergens in cleaning. Contact with metal allergens might also be important.

OCCUPATIONAL RISK FACTORS FOR CONTACT DERMATITIS IN CLEANING

Cleaners are exposed to a variety of allergenic and irritant substances in cleaning agents (floor cleansers; floor maintenance products; daily and periodical restroom, toilet, furniture, glass, window and kitchen cleansers, etc.). Moreover, they bear a high burden of wet work during their working days. The interplay of these factors is causative for occupational contact dermatitis in cleaning [1,4,18,19].

Recently, Mirabelli *et al.* [8▪▪] performed an analysis of risk factors for hand dermatitis in the cleaning industry, based on data from the Epidemiological Study on the Risk of Asthma in Cleaning Workers 2 (EPIASLI2) study. The association between cleaning tasks at different workplaces, exposure to cleaning agents and occupational contact dermatitis was analysed in 693 workers from 37 cleaning companies compared to 125 controls. Hand dermatitis in cleaning was found to be significantly associated with cleaning outdoors [PR 1.85, confidence interval (95%) CI 1.16–2.96], cleaning common areas of residential buildings (PR 1.77, 95% CI 1.11–2.84), schools (PR 1.84, 95% CI 1.15–2.93) and cleaning building sites (PR 1.87, 95% CI 1.18–2.95). Overall prevalence of hand dermatitis in cleaners was 28%. Even higher prevalences were seen in those handling cleaning agents which contain hydrochloric acid (prevalence 40%; PR 1.73, 95% CI 1.00–2.99) and dust mob products (prevalence 36%; PR 2.12, 95% CI 1.22–3.71) up to 1–3 days a week. Moreover, frequent handling (>4 days a week) of products containing ammonia, bleach, multiuse products and perfumed products was associated with an increased dermatitis risk. Independently of handling frequency, working with degreasing agents almost doubled the risk of acquiring hand dermatitis in cleaning. Interestingly, hand dermatitis prevalence increased with increasing numbers of worksite types and cleansing products used.

IRRITANT CONTACT DERMATITIS

Irritant contact dermatitis, with a share of 60–80% of the cases, was reported to be the most common manifestation of contact dermatitis in cleaning over decades [1,3,7,20] (Table 1).

ALLERGIC CONTACT DERMATITIS

Overall, allergic contact dermatitis was diagnosed to be relevant in 11–32% of employees suffering from occupational contact dermatitis in cleaning (Table 1). Rubber chemicals, disinfectants, fragrances and metals are the most common allergens published to be relevant for cleaners so far [1–3,6,7,9].

Recently, a comprehensive analysis of type IV sensitization in a large number of cleaners was published by Liskowsky *et al.* [10]. Here, patch test data in 803 female cleaners, tested in the patch test clinics of the Information Network of Departments

Table 1. Prevalence of occupational contact dermatitis in cleaning

Authors	*N*	Prevalence of occupational contact dermatitis	ICD	ACD	Others
Dahlquist and Fregert [20]	123	53%[a]	80%	11%	10%
Lammintausta [3]	204	10%	59%	23%[b]	9%
Hansen [1]	541	15.3%	75%	21%	n.m.
Singgih *et al.* [7]	356	12%	65%	32%	2%
Gawkrodger *et al.* [4]	456	12%	n.m.	n.m.	n.m.
Nielsen [5]	1166	12%	n.m.	n.m.	n.m.
Mirabelli *et al.* [8▪▪]	639	28%	n.m.	n.m.	n.m.

ACD, allergic contact dermatitis; ICD, irritant contact dermatitis; n.m., not mentioned.
[a]Selection bias may explain the high prevalence of occupational contact dermatitis in this study.
[b]Irritant and allergic contact dermatitis, no separate data for allergic contact dermatitis available.

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of Dermatology (IVDK) from 1996 to 2009, were analysed. Occupational factors were assumed to be responsible for the condition in 81.6% ($n = 655$) of the cleaners. Finally, allergic contact dermatitis was diagnosed in 31% ($n = 249$) of the patients. Compared with women without occupational dermatitis (control group, $n = 64\,736$), female cleaners showed significant more sensitizations to rubber chemicals, especially thiurams (11.6%, 95% CI 9.1–14.1 vs. 1.5%, 95% CI 1.4–1.6), zinc diethyldithiocarbamate (3.4%, 95% CI 2.1–4.7 vs. 0.4%, 95% CI 0.3–0.4) and mercaptobenzothiazole (1.8%, 95% CI 0.7–2.9 vs. 0.5%, 95% CI 0.4–0.6). Concerning thiuram vulcanizing agents, these findings were underlined by another analysis of clinical surveillance data of the IVDK. Here, cleaners had a 3.5-fold higher relative risk for thiuram sensitization compared with office workers and teachers [21]. The most likely allergen source for sensitization against rubber chemicals are protective gloves, especially single-use gloves [22,23], in which relevant amounts of unreacted accelerators, antioxidants and antiozonants can be found [24]. Preventive strategies would need to focus on the provision of quality-improved, thiuram-free, re-usable cotton-lined gloves to reduce allergen exposure [25].

Other relevant sensitizers were disinfectants like formaldehyde (3.4%, 95% CI 2.0–4.7 vs. 1.4%, 95% CI 1.3–1.5), glutaraldehyde (2.8%, 95% CI 1.3–4.2 vs. 0.7%, 95% CI 0.6–0.9), glyoxal (3.7%, 95% CI 1.8–5.5 vs. 0.8%, 95% CI 0.5–1.0) and benzalkonium chloride (3.5%, 95% CI 1.7–5.3 vs.0.9%, 95% CI 0.8–1.1). High sensitization rates might result from the fact that employees in cleaning often use single-use medical examination gloves with a limited material thickness of approximately 0.1–0.18 mm for cleaning and disinfection tasks. These gloves are not resistant to chemicals, which break through the gloves within a few minutes up to hours, depending on the material and the thickness of the gloves [26–29]. Gloves worn in contact with formaldehyde, glyoxal, glutaraldehyde, quaternary ammonium compounds and polymethylurea derivates containing disinfectants must reach a material thickness of at least 0.4 mm for nitrile, 0.5 mm for chloroprene, 0.7 mm for fluorinated rubber and 0.5 mm for butyl rubber gloves to provide relevant protection [30,31].

The occupational relevance of metal sensitization is discussed controversially [32,33]. The data of Liskowsky *et al.* [10] substantiate the notion that nickel might be an occupationally relevant allergen. Nickel sensitization rates in female cleaners (28.2%, 95% CI 24.5–31.9) and female controls with occupational dermatitis from other occupations (29.1%, 95% CI 28.3–29.9) showed significantly higher sensitization rates to nickel than women without occupational dermatitis (22.4%, 95% CI 22.0–22.7). These finding were confirmed by a study [11] from Italy, analysing the association between sensitization to metals and occupation in 12 492 patients revealing a high prevalence of nickel [odds ratio (OR) 1.29, 95% CI 1.08–1.53), chromium (OR 1.66, 95% CI 1.17–2.34), nickel + chromium (OR 2.11, 95% CI 1.33–3.34) and nickel + cobalt + chromium co-sensitization (OR 1.79, 95% CI 1.09–2.94) in cleaners ($n = 1171$). The authors speculate that metals from working place tools and detergents like reported in the 90s [34,35] might be able to better permeate into the compromised skin of cleaning employees and subsequently cause sensitization [11]. However, the discussion on this topic is still going on [36].

TIME TRENDS

Liskowsky *et al.* [10] analysed potential time trends for occupational allergens in cleaners. Surprisingly, no differences were seen in patterns of sensitization to occupational allergens in younger (≤40 years of age) and older (>40 years of age) female cleaners indicating that neither allergen exposure had changed relevantly over time nor prevention strategies had a sufficient effect so far.

PREVENTION

Despite the fact that cleaning is a skin risk occupation, workplace training in skin care and protection is rare. In a recent questionnaire-based study of Lynde *et al.* [37], only a minority of cleaners (21% of male and 16% of female cleaners) were trained. Moreover, those who did not receive training developed dermatitis more often compared with those who were trained.

CONCLUSION

Prevalence of occupational contact dermatitis is still high in cleaning. Irritant contact dermatitis is prevailing, but allergic contact dermatitis is quite frequent, too. Up to now, prevention strategies in cleaning seem to be insufficient. For the future, targeted primary and secondary prevention strategies are urgently needed. Summarizing the recent literature, skin care and protection regimes for cleaners might include the following items: replacement and avoidance of hazardous substances in cleaning, avoidance of multiple work sites types, reduction of the number of cleansing products used, regular use of re-usable, thiuram-free, chemical-resistant gloves with cotton lining for wet work

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and handling disinfectants and other hazardous cleaning agents, no use of gloves for dry work tasks, reduction of hand washing procedures, and regular use of skin care and protection ointments [8▪▪,10, 18,25,38]. Only a consequent use of suitable skin care and protection measures, as well as regular training of the employees, might improve the situation in cleaning in future.

Acknowledgements

None.

Conflicts of interest

There are no conflicts of interest.

REFERENCES AND RECOMMENDED READING

Papers of particular interest, published within the annual period of review, have been highlighted as:

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- ▪▪ of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 581–582).

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