

Review Article

Evidence-based guidelines for the prevention, identification and management of occupational contact dermatitis and urticaria*

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Background: Occupational contact dermatitis is the most frequently reported work-related skin disease in many countries. A systematic review was commissioned by the British Occupational Health Research Foundation in response to a House of Lords Science and Technology Committee recommendation.

Objectives: The systematic review aims to improve the prevention, identification and management of occupational contact dermatitis and urticaria by providing evidence-based recommendations.

Methods: The literature was searched systematically using Medline and Embase for English-language articles published up to the end of September 2009. Evidence-based statements and recommendations were graded using the Royal College of General Practitioner's three-star system and the revised Scottish Intercollegiate Guidelines Network grading system.

Results: Three thousand one hundred and fifty-five abstracts were identified and screened. From these, 786 full papers were obtained and appraised. One hundred and nineteen of these studies were used to produce 36 graded evidence statements and 10 key recommendations.

Conclusions: This evidence review and its recommendations focus on interventions and outcomes to provide a robust approach to the prevention, identification and occupational management of occupational contact dermatitis and urticaria, based on and using the best available medical evidence.

Key words: evidence-based medicine; occupational contact dermatitis; occupational urticaria; prevention.
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Dermal and inhalation exposures represent the main pathways of occupational exposure to hazardous substances. Occupational skin disease is one of the commonest occupational diseases. Occupational contact dermatitis is the commonest occupational skin disease (1–10). Less common occupational skin disorders include occupational contact urticaria, folliculitis/acne, infections, neoplasia, hyperpigmentation and vitiligo.

This review focuses on the following three occupational skin diseases:

1. Irritant occupational contact dermatitis, where agents have a direct toxic effect on the skin, e.g. wet work, detergents, alkalis, solvents and friction, and which is the commonest type of occupational contact dermatitis.

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2. Allergic occupational contact dermatitis, which involves a delayed or type IV hypersensitivity reaction as the result of a T-cell-mediated immune response to skin sensitizers such as epoxy resins and preservatives.
3. Occupational contact urticaria, which can be either non-immunological or immunological, involving an immediate or type I hypersensitivity reaction, associated with the presence of specific IgE. Occupational contact urticaria is associated with proteins in food and latex gloves, especially in healthcare workers, and with some low molecular weight agents.

Methods

Medline and Embase were searched systematically from 1950 and 1980, respectively, to the end of September 2009 for original scientific studies published in English. Pairs of working group members independently reviewed 3155 abstracts to select 786 papers for further, independent critical review. Single case studies and narrative reviews were excluded. Other reasons to reject studies included the following: papers did not address the scoping questions for this project, the outcome variables studied were not confirmed cases of occupational contact dermatitis or urticaria, duplicate publication, papers were superseded by more recent studies that incorporated the same data, or studies did not control sufficiently for bias or confounding. Data from 119 papers were entered into evidence tables and contributed to the evidence statements (ESs).

Where possible, ESs were linked to a systematic review, which included all earlier original studies in that area. Direct reference to original studies was made where there was no systematic review, where they met quality criteria but were not included in previous reviews, or where they were necessary to support an important point.

Criteria for grading evidence and recommendations were developed primarily to guide inferences about treatment. Questions about disease frequency, aetiology, diagnosis and prognosis require other hierarchies. There are few meta-analyses and randomized controlled trials related to occupational contact dermatitis and occupational contact urticaria, and so little Scottish Intercollegiate Guidelines Network (SIGN) grading system level 1 evidence. Therefore, each ES and recommendation was graded using both the revised SIGN grading system 2000 for levels of evidence (Table 1) and recommendations (Table 2), and the Royal College of General Practitioners three-star system modified in 2008 by the Swedish Council on Technology Assessment in Health Care report for scientific studies (Table 3). Recommendations were written in precise, behaviourally specific terms, using both the revised SIGN grading system and the modified three-star system, and linked to the supporting ESs.

Results

Background

The prevalence of occupational skin diseases has not been well defined, partly because of differences in

Table 1. Scottish Intercollegiate Guidelines Network (SIGN) levels of evidence

1++	High-quality meta-analyses, systematic reviews of randomized controlled trials or randomized controlled trials with a very low risk of bias.
1+	Well-conducted meta-analyses, systematic reviews of randomized controlled trials or randomized controlled trials with a low risk of bias.
1–	Meta-analyses, systematic reviews of randomized controlled trials or randomized controlled trials with a high risk of bias.
2++	High-quality systematic reviews of case–control or cohort studies. High-quality case–control or cohort studies with a very low risk of confounding, bias or chance, and a high probability that the relationship is causal.
2+	Well-conducted case–control or cohort studies with a low risk of confounding, bias or chance, and a moderate probability that the relationship is causal.
2–	Case–control or cohort studies with a high risk of confounding, bias or chance, and a significant risk that the relationship is not causal.
3	Non-analytical studies, e.g. case reports, case series.
4	Expert opinion.

Table 2. Scottish Intercollegiate Guidelines Network (SIGN) grades of recommendation

A	At least one meta-analysis, systematic review or randomized controlled trial rated as 1++, and directly applicable to the target population; or a systematic review of randomized controlled trials or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results.
B	A body of evidence including studies rated as 2++, directly applicable to the target population, and demonstrating overall consistency of results; or extrapolated evidence from studies rated as 1++ or 1+.
C	A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results; or extrapolated evidence from studies rated as 2++.
D	Evidence level 3 or 4; or extrapolated evidence from studies rated as 2+.

Table 3. Royal College of General Practitioners three-star system. High-quality scientific studies were taken to be major epidemiological surveys and prospective cohort studies. Medium-quality studies included retrospective, cross-sectional or uncontrolled cohort studies and case series

Evidence grade		Definition
***	Strong	The conclusion is supported by at least two independent studies with high quality, or a good systematic review.
**	Moderate	The conclusion is supported by one study with high quality, and at least two studies with medium quality.
*	Limited	The conclusion is corroborated by at least two studies with medium quality.
	Insufficient	No conclusions can be drawn when there are no studies that meet the criteria for quality.
	Contradictory	No conclusions can be drawn when there are studies of the same quality whose findings contradict one another.

definitions, diagnostic criteria and work settings, as well as limited surveillance data. More statistics are available related to incidence. Published frequencies of occupational skin diseases come from voluntary and mandatory reporting schemes, compensation registries and case series from specialized dermatological clinics. The true frequencies of occupational contact dermatitis and occupational contact urticaria are unknown.

ES1 *** SIGN 2+++. Occupational contact dermatitis is the most frequently reported occupational skin disease in developed countries and accounts for between 70% and 90% of all reported cases of occupational skin disease (1–10).

ES2 *** SIGN 2+++. Overall, in the general workforce, irritant occupational contact dermatitis occurs more commonly than allergic occupational contact dermatitis (3, 4, 7, 10–12).

Dermatologists see proportionately more patients with allergic disease than other physicians (7, 10, 13–15).

ES3 *** SIGN 2+++. Occupational contact urticaria accounts for between 1% and 8% of reported cases of occupational skin disease (1–3, 5, 6, 8, 10, 16).

ES4 *** SIGN 2+++. The annual population incidence of occupational contact dermatitis ranges from an estimated 5.7 to 101 cases per 100 000 workers per year. The most reliable studies estimate the incidence to be between 11 and 86 cases per 100 000 workers per year (2–4, 6–8, 10, 17, 18).

ES5 *** SIGN 2+++. The annual population incidence of occupational contact urticaria ranges from an estimated 0.3 to 6.2 cases per 100 000 workers per year (2, 6, 10, 19, 20).

The predominant causes reflect variations in economic activity between and within countries, methods of data collection, occupational classifications of workers, and different perceptions of whether the condition is occupational or not. Most cases of irritant occupational contact dermatitis are caused by cumulative exposure to chemical agents. Physical irritants, particularly friction and low humidity, can

cause or contribute to the development of occupational contact dermatitis. Physical irritation accounts for a little more than 1% of large case series seen at contact dermatitis clinics (21, 22).

ES6 *** SIGN 2+++. The most frequently and consistently reported agents in cases of allergic occupational contact dermatitis include cobalt, chromates, cosmetics and fragrances, epoxies, nickel, plants, preservatives, and resins and acrylics (1, 3, 6–10, 12, 17, 19, 23–29).

ES7 *** SIGN 2+++. The most frequently and consistently reported agents in the case of irritant occupational contact dermatitis include alcohols, cutting oils and coolants, degreasers, disinfectants, petroleum products, soaps and cleaners, solvents and wet work (1, 5–10, 12, 17, 23, 26, 27).

ES8 *** SIGN 2+++. The most frequently and consistently reported agents in the case of occupational contact urticaria include cow dander, food and animal products, flour and grains, and natural rubber latex (6, 10, 19, 20, 23).

Although occupational contact urticaria is most usually reported to be caused by contact with proteins, occasionally it can also be caused by contact with low molecular weight chemicals, including 2-ethylhexyl acrylate (20) and acid anhydrides (30).

ES9 *** SIGN 2+++. The workers most commonly reported to be at increased risk of developing occupational contact dermatitis include agricultural workers, beauticians, chemical workers, cleaners, construction workers, cooks and caterers, electronics workers, hairdressers, health and social care workers, machine operators, mechanics, metalworkers and vehicle assemblers (1–4, 7, 8, 12–14, 18, 19, 24, 28, 29, 31–33).

ES10 *** SIGN 2+++. The workers most commonly reported to be at increased risk of developing occupational contact urticaria include bakers, farmers, health and social care workers, and those in food preparation occupations (19, 20, 23).

Exposure to skin irritants and allergens in the workplace is the most significant independent risk

factor for developing occupational contact dermatitis and occupational contact urticaria. Personal risk factors have been purported to exist, e.g. atopy, a previous history of eczema or dermatitis, dry skin and hyperhidrosis. Such risk factors are often described in publications with references to narrative reviews and book chapters. There is little original scientific research that explores these endogenous risk factors directly.

Inconsistencies between studies relate to the ascertainment of atopy, ranging from the use of immunological tests to detect specific IgE to common allergens, to those that rely on a personal or family history of asthma, eczema or hayfever reported by self-administered questionnaires. Further inconsistencies relate to differences in defining cases of dermatitis, some studies relying on self-administered questionnaires and others on formal assessment by a dermatologist. Studies based on subjects where occupational contact dermatitis represented a minority of cases, or that defined atopy more broadly, e.g. including inability to tolerate wool next to the skin, although noted to be cited often in narrative reviews, were excluded from this systematic review. There are also indications that atopic individuals with hand dermatitis avoid or leave their occupation (34), leading to a healthy worker effect. Inferences about the role of atopy must be interpreted with caution.

Similar numbers of studies have reported that atopy does not increase the risk of developing occupational contact dermatitis (35–39), including irritant occupational contact dermatitis (38, 40), or that it is an independent risk factor (41, 42), especially among studies where irritant occupational contact dermatitis predominates (43–46). Some studies observed that a personal or family history of atopy is commoner among those with irritant occupational contact dermatitis than among those with allergic occupational contact dermatitis (12, 47). One study reported that atopy protected against the development of allergic occupational contact dermatitis (48). Other studies have shown that a history of atopic dermatitis or previous hand or flexural dermatitis predicts the development of occupational contact dermatitis (49–53), whereas a history of respiratory atopy does not (49, 50), or is less likely to (52).

ES11. No conclusions can be drawn regarding atopy as a risk factor for the development of occupational contact dermatitis, as there are studies of the same quality whose findings contradict one another (12, 35, 36, 38–40, 42, 44–48, 50).

ES12 ** SIGN 2+. A history of atopic dermatitis, particularly in adulthood, appears to be an independent risk factor for the development of occupational contact dermatitis (49–53).

A small number of studies have consistently associated occupational contact urticaria with a personal (16, 54) or family history of atopic diatheses (54) and positive prick test responses to common aeroallergens (54, 55).

ES13 *** SIGN 2+. Atopy appears to be an independent risk factor for the development of occupational contact urticaria (16, 54, 55).

The distribution of the occupational skin disease depends on the nature of the job, whether or not personal protective equipment (PPE) is selected and used correctly, behaviour (e.g. hand to face contact) and whether or not the offending agent is airborne.

ES14 *** SIGN 2+. The hands are most commonly affected by occupational contact dermatitis and urticaria, and thereafter the wrists, arms and face (1, 11, 16, 29, 42, 45, 56–62).

Studies have noted an increased risk for the development of occupational contact dermatitis within the first months of employment (29, 50, 58, 63, 64), or in the younger and least experienced (61). However, this may be related to the tasks that workers perform, as among hairdressers, trainees perform more frequent wet work (65). Other studies have shown risk to be increased later in a person's career (42, 56, 59).

ES15 ** SIGN 2+. Occupational contact dermatitis can present at any stage in a worker's career, including apprenticeship (29, 42, 50, 56, 58, 61, 65).

Prevention

Occupational skin disease can be prevented by applying the normal hierarchy of controls, i.e. elimination, substitution, engineering controls, safe work practices and, where this is not possible, personal protective equipment (PPE). Reducing exposure reduces the incidence of occupational contact urticaria, when latex gloves are replaced by powder-free, low-protein latex gloves (66), and occupational contact dermatitis, when chromate is reduced to the trivalent state by ferrous sulfate in cement (67, 68).

ES16 ** SIGN 2+. Substitution reduces the incidence of occupational contact dermatitis and occupational contact urticaria (66–68).

PPE only protects when selected correctly, worn properly, removed safely, and either replaced or maintained regularly. Some items of PPE, notably latex gloves, can cause occupational contact dermatitis and occupational contact urticaria (66). Wearing occlusive gloves as a solitary measure does not reduce the incidence of irritant occupational contact dermatitis (69).

ES17 ** SIGN 1+. Limited wearing of gloves can help to reduce the incidence of irritant occupational contact dermatitis when coupled with other preventive measures (70, 71).

ES18 * SIGN 1+. Wearing cotton glove liners can prevent development of the impaired skin barrier function that can be caused by prolonged wearing of occlusive gloves (72).

A systematic review reported mixed evidence for the effectiveness of pre-work (barrier) creams (72). Individual studies report that they offer no or very limited protection (57, 73–75), although they may improve skin condition when used in combination with cleansing and after-work creams (75). Pre-work creams are not recommended for people who wear latex gloves, as they may favour the uptake of allergens from gloves (66).

ES19 *** SIGN 1++. Some pre-work creams may help to prevent the development of occupational contact dermatitis, but pre-work creams are not generally effective as a protective measure (72, 75).

ES20 *** SIGN 1++. The regular application of emollients helps to prevent the development of occupational contact dermatitis (72, 76).

There is no direct evidence relating to the effectiveness of health surveillance in the early detection of occupational contact dermatitis or occupational contact urticaria, or the comparative effectiveness of different screening methods (77). There is evidence that employee education and training programmes help to reduce the incidence of occupational contact dermatitis (78–80) and that educational interventions induce important behavioural changes in latex glove use among healthcare workers (66).

ES21 ** SIGN 2+. Appropriately targeted and sustained educational interventions induce important behavioural changes (66).

Evaluation of the worker presenting with skin problems

Care must be taken to distinguish between occupational and non-occupational disease and between irritant and allergic occupational contact dermatitis, as the occupational management of the individual patient will differ. Diagnosis is an iterative process that involves fastidious history taking, clinical examination, patch testing and prick testing. A temporal relationship with work and/or the presence of a rash on the hands only raise suspicion of an occupational disease; they do not confirm an occupational cause. The identification of any offending allergen by patch or prick tests is a major objective, as exclusion of an offending allergen from the environment can contribute to clinical recovery in the individual worker and avoidance of new cases of disease.

ES22 * SIGN 2+. A temporal relationship between the onset or aggravation of symptoms and work suggests that a person's job may have

contributed to or caused their occupational contact dermatitis or occupational contact urticaria (81).

ES23 * SIGN 2+. The diagnoses of occupational contact dermatitis and occupational contact urticaria are made by fastidious history taking, clinical examination, patch testing and prick testing (81–84).

One study showed that 28% of patients had symptoms for more than 5 years before presentation and that the presence of symptoms for more than 1 year before diagnosis of allergic contact dermatitis caused by chromates significantly predicted chronicity (85).

Impact on the worker confirmed to have occupational contact dermatitis or occupational contact urticaria

There is little if any evidence related to the prognosis of occupational contact urticaria. Similar proportions (at least 40%) of patients with occupational contact dermatitis report either improved or ongoing symptoms (57, 85–97). Purported risk factors for poor prognosis include male sex (92, 97), severity (88) and atopy (87, 93, 98), but findings for atopy (85) and other factors are inconsistent.

ES24 *** SIGN 2+. The prognosis of occupational contact dermatitis varies widely and, in some occupational settings, reasonable control of symptoms and job retention is possible (86, 88, 90, 92, 93, 99).

ES25 ** SIGN 2+. Up to half of workers with occupational contact dermatitis experience adverse effects on quality of life, daily function and relationships at home (88, 100–103).

ES26 *** SIGN 2+. Up to half of workers with occupational contact dermatitis have time off work on sick leave because of their symptoms (85, 97, 100, 101, 104–107).

ES27 *** SIGN 2++. Loss of job or complete change of employment because of their skin disease is common among employees with occupational contact dermatitis (48, 57, 85, 86, 88, 95, 97, 100, 101, 106, 108, 109).

ES28 *** SIGN 2++. The majority of people with occupational contact dermatitis manage to continue working in some capacity, albeit sometimes in altered employment (85, 92, 97, 101, 106, 107, 110, 111).

Management of the worker confirmed to have occupational contact dermatitis or occupational contact urticaria

Different interventions have been evaluated, although many studies do not specify which work practice changes were made. The rapid changing of

contaminated clothing (111), the use of disposable towels rather than contaminated rags (70) and the use of fabric softeners in work clothing (72) have been reported to be effective in some occupational settings. Avoidance of relevant irritants and allergens can help to improve or resolve dermatitis (45, 48, 90). However, a minority of patients may suffer from persistent dermatitis even after years of allergen/irritant avoidance (99, 101, 109, 112). This is particularly marked for allergic occupational contact dermatitis caused by chromate and other metal salts (89, 107, 113). The nature of the allergen or irritant must be accounted for when considering whether avoidance of further exposure will lead to recovery or not. A recent systematic review of latex allergy reported that a change from powdered to powder-free latex gloves was associated with significantly reduced occupational contact dermatitis and occupational contact urticaria (66).

ES29 *** SIGN 2++. A significant proportion of workers who have had occupational contact dermatitis continue to have active symptoms and impairment of function years after diagnosis, despite treatment and change of job (57, 85–89, 91–97, 99, 101, 109, 112, 113).

ES30 *** SIGN 2+. Avoidance of further exposure can lead to recovery from occupational contact dermatitis and occupational contact urticaria in a number of patients, particularly with natural rubber latex (66).

ES31 * SIGN 3. Allergen and irritant avoidance can lead to disease resolution; however, persistent

reactions may occur despite avoidance, particularly with chromate and other metal salts (45, 48, 89, 90, 107).

In two studies of occupational contact dermatitis, advice about work practices, PPE or job changes made no difference to clinical improvement (104, 114), whereas six studies showed benefit in workers with occupational contact dermatitis or occupational contact urticaria from redeployment (115), the introduction of exposure controls (116, 117), or the use of gloves or protective clothing (70, 90, 116). The use of gloves can improve occupational contact dermatitis, enabling workers to continue in the same occupation (45, 70, 90, 105), or worsen it, although cotton-lined gloves may mitigate this (72).

ES32 * SIGN 3. Redeployment to a low-exposure area or the introduction of exposure controls may lead to improvement or resolution of occupational contact dermatitis and occupational contact urticaria in some workers, but is not always effective (104, 114–117).

ES33 * SIGN 3. The enhanced use of gloves or protective clothing may improve or prevent symptoms in some but not all workers who continue to be exposed to the causative agent (45, 70, 90, 105, 116).

Educational interventions have variable impacts; some have no demonstrable effect (104), whereas others reduce the incidence of dermatitis and produce better outcomes in informed workers (94, 118).

Table 4. Key recommendations for occupational health management

Employers and their health and safety personnel should:		
1	Implement programmes to remove or reduce exposure to agents that cause occupational contact dermatitis or occupational contact urticaria (ES16).	** SIGN C
2	Provide appropriate gloves and cotton liners where the risk of developing occupational contact dermatitis or occupational contact urticaria cannot be eliminated by removing exposure to its causes (ES17, ES18).	** SIGN A
3	Make after-work creams readily available in the workplace and encourage workers to use them regularly (ES20).	*** SIGN A
4	Not promote the use of pre-work (barrier) creams as a protective measure (ES19).	*** SIGN A
5	Provide workers with appropriate health and safety information and training (ES21).	** SIGN C
6	Ensure that workers who develop occupational contact dermatitis or occupational contact urticaria are properly assessed by a physician who has expertise in occupational skin disease for recommendations regarding appropriate workplace adjustments (ES24, ES27, ES28, ES30, ES31, ES32, ES33).	* SIGN D
Health practitioners should:		
7	Ask a worker who has been offered a job that will expose them to causes of occupational contact dermatitis whether they have a personal history of dermatitis, particularly in adulthood, and advise them of their increased risk, and to care for and protect their skin (ES12).	** SIGN C
8	Ask the worker who has been offered a job that will expose them to causes of occupational contact urticaria whether they have a personal history of atopy and advise them of their increased risk, and to care for and protect their skin (ES13).	*** SIGN C
9	Take a full occupational history whenever someone of working age presents with dermatitis or urticaria, asking about their job, the materials with which they work, the location of the rash and any temporal relationship with work (ES6, ES7, ES8, ES9, ES10, ES14, ES15).	*** SIGN C
10	Arrange for a diagnosis of occupational contact dermatitis or occupational contact urticaria to be confirmed objectively (patch tests and/or prick tests) and not on the basis of a compatible history alone, because of the implications for future employment (ES27, ES28).	** SIGN C

ES34 * SIGN 2+. Educating and informing workers with occupational contact dermatitis about their diagnosis and its causes, and the measures that they should take, enables workers to continue using the agents that caused their diseases and improves outcome (94, 118).

A systematic review reported a small body of consistent evidence that conditioning creams improve skin condition in workers with damaged skin, and that two small studies found that pre-work creams did not improve clinical indicators of skin condition (77).

ES35 *** SIGN 1++. Conditioning creams improve skin condition in workers with damaged skin (77, 119).

ES36 *** SIGN 1++. Pre-work creams do not improve skin condition in workers with damaged skin (77).

Discussion

Occupational contact dermatitis and urticaria can develop at any stage of a person's career, so practitioners must always be alert to the possibility that work has caused or contributed to dermatitis or urticaria in people of working age. The fact that the prognosis of occupational contact dermatitis varies widely and that some patients continue to have persistent dermatitis, despite avoidance of exposure, emphasize the importance of prevention. The key recommendations for the occupational health management of occupational contact dermatitis and urticaria, based on this systematic review, are presented in Table 4.

There remain gaps in the evidence; this is particularly so in relation to health assurance programmes for workers at risk. There is a need for well-conducted occupational health research of practical value that might include the relative benefits of health surveillance versus worker education and training. Unlike with occupational asthma, little is known about the length of time it takes for a worker to report relevant symptoms, how long it subsequently takes for a worker to undergo specialist assessment following presentation, and whether earlier diagnosis and earlier avoidance of further exposure improve outcome.

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