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The Guidelines Development Group

See page 2.

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Our mission: *'Bringing employers and researchers together to produce research that will contribute to good employee health and performance at work'*.

BOHRF raises and deploys funds for occupational health research of practical value and practical guidelines based on evidence to reduce the enormous cost to employers and workers of work-related illnesses in the UK.

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PURPOSE

The purpose of these guidelines is to help reduce:

- the incidence of occupational contact dermatitis and occupational contact urticaria by improved prevention, and
- the severity of individual cases of disease by earlier identification and improved case management.

SCOPE

The full guidelines are aimed at doctors and working in:

- primary care
- occupational health and
- dermatology

A series of associated summary leaflets are aimed at:

- general practitioners and practice nurses
- occupational health physicians and nurses and health and safety practitioners
- employers, workers and their representatives

The guidelines focus on interventions that might be considered appropriate for clinicians and employers to implement and they supplement other guidelines for the clinical management of dermatitis and urticaria.

The guidelines consist of:

- evidence statements with ratings of the strength of evidence and associated references
- recommendations with grades of the strength of evidence behind the recommendations
- good practice points where evidence is lacking

The guidelines do not intend to:

- provide a list of the hundreds of agents known to cause dermatitis and urticaria
- discuss non-occupational dermatitis or eczema and urticaria
- discuss other types of occupational skin disease, e.g. skin cancers and skin infections

Clinicians, employers and workers need to exercise their judgement, knowledge and expertise when deciding whether it is appropriate to apply guidelines, taking into account individual circumstances and patients' wishes. Clinical judgement is necessary when using evidence statements to guide decision-making. Limited recommendations on a particular issue or effect do not necessarily mean that it is untrue or unimportant but may simply reflect insufficient evidence.

It is not intended, nor should it be taken to imply, that these guidelines override existing legal obligations. Duties under the UK Health and Safety at Work Act 1974, the Management of Health and Safety at Work Regulations 1999, the Control of Substances Hazardous to Health Regulations 2002, the Disability Discrimination Act 1995 and 2005 and other relevant legislation and guidance must be given due consideration, as should laws relevant to other countries.

EXECUTIVE SUMMARY

These guidelines are intended to help reduce the incidence of occupational contact dermatitis and occupational contact urticaria. They aim to provide managers, workers and safety and health professionals with evidence based guidance related to the prevention, identification and management of cases.

Skin disease is the second commonest occupational disease in the European Union after musculoskeletal disorders¹. Contact dermatitis accounts for 70-90% of all occupational skin disease, while contact urticaria accounts for less than 10%. Other occupational skin disorders include folliculitis/acne, infections, neoplasia, hyperpigmentation and vitiligo. Up to half of workers with occupational contact dermatitis experience adverse effects on quality of life, daily function and relationships at home. It is because occupational skin disease is so common and the impact is so severe that this evidence review was undertaken.

This review is focused on the following three skin conditions caused by exposure to substances in the course of work:

- **occupational irritant contact dermatitis**, where agents have a direct toxic effect on the skin e.g. wet work, detergents, alkalis, solvents, friction, etc, and which is the commonest type of occupational contact dermatitis.
- **occupational allergic 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, preservatives, etc. Allergic contact dermatitis often carries a worse prognosis than irritant contact dermatitis.
- **occupational contact urticaria** which can be divided into two broad categories: non-immunologic contact urticaria and immunologic contact urticaria that involves an immediate or type I hypersensitivity reaction, associated with the presence of specific immunoglobulin E. Contact urticaria is associated with proteins in food and latex gloves and with some low molecular weight agents.

Many industrial substances are irritants and some are also allergens.

These conditions can develop at any stage of a person's career and, in some jobs, many cases present during the training period. Different jobs carry different levels of risk for occupational contact dermatitis. Those at the highest risk include hairdressers, health care workers, cleaners, construction workers, cooks and caterers, mechanics, metalworkers and vehicle assemblers, chemical/petroleum plant operatives and agricultural workers. Those at greatest risk of developing occupational contact urticaria include bakers, farmers, health care workers and those in food preparation occupations.

A history of atopic dermatitis, particularly in adulthood, appears to be an independent risk factor for the development of occupational contact dermatitis. Atopy appears to be an independent risk factor for the development of occupational contact urticaria. However, personal pre-disposing factors are a lesser consideration than exposure to skin sensitizers and skin irritants. Thus the priority must be to prevent the onset of disease by adequate control of exposure in the workplace. Occupational contact dermatitis and urticaria can be prevented by applying the normal hierarchy of controls, i.e. hazard elimination, hazard substitution, engineering controls, safe work practices and, where this is not possible, personal protective equipment. Gloves have only been shown to help reduce the incidence of irritant occupational contact dermatitis when coupled with other preventive measures. They must be selected according to their chemical and physical resistance properties and their general suitability for the job tasks. Wet work is a significant risk factor for irritant contact dermatitis and occurs when the hands are in contact with water (including water-diluted detergents) or where the prolonged wearing of gloves causes the hands to become moist from perspiration. Thin cotton gloves that absorb sweat may be worn inside occlusive gloves.

Pre-work creams are of questionable value. They are often referred to as barrier creams, but this term gives rise to a false perception that they form a physical barrier to protect the skin. Some pre-work creams may help to prevent the development of occupational contact dermatitis, but pre-work creams are not generally effective as a preventative measure. Their use should not be promoted as this may confer on workers a false

sense of security and encourage them to be complacent in implementing more appropriate preventative measures. After-work or conditioning creams help to prevent the development of occupational contact dermatitis. Their use should be encouraged and they should be made readily available in the workplace. Conditioning creams have also been demonstrated to improve skin condition in workers who have developed occupational contact dermatitis. Likewise, appropriately targeted educational programmes have been shown to be effective in inducing important behavioural changes that help to prevent the onset of disease and improve outcome in those who have developed occupational contact dermatitis.

Care must be taken to distinguish between occupational and non-occupational disease and between irritant and allergic occupational contact dermatitis, since the occupational management of the individual patient will differ. The diagnosis of occupational contact dermatitis and urticaria 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 cause, and do not necessarily confirm an occupational causation. The identification of any offending allergen by patch or prick tests is a major objective, since exclusion of an offending allergen from the environment can contribute to clinical recovery in the individual worker and avoidance of new cases of disease.

The prognosis of occupational contact dermatitis varies widely and, in some occupational settings, reasonable control of symptoms and job retention is possible. Similar proportions of patients report either improvement / complete resolution or ongoing symptoms. A small proportion of patients continue to have persistent or post-occupational contact dermatitis in the very long term, even after removal from exposure. Loss of job or complete change of employment is common among workers with occupational contact dermatitis; however, most manage to continue working in some capacity. There is little if any evidence related to the prognosis of occupational contact urticaria.

The pharmacological treatments for dermatitis and urticaria are the same for occupational and non-occupational forms of the diseases. This review therefore only addresses the occupational management of affected individuals. Redeployment to a low exposure area or the introduction of exposure controls may lead to improvement or resolution of occupational contact dermatitis and urticaria in some workers, but is not always effective. Likewise, 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. Difficulties in managing these diseases, once caused, emphasise further the importance of prevention.

Other work relevant to the guideline

Because NHS Plus and the Royal College of Physicians of London recently undertook a systematic review of latex allergy², studies related to latex were excluded from this review. NHS Plus and the Royal College of Physicians subsequently published a systematic review of dermatitis³, the main focus being the management of existing cases of dermatitis in healthcare workers and the risk of infection. Therefore there is little overlap between the scope of that work and this review.

This BOHRF guideline development group included one member of the NHS Plus latex guidelines development group (BB) and four members of the NHS Plus dermatitis guidelines development group (IF, JE, JS, PB) to help ensure that we complemented previous reviews and did not duplicate previous research.

1. European Agency for Safety and Health. European Risk Observatory Report EN8. Expert forecast on emerging chemical risks related to occupational safety and health. Office for Official Publications of the European Community. Luxembourg. 2008.
2. NHS Plus / Royal College of Physicians. *Latex allergy: occupational health aspects of management: a national guideline*. RCP. London. 2008.
3. NHS Plus / Royal College of Physicians. *Dermatitis: occupational health aspects of management: a national guideline*. RCP. London. 2009.

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 and urticaria** **** SIGN C**

*** SIGN 2+ Substitution reduces the incidence of occupational contact dermatitis and urticaria.
- 2 provide appropriate gloves and cotton liners where the risk of developing occupational contact dermatitis or urticaria can not be eliminated by removing exposure to its causes** **** SIGN A**

** SIGN 1+ Limited wearing of gloves can help to reduce the incidence of irritant occupational contact dermatitis when coupled with other preventive measures

** SIGN 1+ Wearing cotton glove liners can prevent the development of impaired skin barrier function that can be caused by prolonged wearing of occlusive gloves
- 3 make after-work (conditioning) creams readily available in the workplace and encourage workers to use them regularly** ***** SIGN A**

*** SIGN 1++ The regular application of emollients helps to prevent the development of occupational contact dermatitis
- 4 not promote the use of pre-work (barrier) creams, since this may confer on workers a false sense of security and encourage them to be complacent in following more effective preventative measures** ***** SIGN A**

*** 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 preventative measure
- 5 provide workers with appropriate health and safety information and training** **** SIGN C**

** SIGN 2+ Appropriately targeted and sustained educational intervention induce important behavioural changes
- 6 ensure that workers who develop occupational contact dermatitis or urticaria are properly assessed by a physician who has expertise in occupational skin disease for recommendations regarding appropriate workplace adjustments** *** SIGN D**

*** SIGN 2+ The prognosis appears to vary widely and, in some occupational settings, reasonable control of symptoms and job retention is possible

*** SIGN 2++ Loss of job or complete change of employment due to their skin disease is common among employees with occupational contact dermatitis.

***SIGN 2++ The majority of people with occupational contact dermatitis manage to continue working in some capacity, albeit sometimes in altered employment

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

* 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

* 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 urticaria in some workers, but is not always effective

* 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.

Health practitioners should:

- 7 ask a worker who has been offered a job that will expose them to causes of occupational contact dermatitis, if 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** **** SIGN C**

** SIGN 2+ A history of atopic dermatitis, particularly in adulthood, appears to be an independent risk factor for the development of occupational contact dermatitis

- 8 ask the worker who has been offered a job that will expose them to causes of occupational contact urticaria, if they have a personal history of atopy and advise them of their increased risk, and to care for and protect their skin** ***** SIGN C**

*** SIGN 2+ Atopy appears to be an independent risk factor for the development of immunologic occupational contact urticaria

- 9 take a full occupational history whenever someone of working age presents with a skin rash, asking about their job, the materials with which they work, the location of the rash and any temporal relationship with work** ***** SIGN C**

*** SIGN 2++ The most frequently and consistently reported agents in the case of allergic occupational contact dermatitis include: cobalt, chromium and chromates, cosmetics and fragrances, epoxies, nickel, plants, preservatives and resins and acrylics

*** 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

*** 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

*** 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

*** 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

*** SIGN 2+ The hands are most commonly affected by occupational contact dermatitis and urticaria, and thereafter the wrists, arms and face

* SIGN 2+ A temporal relationship between symptoms and work indicates that a person's job has either contributed to or caused their occupational contact dermatitis or urticaria.

- 10 arrange for a diagnosis of occupational contact dermatitis or urticaria to be confirmed objectively (patch tests and/or skin prick tests) and not on the basis of a compatible history alone because of the implications for future employment** **** SIGN C**

*** SIGN 2++ Loss of job or complete change of employment due to their skin disease is common among employees with occupational contact dermatitis

*** SIGN 2++ The majority of people with occupational contact dermatitis manage to continue working in some capacity, albeit sometimes in altered employment

M E T H O D O L O G Y

Scoping questions

The scoping questions were developed by the Chairman of the Guideline Development Group and were modelled on the scoping questions used to develop BOHRF evidence based guidelines for occupational asthma. The scope was reviewed by a consultant dermatologist with special expertise in occupational skin disease and approved by the BOHRF Research Committee.

Stakeholder Involvement

Members of the Guideline Development Group represented key stakeholder groups, including dermatology, general practice, health and safety, occupational health, occupational hygiene, patients, employers and workers at risk. Training was provided to those involved in critical appraisal and who had not previously undertaken critical appraisal.

Systematic literature search

The Research Working Group decided the search terms to be used and expert advice was provided by Health and Safety Executive's Information Services. The search terms pertaining to each scoping question topic are shown in Appendix 1.

The Scientific Secretary performed the literature search of MEDLINE and EMBASE from 1950 and 1980 respectively for original scientific studies published in English. The initial search was performed in February 2009 and was repeated at the end of September 2009. Additional searching included personal bibliographies, citation tracking, scanning of relevant journals and papers known to be in press at the end of September 2009.

Review of abstracts

3155 abstracts were considered. The Scientific Secretary sent abstracts to paired members of the Research Working Group for independent double-blind selection of studies that were thought to merit critical appraisal. Case reports were excluded and narrative reviews were excluded, except for citation tracking. The Scientific Secretary informed reviewers of the results of the double-blind screening. Reviewers discussed differences and agreed upon full papers to be requested for review, or a third reviewer was used where it was essential to expedite the process.

Critical appraisal of papers

The Scientific Secretary ordered 786 full papers and sent them to paired members of the Research Working Group for independent double-blind critical appraisal and grading of the strength of the evidence depending on the likelihood of bias and confounding. Studies were graded according to the revised Scottish Intercollegiate Guidelines Network (SIGN) grading system 2000 (Table 1). The Scientific Secretary informed reviewers of their paired reviewer and shared the results of the independent critical appraisal. Where reviewers disagreed about the score of the paper or its relevance, they discussed it to reach resolution. Where resolution was not achieved, a third reviewer was involved.

Case reports and narrative reviews were excluded. Other reasons to reject studies included:

- Papers did not address the scoping questions for this project
- Duplicate publication
- Papers were superseded by more recent studies that incorporated the same data
- Studies did not control sufficiently for bias or confounding

Evidence tables

The Scientific Secretary entered the scores and summaries for accepted papers provided by the reviewers into evidence tables. 119 studies were included in the evidence tables.

Evidence statements

The evidence tables were reviewed to formulate evidence statements. An explicit link was made to the most comprehensive and most recent source supporting the evidence for each evidence statement. Where possible this was 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 were not included in the original review(s), or where they were necessary to support an important point.

Criteria for grading evidence and recommendations often regard randomised controlled trials as providing the highest level of evidence. However, such hierarchies are designed principally to guide inferences about the effects of treatment. Since randomised controlled trials do not apply in many areas of occupational medicine e.g. health surveillance, susceptibility to disease or the sensitivity and specificity of screening and diagnostic procedures, there is scarce level 1 evidence as defined by the SIGN grading system. To overcome this limitation the strength of each evidence statement was graded using both the SIGN system (Table 1) and the Royal College of General Practitioners (RCGP) 3 star system modified in 2008 by the Swedish Council on Technology Assessment in Health Care report for scientific studies (Table 2).

Key recommendations

The evidence statements were reviewed to determine key recommendations for occupational health management. Recommendations were written in precise, behaviourally specific terms. Each recommendation was graded using both the revised SIGN grading system (Table 3) and the modified RCGP 3 star system (Table 2) and linked to the supporting evidence statements.

As with NICE guidelines, papers with a 'minus' grade (indicating a high level of bias or confounding) or grade 3 or 4 were only used as a basis for a recommendation where there was a lack of stronger evidence.

Key recommendations were agreed by the Guidelines Development Group.

External review

The final draft of the guidelines was reviewed independently by two dermatologists experts in the field on occupational skin diseases.

Levels and grades of evidence and recommendations

1++	High quality meta analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a very low risk of bias.
1+	Well conducted meta analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a low risk of bias.
1-	Meta analyses, systematic reviews of randomised controlled trials or randomised 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-analytic studies, e.g. case reports, case series.
4	Expert opinion.

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

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.

Table 2: Royal College of General Practitioners (RCGP) 3 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.

A	At least one meta analysis, systematic review, or randomised controlled trial rated as 1++, and directly applicable to the target population; or a systematic review of randomised 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: Scottish Intercollegiate Guidelines Network (SIGN) grades of recommendation

EVIDENCE LINKED STATEMENTS

A Background

Dermal and inhalation exposures represent the main pathways of occupational exposure to hazardous substances. Accordingly occupational skin disease is one of the commonest occupational diseases and occupational contact dermatitis is the most common occupational skin disease.

A1 *** 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.

(Burnett 1998, Chen 2005, Dickel 2002a, Dickel 2002b, Kaufman 1998, McDonald 2006, Meyer 2000, Pal 2009, Sirajuddin 2001, Turner 2007)

There is wide variation in the attribution of allergic versus irritant occupational contact dermatitis. The proportion of cases of occupational contact dermatitis that may be attributed as being allergic, irritant or mixed allergic/irritant in nature depends on the type of industry, the jobs that people have, the hazards to which they are exposed, the centres that report cases and differences in defining the disease and confirming diagnoses. The proportion of patients with allergic contact dermatitis is often greater among those referred to dermatology departments and reported by dermatologists (Ho 2006, Kucenic 2002, Meyer 2000, Rietschel 2001, Turner 2007).

A2 *** SIGN 2++ Overall in the general workforce, irritant occupational contact dermatitis occurs more commonly than allergic occupational contact dermatitis.

(Dickel 2002a, Dickel 2002b, Lodi 2000, Meyer 2000, Sun 1995, Turner 2007)

Occupational contact urticaria is responsible for a much smaller proportion of reported cases of occupational skin disease than either allergic or occupational contact dermatitis.

A3 *** SIGN 2++ Occupational contact urticaria accounts for between 1% and 8% of reported cases of occupational skin disease.

(Burnett 1998, Chen 2005, Dickel 2002a, Kaufman 1998, McDonald 2006, Pal 2009, Turner 2007, Williams 2008)

What is the prevalence and incidence of occupational contact dermatitis?

The prevalence of occupational skin diseases has not been well defined, due partly to inconsistent definitions, diagnostic criteria and work settings as well as limited surveillance data. More statistics are available relating to incidence, principally from surveillance schemes. Such schemes are likely to suffer from underreporting, particularly voluntary schemes, schemes which receive data only from one group of physicians and compensation registries. The reported incidence of occupational diseases varies between and within countries depending on the predominant work sectors and occupations and the methodologies of data collection, case definition and reporting. Published frequencies of occupational skin disease come from voluntary and mandatory reporting schemes, compensation registries and case series from specialised dermatological clinics. Population-based studies and mandatory reporting schemes estimate the incidence of occupational skin disease most accurately, but few such studies have been published. The true frequencies of occupational contact dermatitis and occupational contact urticaria therefore are not known.

A4 *** 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.

(Chen 2005, Dickel 2002a, Dickel 2002b, Keil 1983, McCall 2005, McDonald 2006, Meyer 2000, Pal 2009, Turner 2007)

What is the incidence of occupational contact urticaria?

A5 *** 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.

(Chen 2005, Kanerva 1994, Kanerva 1996, McDonald 2006, Turner 2007)

Which agents cause occupational contact dermatitis and occupational contact urticaria?

The predominant causative agents reported to incur high risk reflect variations of 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 contact dermatitis are caused by cumulative exposure to one or more chemical agents. Physical irritants, particularly friction and low humidity, can also cause or contribute to the development of occupational dermatitis. Physical irritation accounts for a little more than 1% of large case series seen at contact dermatitis clinics (Morris-Jones 2002, McMullen 2006). This is likely to be an under-estimate since most cases are unlikely to be referred to contact dermatitis clinics and the contribution of friction to contact dermatitis is likely to be under-recognized.

A6 *** SIGN 2++ The most frequently and consistently reported agents in the case of allergic occupational contact dermatitis include: cobalt, chromium and chromates, cosmetics and fragrances, epoxies, nickel, plants, preservatives and resins and acrylics.

(Burnett 1998, Dickel 2002a, Goon 2000, Kanerva 1994, Keil 1983, Kiec-Swierczynska 1996, Lachapelle 1979, Lim 2007, McDonald 2006, Meding 1990, Meyer 2000, Pal 2009, Rosen 1992, Serra-Baldrich 1995, Sirajuddin 2001, Sun 1995, Turner 2007)

A7 *** 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.

(Burnett 1998, Goon 2000, Kaufman 1998, Keil 1983, Lim 2007, McDonald 2006, Meding 1990, Meyer 2000, Pal 2009, Sirajuddin 2001, Sun 1995, Turner 2007,)

A8 *** 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.

(Goon 2000, Kanerva 1994, Kanerva 1996, McDonald 2006, Turner 2007)

While occupational urticaria is most usually reported to be caused by contact with proteins, it can also be caused by occasional contact with low molecular weight chemicals, e.g. 2-ethylhexyl acrylate (Kanerva 1996) and acid anhydrides (Helaskoski 2009).

Which workers are at risk of developing occupational contact dermatitis and occupational contact urticaria?

A9 *** 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.

(Behrens 1994, Burnett 1998, Chen 2005, Dickel 2002a, Dickel 2002b, Ho 2006, Kanerva 1994, Kiec-Swierczynska 1996, Kucenic 2002, McCall 2005, Meyer 2000, Pal 2009, Rosen 1992, Serra-Baldrich 1995, Smit 1993, Smith 2000, Sun 1995)

A10 *** 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.

(Goon 2000, Kanerva 1994, Kanerva 1996)

What are the personal risk factors for developing occupational contact dermatitis and urticaria?

Exposure to skin irritants and allergens in the workplace is the most significant independent risk factor for developing occupational contact dermatitis and urticaria. A number of personal risk factors have been purported, e.g. atopy, a previous history of eczema or dermatitis, dry skin and hyperhidrosis. Such personal or endogenous risk factors are often described in publications with references to narrative reviews and book chapters, i.e. publications that lie outside of the methodology of the systematic review. There is little original scientific research that explores such endogenous risk factors directly. The evidence that does exist derives from small studies of different design and consequently the findings are often inconsistent.

Is atopy a risk factor for developing occupational contact dermatitis and urticaria?

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 which defined atopy more broadly e.g. including inability to tolerate wool next to the skin, while noted to be cited often in narrative reviews, were excluded from this systematic review at the critical appraisal stage. Many studies rely on small numbers. There are indications that atopics with hand dermatitis avoid or leave their occupation (Meding 1994) leading to a healthy worker effect. These limitations mean that inferences about the role of atopy must be interpreted with caution.

Similar numbers of studies have reported that atopy presents either no statistically significant increased risk for the development of occupational contact dermatitis (de Boer 1989, Hansen 1989, Majoie 1996, Seidenari 1990, van Putten 1984) including irritant contact dermatitis (Ashworth 1993, Seidenari 1990) or that a personal history of atopy is an independent risk factor (Alanko 2004, Mancuso 1990), especially among studies where irritant contact dermatitis predominates (Lammintausta 1981, Shiao 2004, Stingeni 1995, Tarvainen 1993). Some studies observed that a personal or family history of atopy is commoner among those with irritant contact dermatitis compared to those with allergic contact dermatitis (Sun 1995, Nettis 2002), but without comparing to rates among control groups of unaffected workers. One study reported that atopy appeared to protect against the development of allergic contact dermatitis (Rystedt 1985). Other studies have shown that a history of atopic dermatitis or previous hand or flexural dermatitis predict the development of occupational contact dermatitis (Bauer 2001, Berndt 1999, Dickel 2003, Nilsson 1985, Roberts 2006) and not (Bauer 2001, Berndt 1999), or less likely (Roberts 2006), in the case of a history of respiratory atopy.

A11 - No conclusions can be drawn regarding atopy as a risk factor for the development of occupational contact dermatitis, since there are studies of the same quality whose findings contradict one another.

(Ashworth 1993, Berndt 1999, de Boer 1989, Hansen 1989, Mancuso 1990, Nettis 2002, Rystedt 1985, Seidenari 1990, Shiao 2004, Stingeni 1995, Sun 1995, Tarvainen 1993, van Putten 1984).

A12 ** SIGN 2+ A history of atopic dermatitis, particularly in adulthood, appears to be an independent risk factor for the development of occupational contact dermatitis.

(Bauer 2001, Berndt 1999, Dickel 2003, Nilsson 1985, Roberts 2006,)

A small number of studies have consistently associated occupational contact urticaria to natural rubber latex with a personal history of atopic diatheses (Filon 2006, Williams 2008), family history of atopic diatheses (Filon 2006) and positive skin prick tests to common aeroallergens (Filon 2006, Valsecchi 2000).

A13 *** SIGN 2+ Atopy appears to be an independent risk factor for the development of immunologic occupational contact urticaria.

(Filon 2006, Valsecchi 2000, Williams 2008)

What is the distribution of occupational contact dermatitis and urticaria?

The hands are most commonly affected by occupational contact dermatitis, and thereafter the wrists, forearms and face (Alanko 2004, Burnett 1998, Conde-Salazar 1995, Krajewska 1976, Lodi 2000, Mancuso 1990, Motolese 1993, Stingeni 1995, Suneja 2008, Tan 1997). Similar distributions have been observed for contact urticaria in a population where most cases were attributable to latex (Williams 2008). The distribution of the rash depends on the nature of the job, whether or not personal protective equipment is selected and used correctly, behaviour (e.g. hand to face contact) and whether or not the offending agent is airborne.

A14 *** SIGN 2+ The hands are most commonly affected by occupational contact dermatitis and urticaria, and thereafter the wrists, arms and face.

(Burnett 1998, Conde-Salazar 1995, Krajewska 1976, Lodi 2000, Mancuso 1990, Minamoto 2002, Motolese 1993, Serra-Baldrich 1995, Slodownik 2006, Stingeni 1995, Suneja 2008, Tan 1997, Williams 2008)

Is time in post an independent risk factor for the development of occupational contact dermatitis?

Age is sometimes discussed as a potential risk factor for the development of occupational contact dermatitis and urticaria. Whether or not younger or older subjects are more likely to be reported to suffer from occupational contact dermatitis or urticaria will depend on factors including the age profile of occupational groups, the tasks that people of different ages are given to perform and personal behaviours.

A few studies have noted an increased risk for the development of occupational contact dermatitis within the first 3-12 months of employment (Berndt 1999, Funke 2001, Hansen 1983, Minamoto 2002, Serra-Baldrich 1995) or in the younger and least experienced (Tan 1997). Among hairdressers, those reported to be at increased risk of developing hand dermatitis are trainees and those with less than 2 years experience. In this study wet work was significantly associated with prevalence, and trainee hairdressers performed more frequent wet work (Perkins 2005).

A few studies have shown risk to increase with the number of years in the same job, and especially after 10 years (Conde-Salazar 1995, Mancuso 1990) with as few as 5% of cases developing in the first year (Conde-Salazar 1995), whereas the median time to onset of symptoms has also been observed to occur in another occupational group at around 7 years (Slodownik 2006).

A15 ** SIGN 2+ Occupational contact dermatitis can present at any stage in a worker's career, including apprenticeship

(Berndt 1999, Conde-Salazar 1995, Funke 2001, Hansen 1983, Mancuso 1990, Minamoto 2002, Serra-Baldrich 1995, Perkins 2005, Tan 1997)

B Prevention of occupational contact dermatitis and urticaria

Primary prevention aims to avert the onset of disease. Secondary prevention aims to detect disease at an early or pre-symptomatic stage for example by health surveillance. Tertiary prevention aims to mitigate the effects of established disease and is considered later under the management of an identified case of occupational contact dermatitis or urticaria. The most effective measure is primary prevention of exposure either by substituting the agent with a less harmful material or by engineering and hygiene measures. Personal protective equipment (PPE) has a role in situations where control at source is not feasible. With any reported study of preventive measures, it is difficult to distinguish the relative effect of one measure against another, since they are usually implemented as a broad programme with many components including, for example, exposure reductions and worker education and training.

Is the incidence of occupational contact dermatitis and urticaria reduced by controlling exposure?

Reducing exposure has been shown to reduce the incidence of occupational contact urticaria, when substituting latex gloves by powder-free, low protein latex gloves (NHS Plus 2008), and occupational contact dermatitis by adding ferrous sulphate to cement in place of chromate (Avnstorp 1989a, Roto 1996).

B1 ** SIGN 2+ Substitution reduces the incidence of occupational contact dermatitis and urticaria.
(Avnstorp 1989a, NHS Plus 2008, Roto 1996)

Is the incidence of occupational contact dermatitis and urticaria reduced by personal protective equipment?

PPE is the last measure to be considered in the hierarchy of control measures. PPE only offers protection when selected correctly, worn properly, removed safely and either replaced or maintained regularly. Some PPE, notably latex gloves, can cause occupational contact dermatitis and urticaria (NHS Plus 2008). Studies on using gloves to prevent the development of occupational contact dermatitis and urticaria are limited. Two studies have demonstrated that wearing occlusive gloves reduces the incidence of irritant contact dermatitis, whereas one has not shown such a relationship (Sprince 1996). The benefits were not exclusively attributable to wearing gloves because they were only one part of more comprehensive prevention strategies (Goh 1993, Loffler 2006). These included reduction of exposure, either by substitution or altered work patterns, education, glove use and skin care/protection programmes.

B2 ** SIGN 1+ Limited wearing of gloves can help to reduce the incidence of irritant occupational contact dermatitis when coupled with other preventive measures.
(Goh 1993, Loffler 2006)

A recent systematic review (Saary 2005) addressed PPE and found only one study. This showed that when gloves were worn overnight they impaired skin barrier function, but that this effect was prevented by the use of cotton liners. The study authors recommended that gloves are used for as short a time as possible and that cotton liners are used under occlusive gloves to reduce the risk of skin barrier impairment.

B3 * SIGN 1+ Wearing cotton glove liners can prevent the development of impaired skin barrier function that can be caused by prolonged wearing of occlusive gloves.
(Saary 2005)

Do pre-work creams help prevent the development of occupational contact dermatitis and urticaria?

There are two important aspects to the effectiveness of pre-work creams; the efficacy of the cream and the effectiveness of application. Pre-work creams are often referred to as barrier creams. The latter term gives

rise to a false perception that these creams form a physical barrier to protect the skin. A systematic review revealed that there is mixed evidence for the effectiveness of pre-work creams (Saary 2005). While some are effective in preventing irritant contact dermatitis, there are limitations in the extent to which this finding can be generalised. One study found evidence that pre-work creams containing aluminium chlorohydrate were ineffective. There was some evidence certain creams can protect against allergic contact dermatitis for specific allergens, but again, these findings cannot be generalised. Three studies explored the use of pre-work creams as a preventative measure against specific agents (epoxy resins, glass fibres, sodium lauryl sulphate and toluene) and found that they offered no or very limited protection (Bendsoe 1987, Elsner 2007, Krajewska 1976). A randomised controlled trial of workers in the building and timber trades found no clinical evidence that pre-work creams alone prevent dermatitis, although such creams in combination with cleansing and after-work creams were effective in improving skin condition, measured by trans-epidermal water loss (Winker 2009). A systematic review of latex allergy concluded that prior use of protective hand creams can not be recommended for people who wear latex gloves and found some indication, albeit based on one small non-randomised study, that such creams may favour the uptake of allergens from gloves (NHS Plus 2008).

B4 *** 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 preventative measure.

(Saary 2005, Winker 2009)

Does the regular application of emollients (e.g. after hand washing) help prevent the development of occupational contact dermatitis and urticaria?

Emollients are skin lotions, creams or ointments that are intended to moisturise the skin and replace lipids that are an important component of the barrier function of healthy skin. Studies have demonstrated the beneficial effects of the regular application of moisturisers (Arbogast 2004, Saary 2005, Winker 2009). However, the available evidence does not address issues such as the optimum timing and frequency of application.

B5 *** SIGN 1++ The regular application of emollients helps to prevent the development of occupational contact dermatitis.

(Arbogast 2004, Saary 2005)

Does health surveillance prevent occupational contact dermatitis and urticaria?

Periodic health surveillance for occupational contact dermatitis and urticaria aims to identify cases at early and reversible stages of disease. There is no direct evidence base, derived from studies in working populations, to address the question of the effectiveness of health surveillance in the early detection of occupational contact dermatitis or urticaria, or the comparative effectiveness of different screening methods (NHS Plus 2009).

Do education and training programmes help prevent the development of occupational contact dermatitis and urticaria?

A recent systematic review of latex allergies reported that appropriately targeted and sustained educational interventions induce important behavioural changes in latex glove use, based on four studies (NHS Plus 2008). Some studies exist identifying the benefits of education and training programmes in the reduction of occupational contact dermatitis (Flyvholm 2005, Sell 2005, van der Walle 1994).

B6 ** SIGN 2+ Appropriately targeted and sustained educational intervention induce important behavioural changes.

(NHS Plus 2008)

C. Evaluation of the worker presenting with skin problems

Care must be taken to distinguish between occupational and non-occupational contact dermatitis and endogenous eczema, and between irritant and allergic occupational contact dermatitis, since the occupational management of the individual patient will differ.

Much of the evidence relating to the diagnosis of contact dermatitis and urticaria emanates from specialist settings and is derived from series of patients with contact dermatitis and urticaria of both occupational and non-occupational causes. The tests used to investigate suspected cases within dermatology clinics (patch tests and skin prick tests) are the same, irrespective of the suspected cause. Hence these tests are not included within this review of occupational contact dermatitis and urticaria. Practitioners should refer to guidelines for the care of contact dermatitis and urticaria for details of these tests.

How are the diagnoses of occupational contact dermatitis and urticaria made?

Confirming diagnoses of occupational contact dermatitis and urticaria is an iterative process. Skill is needed in taking an occupational history. Differences in distribution of the rash only raise suspicion of an occupational cause. While the hands and thereafter the arms and face are most commonly affected by occupational contact dermatitis and urticaria (see page 14) such distributions are not confined to occupational disease and only help to inform the diagnosis. Similarly symptoms improving away from work can produce false positive diagnoses, so further validation of occupational contact dermatitis and urticaria is needed. The diagnosis is made most easily before exposures or treatments are modified, so that the rash may be observed.

Skin prick tests or blood tests for specific IgE are available for investigating contact urticaria for most high molecular weight allergens, and a few low molecular weight agents but there are few standardised allergens available commercially and this limits their use.

A wide range of standardised contact allergens (usually of low molecular weight) are available commercially for patch testing. However, a positive test denotes sensitisation and this can occur with or without disease.

The work-relatedness of symptoms and signs are the best guide to whether contact dermatitis or urticaria is aggravated or caused by work (van Wendel de Joode 2007). However, pre-existing dermatitis can be aggravated by exposures at work (van Wendel de Joode 2007). Dermatitis can develop a chronic state where the work-relatedness becomes less obvious (see page 18).

C1 * SIGN 2+ A temporal relationship between symptoms and work indicates that a person's job has either contributed to or caused their occupational contact dermatitis or urticaria.
(van Wendel de Joode 2007)

C2 * SIGN 2+ The diagnosis of occupational contact dermatitis and urticaria are made by fastidious history taking, clinical examination, patch testing and prick testing.
(Freeman 1991, Prah 1979, Usmani N 2007, van Wendel de Joode 2007)

One study revealed that 37% of patients presented to a dermatologist within one year of developing symptoms, while 28% had symptoms for more than five years before presentation and that the presence of symptoms for more than one year before diagnosis of allergic contact dermatitis caused by chromates significantly predicted chronicity (Halbert 1992). Further research is indicated to investigate the causes of delays to diagnosis and the impact that delays have on disease outcome, particularly in the case of allergic contact dermatitis. Such research will help determine the optimum timing of referrals for specialist investigation.

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

What is the prognosis of occupational contact dermatitis and urticaria?

Information about prognosis in occupational contact dermatitis comes mainly from studies that have followed up patient populations from dermatology clinics or compensation schemes (Cvetkovski 2005, 2006, Doms-Goossens 1980, Holness 1995, Kalimo 1999, Keogh 2006) or from cohorts of workers in specific occupational settings (Avnstorp 1989b, Estlander 1988, Goh 1985, Johnson 1971, Shah 1998, Soder 2007). Among the former, numbers tend to be larger and follow-up intervals longer (up to 13 years after diagnosis). There is little if any evidence related to the prognosis of occupational contact urticaria.

Similar proportions of patients with occupational contact dermatitis report either improvement / complete resolution (41-100%) (Cahill 2005, Cvetkovski 2006, Goh 1985, Holness 1995, Johnson 1971) or ongoing symptoms (44 to 89%) (Cahill 2005, Cvetkovski 2005, Cvetkovski 2006, Doms-Goossens 1980, Guo 1994, Halbert 1992, Holness 1995, Kalimo 1999, Krajewska 1976, Nethercott 1988, Rademaker 2000, Soder 2007). As many as about one in ten patients continue to have symptoms in the very long term, even after removal from exposure (persistent or post-occupational contact dermatitis) (Keogh 2006, Lazarov 2006, Lips 1996, Sajjachareonpong 2004).

A few studies have investigated the risk factors for poor prognosis. Lack of clinical or functional improvement was related to male gender (Holness 1995, Soder 2007), severity (Cvetkovski 2006), and atopy (Cvetkovski 2005, Johnson 1971, Susitaival 1995), but findings for atopy (Halbert 1992) and other factors including age have been inconsistent.

D1 *** SIGN 2++ A significant proportion of workers with occupational contact dermatitis continue to have active symptoms and impairment of function years after diagnosis, even despite treatment and change of job.

(Avnstorp 1989b, Cahill 2005, Cvetkovski 2005, Cvetkovski 2006, Doms-Goossens 1980, Guo 1994, Halbert 1992, Holness 1995, Johnson 1971, Kalimo 1999, Keogh 2006, Krajewska 1976, Lazarov 2006, Lips 1996, Nethercott 1988, Rademaker 2000, Sajjachareonpong 2004, Soder 2007)

D2 *** SIGN 2+ The prognosis appears to vary widely and, in some occupational settings, reasonable control of symptoms and job retention is possible.

(Cahill 2005, Cvetkovski 2006, Goh 1985, Holness 1995, Keogh 2006, Johnson 1971)

What is the impact of occupational contact dermatitis or urticaria on the worker, including e.g. work life, personal life and employment?

Studies that address the impact of occupational contact dermatitis have looked at a variety of outcomes including quality of life or daily function/activities, relationships at home, sickness absence, loss or change of employment, need to access medical services, financial loss and award of compensation or benefits. Virtually no information was available on the impact of occupational urticaria on the worker.

Many people with occupational contact dermatitis (18-46%) report impaired quality of life, daily function, leisure activities or relationships at home (Cvetkovski 2006, Holness 1995, Lazarov 2005, Lazarov 2006, Rabin 2007). Absence from work is common among workers with occupational contact dermatitis (6-52%) (Adishes 2002, Fischer 1996, Halbert 1992, Holness 2004, Lazarov 2005, Lazarov 2006, Shah 1998, Soder 2007) and sickness absence can last for many months or even years (Halbert 1992).

Complete change of job or retirement is also reported commonly. A variable proportion of between 6 and 80% of people with occupational contact dermatitis have to change jobs or stop working with the agent(s) that

caused their disease (Cahill 2005, Cvetkovski 2006, Halbert 1992, Holm 1994, Krajewska 1976, Lazarov 2005, Lazarov 2006, Lips 1996, Nethercott 1988, Rystedt 1985). Between 9 and 33% retire completely or are unemployed (Holness 2004, Lazarov 2006, Lips 1996, Soder 2007). However, most patients (up to 78%) manage to continue working in some capacity (Holness 1995, Lazarov 2006), either in the same (19 to 83%) (Estlander 1988, Fischer 1983, Holness 2004, Halbert 1992, Shah 1998) or another job (23 to 30%) (Fischer 1983, Soder 2007). 7 to 44% experience significant loss of income (Halbert 1992, Lazarov 2005, Lips 1996) and 41 to 60% receive some form of financial compensation (Cahill 2005, Lazarov 2006).

D3 ** SIGN 2+ Up to half of workers with occupational contact dermatitis experience adverse effects on quality of life, daily function and relationships at home.
(Cvetkovski 2006, Lazarov 2005, Lazarov 2006, Hutchings 2001, Rabin 2007).

D4 *** SIGN 2+ Up to half of workers with occupational contact dermatitis have time off work on sick leave due to their symptoms.
(Adishes 2002, Fischer 1996, Halbert 1992, Holness 2004, Lazarov 2005, Lazarov 2006, Shah 1998, Soder 2007)

D5 *** SIGN 2++ Loss of job or complete change of employment due to their skin disease is common among employees with occupational contact dermatitis.
(Cahill 2005, Cvetkovski 2006, Halbert 1992, Holm 1994, Holness 2004, Krajewska 1976, Lazarov 2005, Lazarov 2006, Lips 1996, Nethercott 1988, Rystedt 1985, Soder 2007).

D6 *** SIGN 2++ The majority of people with occupational contact dermatitis manage to continue working in some capacity, albeit sometimes in altered employment.
(Lazarov 2006, Estlander 1988, Fischer 1983, Holness 1995, Holness 2004, Halbert 1992, Shah 1998, Soder 2007)

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

Few high quality studies address the question of whether a worker who has developed occupational contact dermatitis or urticaria can remain in their original employment. There is also a tendency for studies to concentrate on avoidance of the cause, rather than measures to allow the individual to continue working with the agent that caused their disease. Some of the available evidence is contradictory, which may indicate that allergens and irritants should be considered individually. Numerous interventions have been evaluated.

Many studies do not specify which changes to the work practice were made, so it is difficult to compare them. Changes (such as the rapid changing of contaminated clothing) enabled an unspecified number to continue working, although this was in a very particular occupational setting (Fischer 1996). Similarly, the use of disposable towels rather than contaminated rags reduced irritant dermatitis in another occupational setting (Goh 1993). The use of fabric softeners in work clothing can reduce irritant dermatitis (Saary 2005). Unspecified changes in work practice conveyed no benefit in a large case series (Adisesh 2002).

Does avoidance of exposure lead to improvement or recovery?

There is evidence that continued exposure to the agent causing the skin disease causes ongoing symptoms (Cahill 2005). Avoidance of relevant irritants and allergens can be effective in improving or resolving the dermatitis (Goh 1985, Rystedt 1985, Stingeni 1995). However, persistent dermatitis may be observed despite adequate allergen/irritant avoidance, even when the avoidance takes place over years. This phenomenon is particularly marked for allergic contact dermatitis to chromate and other metal salts (Dooms Goossens 1980, Shah 1998). Therefore, 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 three studies that showed that a change from powdered to powder free latex gloves was associated with significantly reduced occupational contact dermatitis and urticaria (NHS Plus 2008).

E1 *** SIGN 2+ Avoidance of further exposure can lead to recovery from occupational contact dermatitis and urticaria in a number of patients, particularly with natural rubber latex.

(NHS Plus 2008)

E2 * 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.

(Dooms Goossens 1980, Goh 1985, Rystedt 1985, Shah 1998, Stingeni 1995)

What evidence is there for benefit of redeployment, workplace modification and use of personal protective equipment?

There is little evidence to address this question. Most studies of interventions in the workplace do not focus on employees with existing dermatitis, so are more orientated towards exploring prevention than treatment. Among the few studies that investigated redeployment or workplace changes, most are small and none had appropriate comparison groups. In one large study and one small case series of occupational contact dermatitis, advice about work practices, personal protective equipment or job changes appeared to make no difference to clinical improvement (Adisesh 2002, Baack 1996). Conversely, six small case series in specific occupational settings found a positive outcome in workers with occupational contact dermatitis or urticaria from redeployment (Kiec-Swerczynska 2005), the introduction of exposure controls (Nethercott 1984, Pedersen 1982), or the use of gloves or protective clothing (Goh 1985, Goh 1993, Nethercott 1984). Evidence of a beneficial effect of personal protective equipment is contradictory. The use of gloves reduces dermatitis, enabling

workers to continue in the same occupation (Fischer 1996, Goh 1985, Goh 1993, Stingeni 1995). Glove use can worsen irritant hand dermatitis, although the use of cotton lined gloves may mitigate this (Saary 2005).

E3 * 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 urticaria in some workers, but is not always effective.

(Adisesh 2002, Baack 1996, Kiec-Swerczynska 2005, Nethercott 1984, Pedersen 1982)

E4 * 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.

(Fischer 1996, Goh 1985, Goh1993, Nethercott 1984, Stingeni 1995)

Do educational programmes enable a worker who develops occupational contact dermatitis or urticaria to remain in employment?

Several educational programmes have been reported i.e. verbal or written advice or formal nurse-led training over a number of occasions. The outcome of these different interventions varies, some having no demonstrable effect (Adisesh 2002). Individuals demonstrating knowledge of their diagnosis and its causes have less dermatitis and are more likely to show improvement than those who are not informed (Holness 1991). Significantly better outcomes have been reported with nurse-led education programmes for irritant occupational contact dermatitis (Kalimo 1999).

E5 * SIGN 2+ Educating and informing workers with occupational contact dermatitis about their diagnosis, its causes and the measures they should take can enable the worker to continue using the agent that caused their disease and improves outcome.

(Holness 1991, Kalimo 1999)

Does attention to good hand care improve the prognosis of occupational contact dermatitis?

Some studies show a benefit of up to 23% for the prophylactic use of emollients in irritant dermatitis (Graham 2005). A recent systematic review reported that there is only a very small body of consistent evidence from two small studies that conditioning creams improve skin condition in workers with damaged skin. The review also reported that two small studies found that pre-work (barrier) creams did not improve clinical indicators of skin condition (NHS Plus 2009).

E6 *** SIGN 1++ Conditioning creams improve skin condition in workers with damaged skin.

(Graham 2005, NHS Plus 2009)

E7 *** SIGN 1++ Pre-work creams do not improve skin condition in workers with damaged skin.

(NHS Plus 2009)

EVIDENCE TABLES

ABBREVIATIONS

ACD = allergic contact dermatitis AD = atopic dermatitis CD = contact dermatitis CU = contact urticaria HCW = healthcare workers HD = hand dermatitis ICD = irritant contact dermatitis
 OACD = occupational allergic contact dermatitis OCD = occupational contact dermatitis OICD = occupational irritant contact dermatitis OSD = occupational skin disease

EVIDENCE TABLE A

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Alanko K, et al	2004	Dental nurses	799	Cross sectional	2+	Out of 923 female dental nurses, 799 were interviewed using a computer-assisted structured telephone questionnaire to inquire about skin, respiratory symptoms, atopy, work history and methods, and exposure at work. 328 nurses, who reported OCD on their hands, forearms or face, were invited to an interview by an occupational physician; 245 nurses participated. Of these, 31 nurses had previously been diagnosed as having an OSD. 133 nurses with a suspected undiagnosed OSD were selected for further clinical examinations with prick and patch testing; 107 (80%) attended these examinations. HD was the main symptom in all. Those who reported never having had atopic skin or respiratory symptoms reported significantly less hand or forearm dermatoses, when compared to atopics ($P < 0.001$). 1/5 of dental nurses had had facial dermatitis, which in about 1/3 was reported as work-related. The frequency of facial dermatoses was also significantly associated with atopy ($P < 0.001$).
Ashworth J, et al	1993	Warehouse	98	Cross sectional	2+	14/98 workers developed HD due to hand washing 10-15 times/day, as they perceived parts from overseas to be "dirty". Others washed hands as frequently, but did not get HD. Atopy and family history was not a risk factor for ICD caused by over-washing the hands. Atopy and family history of atopy were more prevalent among workers without a skin problem.
Avnstorp C	1989a	Cement manufacture	196 & 229	Cross sectional	2++	This is a study of the prevalence of chromate allergy and HD among workers engaged in the manufacture of pre-fabricated concrete building components in Denmark in 1981 and again in 1987. In September 1981 the chromate content of cement manufactured and sold in Denmark was reduced to not more than 2 parts per million of water-soluble chromate. This was accomplished by adding ferrous sulphate, thus increasing the cost of the cement by about 1%. There was a statistically significant decrease in the prevalence of chromate allergy and HD following the addition of ferrous sulphate, but there was no change in the frequency of skin irritation. The economic benefit of adding ferrous sulphate was demonstrated by a decrease in the need for dermatological services and topical steroid treatment. Cement eczema as a result of chromate allergy is a common occupational dermatitis among workers in the building and construction industries and a reduction in the chromate content of cement would appear to be a reasonable preventive measure in areas where there is a large concentration of construction industries.

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Bauer A, et al	2001	Food industry	91	Cohort	2+	Apprentices were interviewed and examined on starting vocational training and follow-up interviews were done at 6 months (n = 79), 12 months (n = 63) and the end of the training (n = 69) at 36 months. 3.3% (n = 3) reported previous HD in childhood and adolescence. The first assessment revealed HD in 17.5% (n = 16). After 6 months, point prevalence of HD was 29.1% (n = 23), after 12 months 27.0% (n = 17) and after 36 months 27.5% (n = 19). Mild to moderate ICD was the most frequent finding. An atopic skin diathesis (> 10 points, "atopy score") (OR = 4.89; CI 95% 1.15-20.79), previous HD (OR = 41.1; CI 95% 4.99-339.) as well as flexural dermatitis (OR = 6.8; CI 95% 1.72-27.22) were predictive factors for the development of HD. No association was found to respiratory atopy (OR = 1.29; CI 95% 0.35-4.7). Wet work showed only a tendency for being a risk factor for HD. Leisure activities, especially house building and rebuilding (OR = 5.4; CI 95% 1.05-27.81), were associated with elevated risk.
Behrens V, et al	1994	Various	30074	Cross sectional	2+	National prevalence estimates of self-reported conditions among working people were calculated from data collected for the 1988 Occupational Health Supplement to the National Health Interview Survey. One person 18 years or older was selected randomly from each family in each sample household and interviewed in person. The prevalence of dermatitis among the sample was 11.2%, CD was 2.8% and OCD was 1.7%. The highest prevalence estimates for OCD were among physicians, dentists, nurses, pharmacists, and dieticians at 5.6%, personal services 4.9%, health assistants and technicians 3.5%, vehicle / equipment/ machinery mechanics 3.5%, machine operators 3.2%, craft and precision production 3.1%, food preparers 2.8%, constructions workers 2.6% and cleaners and facilities management 2.4%.
Berndt U, et al	1999	Metal-working	201	Cohort	2++	This study was performed as part of the Swiss Prospective Metal Worker Eczema Study to examine the role of atopy as a possible risk factor for the development of HD in trainee metal workers. In a cohort of young men without any skin problems at the start of their apprenticeship, 9.5% developed HD within 6 months. The 2.5-year incidence was 23%. There was no significantly increased risk for HD in participants with an atopic skin diathesis according to the atopy score of Diepgen. Analysis of individual atopic signs and symptoms showed metal reactivity to have a significant influence on the onset of early skin damage within 6 months, whereas a history of flexural eczema was significantly related to the overall incidence over 2.5 years.
Burnett CA, et al	1998	Various	8835	Cross sectional	2++	The annual survey of occupational injuries and illnesses from the Bureau of Labour Statistics collects employer reports on OSD. OCD accounted for 70% of all cases of OSD, while urticaria and hives accounted for 1.1%. The largest number of cases was in health services, the highest rate in agricultural crops and the largest number of cases in non-construction labourers (followed by nursing attendants, gardeners and machine operators). Cleaning/polishing agents caused the largest number of cases. Other causes include plants, chemicals, clothing and shoes, petroleum products, solvents and degreasers. Hands and fingers were most commonly affected in about 34% of cases.
Chen Y, et al	2005	Various	640	Surveillance scheme	2++	241 physicians in the UK reporting scheme THOR were based in Scotland. UK Labour Force Survey provided denominator data. 4043 estimated cases were reported from Scotland, OSDs making up 16%. CD accounted for 83% of all cases of OSD (76% in the rest of the UK) and CU 6% of cases (3% for the rest of the UK). 2/3 of CD were allergic or mixed allergic and irritant. The crude incidence rate for Scotland was 11.3/100,000 (10.6/100,000 for the rest of the UK). The crude incidence rate for CU was 8/1,000,000 (4/1,000,000 for the rest of the UK). Highest risk for OCD seen for hairdressers and beauticians (86.4/100,000). Also high for food and beverage production (30.1/100,000) and in health and social work (21.2/100,000).
Conde-Salazar L, et al	1995	Construction	449	Case series	3	90.8% were patch tested, because of cutaneous lesions or a history suggestive of OCD. 65.5% (268) of those patch tested showed one or more reactions connected with work. Chromate at 42.1% was the main allergen, followed by cobalt, 20.5%, nickel, 10%, and epoxy resin, 7.5%. 25.9% (106) of patients showed sensitization to rubber components. Only 5% developed the onset of symptoms within the first year of employment, 31% developed symptoms after 2-10 years in the job and the remainder developed symptoms later. The hands were affected most often in 60% of cases (n=270).

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
de Boer EM, et al	1989	Metalworking	286	Case series	3	31% of subjects had mild changes e.g. erythema, dry skin and 27% had serious widespread dermatitis. Most were ICD; ACD accounting for only 2.8%. Exposure to water-based metal working fluid caused dermatitis more often than neat oils. Atopy was not a risk factor for MWF ICD, but a tendency towards ICD was higher.
Dickel H, et al	2002a	Various	336	Reporting scheme	2++	A register of OSDs was implemented in 1999 in the Saarland. This register study analysed all initial reports from July 1999 to June 2001. In 78% (n = 263) of the cases an occupational cause for the skin disease was stated. Equivalent to 6.8 cases/10,000 workers/year within these occupational groups. The most frequent final diagnosis was ICD (75%) followed by ACD (34%) and AD (19%). Work-related delayed-type sensitisations to potassium dichromate (n = 8) and immediate-type sensitisations to natural rubber latex (n = 11) were most frequently seen. Questionnaire results showed frequent occupational skin contact with wet work (59%), detergents (48%), and disinfectants (38%). High-risk occupational groups were hairdressers and personal hygiene workers (48.2/100,000/year), bakers and pastry cooks (32.7/100,000/year), cooks and food preparation workers (18.7/100,000/year) cleaners (13.9/100,000/year) and nurses and physician assistants (12.6/100,000/year).
Dickel H, et al	2002b	Various	3097	Reporting scheme	2++	The study analysed data from workers' compensation claims reported to a register of OSDs in Northern Bavaria. From 1990 to 1999, 5285 patients had their cases assessed and recorded by government-employed physicians, 3730 had a confirmed occupational causation. The incidence rates of CD were calculated in 24 occupational groups in which there were a known total number of employees. In these groups, 3097 (59%) patients with OSD were observed, with an overall annual incidence rate of 4.5/10,000 workers for ICD, compared with 4.1/10,000 workers for ACD. The highest ICD incidences were in hairdressers (46.9/10,000/year), bakers (23.5/10,000/year), and pastry cooks (16.9/10,000 /year). ICD was the main diagnosis in pastry cooks (76%), cooks (69%), food processing industry workers and butchers (63%), mechanics (60%), and locksmiths and automobile mechanics (59%). The questionnaire showed frequent contact with detergents (52%), disinfectants (24%) and acidic and alkaline chemicals (24%) in the workplace.
Dickel H, et al	2003	Various	3730	Reporting scheme	2++	Analyzed data in the register of OSDs (mainly HD) in northern Bavaria from 1990 to 1999. The main outcome measure was the attributable risk of atopic skin diathesis (ASD) on OSD within 24 occupational groups. 1366/3730 workers with an OSD (37%) presented an ASD. The authors assumed a prevalence of ASD in the total population of 20% based on others studies. The authors predicted that 21.6% (95% confidence interval 19.4; 23.7) of OSD cases within these 24 groups may be ascribed to this endogenous risk factor. 872/2068 (64%) of workers with ICD had an ASD compared to 613/1924 (45%) of workers with ACD.
Filon FL, et al	2006	Healthcare	1040	Cross sectional	2++	During 1997–99 the authors evaluated 1040 HCWs exposed to latex allergen for symptoms and sensitisation by means of a questionnaire, medical examination, skin prick tests, and IgE specific antibody assay. Glove related symptoms were present in 227 workers (21.8%). Commonest symptoms were erythema and itching (181 subjects, 17.4%) while 26 (2.5%) had OCD related to glove use. CU was observed in 38 subjects (3.6%). Symptoms were significantly related to skin prick tests positive to latex (OR = 9.70; 95% CI 5.5 to 17) and to personal atopy (OR = 2.29; 95% CI 1.6 to 3.2). There was a significant association with glove related symptoms and duration of glove use at work; the workplaces with the highest prevalence of symptoms were operating theatres (33.5%), and the laboratory / haemodialysis ward (25.4%) There was a significant association with a positive history of atopic disease (OR = 2.29; 95% CI 1.6 to 3.2), with family atopy (OR = 1.85; 95% CI 1.3 to 2.7), with skin prick test positivity to common inhalant allergens (OR = 1.3, 95% CI 1.0 to 1.8), and with skin prick tests positive to latex (OR = 9.7; 95% CI 5.5 to 17). The Mantel-Haenzel ORs for association of symptoms and latex SPT status adjusted for atopic status as defined by prick test confirm the strong association between latex sensitisation and glove related symptoms, higher for CU (OR=46;95% CI 17 to 128) and lower for itching / erythema (OR 4.5;95% CI 2.5 to 8).
Funke U, et al	2001	Car manufacture	2078	Cohort	2+	1 year incidence of HD in apprentices 8.6%; 3 year incidence 14.1%. Within the first 6 months, incidence of HD was high, and then declined.

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Goon ATJ, et al	2000	Various	965	Case series	3	Patients diagnosed with OSD in the National Skin Centre, Singapore, from 1989 to1998 were studied retrospectively. ICD (61.2%) was more common than ACD (36.0%). The major sources of occupational dermatitis in Singapore were the metal/engineering, building/construction, electrical/electronics and transport industries. The main irritants were detergents/wet work, solvent and oil/grease and coolants. The main allergens were chromate, rubber chemicals, nickel, resins and food. There were 23 cases of CU, 20 due to food.
Hansen KS	1983	Hospital cleaners	541	Cross sectional	2+	Patch tests used standard ICDRG series and additional allergens associated with work. Rubber gloves were also patch tested. 21% subjects had allergic dermatitis and 75% irritant dermatitis. ACD was linked with formaldehyde, glutaraldehyde, chloramine, nickel and rubber. Detergents, alkali substances, acids and sodium perbromate and hypochlorite substances were among those that caused irritant CD. Younger subjects had greater prevalence: 50% occurrence within first 6 months of work.
Hansen KS, et al	1989	Abattoir workers	144	Cross sectional	2+	Protein contact dermatitis, described as "gut eczema" or "fat eczema" by slaughterhouse workers, was first described a decade ago and presents as an itching, vesicular eczema on the hands and fingers, a few hours after contact with animal material, especially gut material. In a cross-sectional study of 144 slaughterhouse workers, a cumulative prevalence of current and anamnestic cases of protein contact dermatitis of 22% was found, with the highest prevalence in workers eviscerating and cleansing gut. The scratch patch test was the only skin test showing positive results in workers with protein contact dermatitis, positive reactions being found, however, in less than half the cases. No clear relationship between atopic predisposition and different types of eczema was seen.
Helaskoski E, et al	2009	Various	21	Case series	3	We describe 21 patients diagnosed with OCU at the Finnish Institute of Occupational Health during 1990-2006. The majority of the patients worked in the manufacture of electrical machines and were exposed to an epoxy hardener containing methyl hexahydrophthalic anhydride. Phthalic anhydride IgE was determined in 20 patients and was found positive in 19 patients. OCU may be more common than previously believed.
Ho CH, et al	2006	Various	716	Case series	3	Subjects with HD were recruited from patients referred to a dermatology department between 1983 and 2002 and had standardised interview and patch testing. 343/716 cases (48%) of HD were related to occupation. Builders, electronics workers, office workers, housewives, hairdressers and healthcare professionals were the commonest occupations. Allergic dermatitis occurred in 38.2% and irritant dermatitis due to chemicals in 19.4%. The incidence of AD was very low (1.97% in males and 2.67% in females).
Kanerva L, et al	1994	Various	558	Reporting scheme	2++	In Finland reporting of occupational diseases is obligatory. This report analyses the 1314 cases of occupational allergic disease reported in 1991 (14.2% of all registered occupational diseases). Allergic OSDs were ACD (412 cases, incidence 17.6/100,000) and CU/protein CD (146 cases, incidence 6.2/100,000). Women were over represented for ACD (247 women/165 men), and CU/protein CD (109 women/37 men). The commonest causes of ACD were rubber chemicals (86), nickel and its derivatives (38), epoxy resins (28) and formaldehyde (23). The commonest occupations reported were cleaners (28), hairdressers and beauticians (25), machine repairers (14) and electrical equipment collectors (14). The commonest causes of allergic CU and protein CD were cow epithelium (70), natural rubber latex (25) and flours. Commonest occupations with CU were farmers (65) and bakers and confectioners (14).

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Kanerva L, et al	1996	Various	2759	Reporting scheme	2++	Data on occupational CU (protein CD included) in Finland during 1990-1994. Of 2759 cases of OACD, (815) 29.5% were CU and 70.5% ACD. Occupational CU was commoner in women (70%) than in men (30%). The 6 commonest causes of CU were (1) cow dander (362 = 44.4%), (2) natural rubber latex (193 = 23.7%), (3) flour, grains and feed (92 = 11.3%), (4) handling foodstuffs (25 = 3.1%), (5) industrial enzymes (14 = 1.7%) and (6) decorative plants (13 = 1.6%). The ranking list of the commonest occupations with occupational CU per 100,000 employed workers was: (1) bakers, (2) preparers of processed food, (3) dental assistants, (4) veterinary surgeons, (5) domestic animal attendants, (6) farmers and silviculturalists, (7) chefs, cooks and cold buffet managers, (8) dairy workers, (9) horticultural supervisors, (10) laboratory technicians and radiographers, (11) physicians, (12) butchers and sausage makers, (13) laboratory assistants, (14) dentists and (15) nurses (21.2 cases per 100,000 employed person). Low-molecular-weight chemicals caused very few cases of occupational CU, the commonest being 2-ethylhexyl acrylate (5 cases).
Kaufman JD, et al	1998	Various	5657	Reporting scheme	2+	Compensation claims for OSD were analysed for 1989-1993. Highest incidences of accepted claims were in manufacturing industries, wholesale farm product raw materials, automotive glass replacement, and beauty shops. 70% of employers with the highest incidences used fibre-reinforced plastics and exposed workers to epoxy and other resin systems associated with CD. The commonest types of exposure were soap / detergent, solvent / degreaser, plants and apparel, including gloves.
Keil JE, et al	1983	Various	958	Compensation register	2+	Authors analysed compensation claims for South Carolina from 1/7/1978 – 30/6/1979. 958 workers claimed for skin disease, 93.8% were diagnosed as OCD. The average incidence for all industries was 10.8/10,000. CD due to oils (8.1%), solvents (11.1%) and other chemicals accounted for 42.7% of cases. Plants were reported in 14.3% of cases, detergents 5.7%, foods 1.9%, drugs 0.2% and other unspecified substances 11.2%. Three industries had incidences more than double the average; these were transportation equipment (26.3%), machinery (22.8%) and furniture products (23.7%).
Kiec-Swierczynska M, et al	1996	Various	332	Case series	3	Analysis of data on OACD amongst patients seen at a Polish Institute for Occupational Medicine 1990 - 1994. Diagnosis was made on the basis of occupational history, clinical examination, patch testing and occupational exposure information. The highest frequencies were in HCWs (26%); metal working and machine-builders (20%) and construction workers (14%). Amongst females, the most frequent occupational groups were nurses (19%), laboratory assistants (17%), fitters (10%) and seamstresses (9%); and amongst males, fitters (26%), masons (19%), turners (12%), laminators (7%) and painters (6%). The most frequently detected occupational allergens were metals - mainly chromates, cobalt and nickel - (224 cases, 67%); disinfecting agents including formaldehyde (75 cases, 23%); epoxy resins (52 cases, 16%) and rubber (49 cases, 15%).
Krajewska D, et al	1976	Various	126	Case series	3	Study at 31 work sites in 8 factories at which 422 persons were employed. In 7 years there were 126 cases of dermatitis. Mean period between starting work and occurrence of dermatitis was 21.5 months, 18.5 months and 7.7 months for different resins or combinations of resins. First signs appeared mainly on the hands (56), less frequently hands and face (33) and face only (9).
Kucenic MJ, et al	2002	Various	135	Case series	3	Analysis of patch test data at a dermatology clinic from 1994-99. 537 patients underwent patch testing, 135 (25%) had OSD. ACD affected 81 (60%), and ICD was found in 46 (34%). HCWs, machinists, and construction workers accounted for nearly half of all patients with OSD. Nickel sulphate, glutaraldehyde, and thiuram mix were the commonest allergens.
Lachapelle JM, et al	1979	Various	400	Case series	3	400 patients (225 male, 175 female) with suspected OCD of the hands were referred to a clinic by doctors. All were patch tested. 49.2% had positive patch tests. Potassium dichromate and PPD involved more male patients. Nickel sulphate, thiuram mix and neomycin gave significantly greater responses in females.

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Lammintausta K, et al	1981	Hospital staff	586	Cross sectional	2++	The relation of different atopic symptoms to the occurrence of HD in employees who perform wet work in hospitals was studied in 204 cleaners, 197 assistant nurses, 102 nurses, 56 kitchen staff and 15 instrument nurses. Atopy was defined as previous or present AD, allergic rhinitis/conjunctivitis or asthma. The prevalence of atopy was 32% and the frequency of past or present HD 44%. HD occurred in about 65% of persons with atopic symptoms. Of the other workers only 33% had had skin problems. The presence of atopic symptoms significantly favoured the development of HD in these occupations ($p < 0.001$).
Lim YL, et al	2007	Various	125	Case series	3	In this 2-year retrospective epidemiologic study of OSD in Singapore, there were 125 patients with OCD. The mean age of patients was 33.8 years, with a male to female ratio of 5.3:1. ICD made up 62.4% of all cases, whereas ACD constituted 37.6%. Wet work/detergents, oil/grease and solvents remained the 3 commonest irritants. There was also a significant increase in representation of workers from the food/catering industry.
Lodi A, et al	2000	Various	160	Case series	3	The authors patch tested 1,565 out-patients affected by dermatitis. Among 838 patients examined 160 had CD. OICD (10.6%) was more frequent than OACD (8.4%). The hands were the commonest localization (94.4%). Commonest occupational groups were food handlers, builders, textile workers, employees, hairdressers, housewives, cleaners, hospital personnel, mechanics and metallurgists. In textile workers between 41 and 50, 100% of OACD was found 94.4% of dermatitis was found on hands. Also diffuse facial effects in construction workers and particularly on the eyelids in textile workers. OICD more common in bar workers and construction workers. OACD more common in hairdressers, textile workers, construction workers.
Majoie IM, et al	1996	Hairdressers	51	Cohort	2+	The development of HD was evaluated in an 8-year follow-up study carried out in junior hairdressers. Predisposing factors were investigated. Data were collected by use of a self-administered questionnaire: 74% response. None of the junior hairdressers presented with HD at the start of the survey. After 8 years, 51% had developed HD. Development of h was not related to atopic constitution or nickel sensitivity. Dry skin type was associated with increased risk of developing HD.
Mancuso G, et al	1990	Animal feed	204	Cross sectional	2+	During 1986-1988, 204 workers in 15 firms were studied. Workers were interviewed and patch tested with 34 allergens in the additives. 93 also consented to patch tests with ICDRG standard series. OCD prevalence was 13.7%, ICD 7.8%, ACD 5.8%. All involved the hands. The arms and face were involved occasionally. OCD was more frequent in patients with a personal history of atopy (20% v 12%). Increase in OCD was linked with duration of employment. This was statistically significant for those working for more than 10yrs.
McCall BP, et al.	2005	Various	611	Compensation register	2+	Retrospective analysis of workers' compensation claims from Oregon (1990-1997). All dermatitis-related workers' claims were merged with US census data to estimate rates of dermatitis by age, sex, occupation, and industry. All individuals with accepted dermatitis claims (N = 611) were included in the analyses. The average claim rate of occupational dermatitis was estimated to be 5.73/100 000 workers (95% confidence interval, 5.66-5.80). Those in farming/fishing/forestry and machine operators/assemblers had the highest rates. Employees in the farming, forestry, and fishing occupations and industries had significantly higher claim rates compared with employees in other occupations.
McDonald JC, et al	2006	Various	5289	Surveillance scheme	2++	Cases reported 1996-2001 to the EPIDERM and OPRA UK national surveillance schemes were analysed by causal agent, occupation and industry, with incidence rates calculated against appropriate denominators. Average annual incidence rates based on data from dermatologists were 97/million overall, 74 for CD and 4 for CU. The corresponding rates for occupational physicians were 623 overall, 510 for CD and 31 for CU. CD was most frequently attributed to rubber chemicals, soaps and cleaners, wet work, nickel and acrylics; most cases of CU were attributed to rubber chemicals or foods and flour. Rates of CD were highest among skilled workers in the petrochemical and rubber and plastic manufacturing industries, with machine operators and technical workers in metal and automotive industries also at increased risk.

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McMullen E, et al	2006	Various	2700	Case series	3	Over a 30-month period during which 2700 new patients were seen, frictional irritancy was identified as playing a role in the dermatosis in 31 cases: in 27 of these, case notes were evaluated for a range of parameters. Physical friction was identified as causing or contributing to dermatitis in 18 men and 9 women. The hands, usually the fingers of the dominant hand, were affected in all but 2 cases. Occupational frictional activities were found in 25 cases: commonly handling small metal components, paper, cardboard or fabric, and driving. Potential frictional activities in hobbies were noted in 12 cases. Wet work irritancy contributed in four cases (15%). Patch testing showed relevant contact allergies as cofactors in 7 of 25 subjects tested (26%). Psoriasis was a cofactor in 4 (15%), and AD in 11.
Meding B, et al	1990	Various	1081	Cross sectional	2++	A random sample of 20,000 people aged 20-65 yrs was drawn from the register of Gothenburg, representing 7.6% of that age group. The response rate was 82.9% (16,584). All individuals considering themselves to have HD during the previous 12 months were invited for dermatological examination. 1,238 patients with HD were offered patch testing. Results were available for 1,081 patients (87%). The 1 year period prevalence of HD in relation to employment was 11.8%. The most harmful exposures were unspecified chemicals, water and detergents. The commonest allergens were nickel, cobalt, fragrance mix, balsam of Peru and colophony. ICD was found more commonly among medical and nursing personnel.
Meding B, et al	1994	Car repair	801	Case referent	2++	In Gothenburg in 1990 all car mechanics were invited for a health check at an occupational health clinic. 801/901 responded. They were given a questionnaire on HD. All reporting problems together with 40 controls from the group not reporting problems were examined by a dermatologist and patch tested. CD was diagnosed in 85/120 reporting problems. The commonest diagnosis was ICD. 33% had ACD. 5% had a history of CU. Compared with the general population a smaller proportion admitted atopy (7% v 9%). Authors suggested that there are indications that atopics with HD avoid or leave the occupation.
Meyer JD, et al	2000	Various	18066 estimate	Surveillance scheme	2+	EPIDERM and OPRA schemes receive reports on incident cases from 244 dermatologists and 790 occupational physicians. The annual incidence of OCD from dermatologist reports was 6.4/100,000 workers and 6.5/100,000 from reports by occupational physicians, an overall rate of 12.9/100,000 workers. Manufacturing industries account for most cases reported to both schemes, with health care second. Dermatologists' reports indicated high rates of OCD in hairdressers and in agriculture. Apart from an increase in cases in nurses, the numbers and proportions of cases of CD within occupations remained constant over the 6-year reporting period. Agents accounting for the highest number of ACD cases were rubber (23.4% of allergic cases reported by dermatologists), nickel (18.2), epoxies and other resins (15.6), aromatic amines (8.6), chromium and chromates (8.1), fragrances and cosmetics (8.0), and preservatives (7.3). Soaps (22.0% of cases), wet work (19.8), petroleum products (8.7), solvents (8.0), and cutting oils and coolants (7.8) were the most frequently cited agents in cases of ICD. Over half the cases reported by dermatologists were thought to have an allergic component, compared with less than a third of those reported by occupational physicians.
Minamoto K, et al	2002	Glass reinforced plastics	29	Cross sectional	2+	Patch tests were carried out on 29 workers. Of the 22 workers who reported skin problems, 16 showed positive results to at least 1 chemical. Analysis based on a self-administered questionnaire and basic visual examination by a dermatologist. Prevalence of self-reported skin symptoms was 58.8%, mainly affecting the hands. 7 cases were diagnosed as ACD due to chemicals, 3 as ICD due to chemicals, and 3 as dermatitis due to mechanical irritation (MI) from glass fibre or dust, as well as 9 as ACD and/or MI. The median period from commencing work until onset was 3 months. History of allergic diseases and shorter duration of employment were risk factors for skin problems.

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Morris-Jones R, et al	2002	Various	392	Case series	3	Of patients who attended a Contact Dermatitis Clinic over a 20 year period, 392 were diagnosed with physical irritant CD (PICD). 335 files were analysed. PICD accounted for 1.15% of all patients attending the clinic over the study period. Diverse occupations and materials were implicated. Occupational exposures were responsible in the majority. Causes were friction (36%), low humidity (33%) and heating (11%).
Motolese A, et al	1993	Tile makers	190	Cross sectional	2+	Dermatitis was present in 22 workers (11.57%) whereas 44 (23.15%) claim to have had dermatitis in the past. The hands were involved in all cases and the forearms were involved in 5/66 cases.
Nettis E, et al	2002	Healthcare	360	Case series	3	Outcomes included patch tests, specific IgE and skin prick tests. Rash was commonest on the hands. Dermatitis was considered to be OCD in 63.6% of cases. The cause of dermatitis was allergic in 32.6% of all cases and irritant in 67.4% of cases. History of AD was found in 25/360 (6.9%) patients. It was more frequent among subjects with only ICD (21/218, 9.6%) than in subjects with only ACD (1/66, 1.5%) or with concomitant ICD & ACD (3/76, 3.9%) ($p < 0.05$). 53 (14.7%) had type I allergy to latex defined by history and positive IgE.
Nilsson, et al	1985	Healthcare	2452	Cohort	2+	By means of a multivariate regression analysis, authors studied the importance of atopy, "wet" and "dry" occupations, and domestic work as risk factors for HD. HD was identified by questionnaire. Median follow-up time 20 months. The total occurrence of HD in the 4 occupational groups studied were: nursing staff 41%, kitchen workers/cleaners 37%, office workers 25% and caretakers/craftsmen 17%. Atopic dermatitis increased the odds of developing HD by 3 times in wet as well as in dry work. Subjects with AD developed a more severe HD than subjects with atopic mucosal symptoms and non-atopics.
Pal TM, et al	2009	Various	4516	Reporting scheme	2++	Voluntary surveillance scheme in the Netherlands during 2001–05. 27 (7% of all) dermatologists participated for the whole period or a part of it. About 80% of cases were OCD, and 2% CU. Hairdressers were the commonest reported occupation followed by nurses, mechanics, metalworkers and cleaners. Other groups commonly affected included cooks, catering workers, horticulturists, florists, shop assistants and nail stylists. Irritant factors (wet work, irritating chemicals and mechanical factors) were by far the commonest reported causal agents. The most reported allergens were hairdresser's products, preservatives, rubber chemicals, plants, acrylates and latex. In 2001 the incidence of CD was 1.8/1000 workers. However, notifications declined over the 5 years, with an almost 50% decline in number of cases was observed. This decline was largely due to a steep fall from 2001 to 2002, presumed to be due to prevalent cases being detected in the first year of the scheme.
Perkins JB, et al	2005	Hairdressing	58	Cross sectional	2++	Postal survey (21.6% response rate) of UK salons. Trainee hairdressers reported increased risk of HD, (RR = 2.95, 95% CI = 1.13-7.66), as did those with < or =2 years in the profession (RR = 4.91, 95% CI = 1.09-22.22). There was a positive association between prevalence and frequent use of protective measures ($p = 0.04$), suggesting that use of protective measures may be a reaction to incidence rather than a precaution. Wet work was significantly associated with prevalence, and RR was increased in those who performed more frequent wet work, i.e., trainee hairdressers.
Rietschel RL, et al	2001	Various	839	Case series	3	839/2,889 patients referred for evaluation of CD had OCD. Of these 455 (54%) were ACD and 270 (32%) were ICD. 14% had other dermatitis, aggravated by work.
Roberts H, et al	2006	Hairdressing	377	Cross sectional	2+	193 trainee and 184 practising hairdressers completed a questionnaire and had their hands examined. Participants were asked about past or present atopy including eczema, asthma or hayfever (which occurred in 59.2%) and were correlated with a history of OSD. Almost 60% had experienced changes on their hands since commencing hairdressing, while 29% had evidence of abnormal skin on examination on the day of participation. Atopic individuals should be advised to care for and protect their skin from the outset to prevent the development of OCD. A past history of AD constituted a higher risk than asthma or hayfever.

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Rosen RH, et al	1992	Various	570	Case series	3	Data from patients at the Skin and Cancer Foundation demonstrated that hairdressing, food, construction and the medical industries were most at risk of OCD. ACD was responsible for 38.2% of cases. The main allergens were chromate, thiuram, epoxy resin, nickel and cobalt. There were 193 atopics of whom 132 (68.4%) suffered ICD and 61 (31.6%) suffered ACD. This compared to 51.6% of non-atopics suffering from ICD and 48.4% suffering from ACD.
Rystedt I	1985	Various	445	Case series	3	Patients attending an Occupational Dermatology Clinic for the first time were identified from medical records and sent a postal questionnaire up to 3 years later. 445 replied, of which 368 had HD at the time of the original consultation. 148 (40%) had changed occupation because of eczema at follow-up. Change of occupation was more common in those with a history of AD in childhood (with no other atopic features – asthma or rhinitis) than in non-atopics. Among atopics 13-17% healed after a change of job, compared to 34% healing after job change for non-atopics. There was no significant difference in rate of healing between those who changed jobs and those who remained in the same job. The data suggest that changing jobs did not necessarily improve OCD particularly among those with a history of AD.
Seidenari S, et al	1990	Various	139	Case series	3	HD affected 37% of subjects examined. Of 52 subjects with OCD, 37% had ACD and 63% irritant CD. 18 subjects were sensitized without showing any previous or present clinical symptoms. Atopy does not appear to affect the prevalence of sensitization, while it does seem possible to correlate it, albeit without statistical significance, to the incidence of dermatitis.
Serra-Baldrich E, et al	1995	Various	72	Case series	3	72/800 (9%) patients seen at a skin clinic had OSD. Main occupations were: metal workers 19 (26.3%), hairdressers 17 (23.6%), builders 14 (19.4%), bakery-pastry makers 5 (6.9%), rubber industry workers 3 (4.1%), chemical industry workers 3 (4.1%), electronics industry workers 3 (4.1%). Evolution period of OSD varied from 15 days to 30 years. A large proportion occurred in 1 to 6 months. The hands were affected (59 cases). Positive reactions to the allergens mainly to paraphenylenediamine (19.79%), nickel sulphate (16.66%), and potassium dichromate (15.62%).
Shiao JSC, et al	2004	Electronics	3070	Cross sectional	2+	302/3070 workers (9.8%) reported symptoms (itching with redness or scaling) compatible with OCD on hands. HD was associated with working in fabrication unit, personal history of atopy, metal allergy & job titles. Among those with reported HD 183 completed skin examination and patch testing, 65/183 (35.5%) were diagnosed as having ICD and 7/183 (3.8%) ACD.
Sirajuddin H, et al	2001	Various	108	Surveillance scheme	2+	Cases reported to an occupational reporting scheme in Malaysia during the year following a new reporting initiative. The commonest reported skin disease was contact dermatitis (87%). The most commonly reported causative agent was epoxy resins used in electronics and other manufacturing industries, with a smaller but substantial number due to oils and greases.
Slodownik D, et al	2006	Military	102	Case series	3	Medical records of recruits to the Israeli Military from 2000 to 2003 were reviewed. Cases of CD were assessed for job, atopy, and allergens. Of 102 cases, 60 had ICD and 42 had ACD, of which 33 (78.6%) were maintenance workers, mainly mechanics. Approximately 85% had only hand involvement. The median exposure before HD had occurred was 6.8 ± 0.35 months. 13 soldiers in the maintenance job category (39%) and 2 soldiers in the clerical group (22.2%) had atopic background. Atopy was found to be a risk factor for ACD when compared to the prevalence of atopy in the general military population.
Smit HA, et al	1993	Various	2185	Cross sectional	2+	Prevalence of HD in different occupational groups was estimated using a questionnaire among workers of a chemical company, an electricity company, public works, nurses and surgical assistants. A survey in a sample of the general population was performed to obtain a reference estimate of prevalence (5.2% in men and 10.6% in women). Prevalence of HD among the occupational groups ranged from 2.9% in office workers to ~ 30% in nurses. In nurses, the age-adjusted PR was 9.3 among men (95% confidence interval [CI]: 3.6-23.9) and 2.2 among women (95% CI: 1.5-3.5). The age-adjusted PR were also significantly elevated in male manual workers of the chemical company, the electricity company and public works and varied from 2.4 to 2.8.

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Smith HR, et al	2000	Various	2848	Case series	3	From 1983 to 1997, HD accounted for 1/4 of patients seen in a CD clinic. Catering was most frequently associated with occupational HD. Other frequent work associations included metalworking, hairdressing, healthcare and mechanical work.
Stingeni L, et al	1995	Healthcare	1532	Cross sectional	2+	1301/1532 (85%) self-administered questionnaires returned from HCWs in one hospital in 1992/3. CD was identified in 365 (28%) workers, of which 276 (21%) was considered to be occupationally related. 276 (21%) were occupational (on hands/forearms). CD was primarily irritant (95% of cases) and attributed mainly to disinfectants and glove use; 14 subjects had ACD (8 cleaners, 4 nurses, 2 doctors). Atopy was reported by 22% of respondents; subjects with OCD reported a statistically significantly higher frequency of atopy than employees with no skin lesions - 28% v 18% (p<0.001).
Sun CC, et al	1995	Various	164	Case series	3	OHD was diagnosed according to medical history, work exposure, physical examination, and patch tests. Electronics, hairdressing, medical, chemical, and construction were the most important industries causing OHD. 58.5% ICD and 41.5% ACD. The commonest allergens included dichromate, nickel, cobalt, fragrance mix and epoxy resin. The commonest irritants were cutting oils, solvents and flux. Main industries affected: electronics, hairdressing, medicine, construction, chemical industries, service, and food industries, clerical, printing and electroplating. More patients with ICD had personal and family histories of atopy.
Suneja T, et al	2008	Various	1434	Case series	3	Patch tests results retrospectively examined for occupation. 100 HCWs compared with 1334 non-HCW. The commonest sites for dermatitis among HCWs were hand (60%), face (13%) and scattered/generalised (10%). Among non-HCWs the commonest affected sites were hands (28%), face (15%) and scattered/generalised (15%).
Tan HH, et al	1997	Electronics	149	Case series	3	All patients were patch tested. Almost equal cases of ACD and ICD were seen. Solvents were the commonest irritant. Commonest allergens = metals, resins, rubber and flux. Hands, palms, fingers, arms, forearms and wrists = main sites. Younger and least experienced at more risk.
Tarvainen K, et al	1993	Glass reinforced plastic	100	Cross sectional	2+	24% of all subjects were atopic while 39% in the group with OSD were atopic. 64% (7/11) of those whose occupational contact dermatitis was localised principally on the hands were atopics. This study showed that skin irritation in glass reinforced plastics workers may readily provoke OICD in atopics.
Turner S, et al	2007	Various	5159	Surveillance scheme	2++	Incidence rates for OSDs reported to The Health and Occupation Reporting (THOR) network (2002-2005) were calculated using Labour Force Survey data or information from the most recent U.K. survey on provision of occupational physician services as denominators. CD accounted for 73.5% of cases reported to EPIDERM and 81% of cases reported to OPRA. CU accounted for 3.2% and 3.9% of cases reported to EPIDERM and OPRA respectively. Within EPIDERM CD was reported as allergic (42.9%), irritant (40.0%) and mixed or unspecified (17.1%). Corresponding ratios for OPRA were 13.5%, 36.4% and 50.2%. The average annual incidence rate of CD was dermatologists 68.0 per million, occupational physicians 259.7 per million. Main causes were latex, soaps/cleansers, wet work, personal protective equipment, nickel, preservatives, resins and acrylics, foods, chromes/chromates and cobalt.

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Valsecchi R, et al	2000	Healthcare	313	Case referent	2+	313/929 (33.5%) HCWs agreed to participate in this study. 118 gave a history of hand problems such as itch, erythema, wheals when wearing gloves, dryness and irritation. Of the 118, 16 refused skin testing and blood tests, so 102 subjects were studied for latex allergy; 21/118 (17.8%) HCWs were found to be latex allergic. 81 gave a history of hand problems worsened by wearing gloves but were not latex allergic on testing. HCWs that completed the questionnaire and answered negatively (195/313) were not tested for latex allergy. Prick tests with the commercial solution were positive in 11 of the 21 subjects studied; prick tests with the eluate of glove, RAST and the use test were positive in all workers. Atopy and a pre-existing irritant contact HD were present in a high percentage of the workers. CU from latex was present in 21 workers. Atopy, defined as the presence of a positive skin reaction to at least one of the common inhalant allergens tested, was present in 9 workers with latex allergy. A comparison between the prevalence of atopics in latex-allergic (9 of 21) and non-latex-allergic workers (11 of 281) showed a strong significant association between atopy and latex allergy ($p \leq 0.0005$).
Van Putten PB, et al	1984	Construction	23	Case series	3	23/135 (18%) of workers exposed to epoxy resins had an OCD affecting the hands or forearms in the previous 3 years. There was no relation between a history of atopy and the development of AOCD.
Williams JDL, et al	2008	Various	143	Case series	3	A retrospective analysis of all patients diagnosed with Occupational CU (OCU) at an occupational dermatology clinic in Melbourne between 1 January 1993 and 31 December 2004. OCU was diagnosed in 8.3% (143 of 1720) of the total number of patients with OSD. Natural rubber latex accounted for the majority of cases. Other common causes were foodstuffs and ammonium persulphate hairdressing bleach. The most commonly affected sites were the hands, followed by the arms and face. The most frequently affected occupations were HCWs, food handlers and hairdressers. All cases of CU in patients with hand symptoms were assessed to be work related. Overall, 93 of 143 (65%) patients diagnosed with OCU had a history of atopy. The rates were similar for non-NRL OCU (43 of 68; 63%) and NRL OCU (50 of 75; 67%, $P = 0.73$). Overall, patients diagnosed with OCU were significantly more likely to be atopic ($P < 0.001$). Significance was also shown for the individual subgroups, non-NRL OCU ($P < 0.01$) and NRL OCU ($P < 0.01$). Hand involvement was present in 125 of 143 (87.4%) patients with OCU, which was a significantly higher proportion than for all other dermatoses (75.9%, $P = 0.002$). For NRL OCU, 70 of 75 (93%) patients had hand involvement ($P = 0.0001$ compared with all other dermatoses), while 55 of 68 (81%) patients with non-NRL OCU had hand involvement ($P = 0.34$).

EVIDENCE TABLE B

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Arbogast, JW, et al	2004	Manufacturing	336	Randomised controlled trial	1+	Studies effect of regular hand care and use of skin conditioning product on skin. Workers were randomly allocated to a control or treatment group. Control group were asked to follow normal skin cleansing routine; treatment group additionally asked to use moisturiser regularly at work. Skin condition assessed by corneometry, TEWL and/or chromametry; self-assessment; visual inspection, at baseline and at 1-2 weeks. No differences in skin condition between groups at baseline. At 1-2 weeks, groups using moisturiser showed statistically significant improvement in all skin condition measures compared with control group. Results indicate beneficial effect of regular use of skin conditioning cream. Sources of bias noted, change of standard soap at start for both trial and control groups could have affected some results equally. Not blinded study, funded by cream manufacturer. 1 cream used for all. All work carried out in spring. Location and climate not described which could also partly account for initial skin condition.
Avnstorp C	1989a	Construction	190/196	Case-control	2+	In 1983 Danish law restricted water-soluble chromium content in cement to 2 mg per kg. Workers in 5 factories making pre-fabricated concrete were patch tested and examined in 1981 and in 1987. Controls for 1981 tests were 128 workers from same factories with no exposure to wet cement. Workers examined in 1987 were younger, on average, and had worked less in the trade. There was a statistically significant difference in 1981 cohort between prevalence of chromate sensitization and eczema on hands or forearms. Relative risk of chromate allergy in 1981 was 8.3 and in 1987 was 2.1. Prevalence of chromate allergy was lower in 1987 than in 1981 and difference was statistically significant. No. of workers on sick leave due to HD was also lower (small no's) and topical steroid use was lower. Glove use was greater in 1987 than in 1981. Among workers exposed to cement containing no more than 2 ppm, prevalence of chromate allergy equalled that of control group. In this study, the 2 populations were matched with respect to exposure time in order to control for bias but few other confounding variables are identified. No changes in welfare facilities at the workplace were noted, which supports results further.
Bendsoe N, et al	1987	Glass fibre	69	Cohort	2+	Comparison of 5 types of preventative cream/ointment in glass fibre workers complaining of itching. 3 different trials comparing 2 products, applied to hand and forearm, with different product on right and left. Products were found to have very limited value in protection against glass fibre irritation. After 3 months with best product freely available, only 25% were using it. Study shows protective creams not of benefit in this environment. Limited detail given on possible protective mechanisms however.
Elsner P	2007	Various	20	Randomised controlled trial	1+	This paper evaluates one cream using TRIT test. 20 volunteers acted as own controls. Only used 1 pre-work cream, 1 irritant (SLS) and one solvent (toluene). Source of funding not given. Skin condition monitored by TEWL, capacitance and colour. Two applications 3hrs apart of SLS induced more irritation than similar regime with toluene. SLS followed 3hrs later with toluene induced worse skin reaction than either alone. Reverse combination TOL/SLS not tried. Significantly less change of TEWL using cream after 5 days with SLS/SLS ($p < .01$) and with SLS/TOL ($p < .01$), but not TOL/TOL (n.s.). One cream significantly reduced TEWL change for one irritant, but not significantly for one solvent. Cannot generalise to all combinations. Need field trials to confirm effect.

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Flyvholm M, et al	2005	Slaughtering	495	Randomised controlled trial	1++	664/736 gut cleaners at 18 slaughterhouses agreed to take part; 205 in intervention group, 439 in comparison group. Intervention group established an occupational health management system & project groups to implement change, informed by appropriate training. Follow-up at 1-year showed significant improvements in the intervention group in terms of frequency of skin problems, increased use of protective measures, including gloves & skin care products.
Goh C. L, et al	1993	Metalworking	20	Case series	3	Hydrocarbon compounds in dielectric fluids can provoke ICD. Most cases due to poor personal hand hygiene. Reduction in ICD followed: 1/ wearing gloves (although this risk increased accidents through loss of dexterity). 2/ Use disposable hand towels to dry hands - not contaminated rags which may irritate by chemical exposure & chaffing. 3/ Personal hygiene & proper hand cleansers. 4/ Cleaning facilities conveniently available. Following these interventions, there were no further cases of ICD & all staff were able to continue working.
KrajewskaD, et al	1976	Various	126	Case series	3	Study at 31 work sites in 8 factories at which 422 persons were employed. In seven years there were 126 cases of dermatitis. Sensitivity to epidian 5 and/or to TET was not less frequent in persons using barrier creams, protective gloves or clothes or taking a shower after work.
Loffler H, et al	2006	Healthcare	521	Randomised controlled trial	1+	Nurses at 14 nursing schools were split into 2 groups. All examined for hand skin problems (30% in both groups, 17% were dermatitis). One group given standard hand hygiene training programme, other given a 3yr enhanced programme of knowledge & training. All given one particular hand care cream to use. 521 recruited but 37% dropouts (from absence, not for skin problems), leaving 325. After 3 years, intervention group had 31% problems, controls 68%. HD was 16% (intervention) & 38% (control). Significant factors were: previously existing problems (both groups, OR=1.9) & training (OR=4.8). No difference seen in cream or hand gel use, but intervention group wore gloves more often & hand-washed less. Curiously, after 18 months, figures were higher than after 3 years. Funding was from hand cream manufacturer. May underestimate effect of training because control group knew they were participating. Results adjusted for factors like sex, age, atopy & existing problems.
NHS Plus	2008	Various	-	Systematic review	2+	Use of powder free, low protein latex gloves reduces incidence of latex allergy. Banning powdered NRL gloves resulted in 80% decrease in suspected/confirmed cases of NRL CU being reported. Appropriately targeted & sustained educational interventions induce important behavioural changes. Prior use of protective hand creams cannot be recommended for people who wear latex gloves. Such creams may favour uptake of allergens from gloves.
NHS Plus	2009	Various	-	Systematic review		There is no direct evidence base, derived from studies in working populations, to address the question of effectiveness of health surveillance in the early detection of occupational contact dermatitis or urticaria, or comparative effectiveness of different screening methods.
Roto P, et al	1996	Construction	1478	Cohort	2++	Explores impact of adding ferrous sulphate to cement on prevalence of ACD in construction workers. In first part of study, undertaken before addition of ferrous sulphate to cement. Of 1620 workers handling cement in Finnish construction companies, 1478 (91%) took part; participants were interviewed & dermatological assessment. All workers with current skin symptoms (n=112) were referred for more detailed dermatological examination. Based on patch testing, prevalence of chromium allergy in workers prior to addition of ferrous sulphate was 4%. In second part of study, Finnish Register of Occupational Diseases was analysed for cases of OCD attributed to chromium before & after addition of ferrous sulphate. There was evidence for a reduction in number of cases of ACD following addition of ferrous sulphate, whereas number of cases of ICD attributed to cement remained stable, suggesting a beneficial impact of ferrous sulphate on Cr(VI) allergy related to cement exposure.

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Saary J, et al	2005	Various	-	Systematic review	2++	Found good & fair quality evidence for effectiveness of some barrier creams in prevention of ICD; good quality evidence for effectiveness of moisturisers with high lipid content in prevention & treatment of ICD; & good quality evidence that fabrics treated with fabric softeners can prevent ICD. Use of occlusive gloves in a fair quality study was found to worsen ICD, an effect that was mitigated by use of a cotton liner. For ACD, there was fair quality evidence for effectiveness of some allergen-specific preventative treatments; & good & fair quality evidence for use of moderate to high potent steroids as effective treatment.
Sell L, et al	2005	Dairy	557	Cross sectional	2++	A prevention programme was introduced in cheese-making dairies to attempt to reduce skin problems. 557/665 employees at 5 dairies agreed to participate; 308 from 2 dairies in the intervention group & 247 from 3 dairies in a comparison group. The intervention involved an occupational health management system, project teams to act as 'change agents' & an educational programme to initiate the change process. Detailed information on knowledge & working practices was gathered by questionnaire at the start of the intervention & at 1 year. The initial prevalence of OCD in the intervention dairies was not sufficiently high to be able to detect any statistically significant reduction as a result of the intervention, although the prevalence of skin symptoms was reduced & behaviours relating to skin protection (use of moisturisers & gloves) was statistically significantly improved during the intervention period.
Sprince NL, et al	1996	Metal working	209	Cohort	2+	Machine operators (MO) & assemblers in a metal working factory were matched for exposure assessment. Medical history questionnaire was collected over 8 weeks & short skin questionnaire & dermatologist examination over 3 days. Dermatologist completed skin examinations on hands, arms, forearms & face. Dosimeters were used to check cobalt, chromium & nickel. Outcome variable was current dermatitis. Risk factors associated with CD in machine operators exposed to metal working fluids (e.g. self-report of number of hours skin wet from exposure to coolants), but some risk factors were not found to be statistically significant & no relationship with glove use was found. Workers could fairly accurately recognise dermatitis, however ICD & ACD was not differentiated.
van der Walle HB	1994	Hairdressers	16	Cohort	2+	HD in hairdressers is caused by a variety of factors. Important are the sensitizing & irritant capacities of some hair-cosmetic ingredients, unsafe packaging which causes contamination of the hands, work tables & instruments with hazardous chemicals, absence of protection with adequate gloves & ignorance of safe handling of these chemicals. A strategy is proposed, based on improvement of the safety of ingredients & packaging, use of vinyl gloves & introduction of safe hairdressing procedures. Introduction of this strategy in hairdressing salons with 16 cases of moderate to severe contact dermatitis reduced the number of cases of active dermatitis to 3 in 4 months.
Winker R, et al	2009	Construction	485	Randomised controlled trial	1+	Investigated the effectiveness of skin creams in 196 builders & 287 timber workers who were randomly assigned to 1 of 4 groups: A. pre-work cream, cleansing & after-work cream; B. pre-work cream & cleansing; C. after-work cream & cleansing; D. cleansing only. Skin condition was assessed blindly by dermatological assessment & by TEWL, at the start of the study & twice thereafter, at around 4-month intervals; subjects also self-assessed skin condition. The final study population consisted of. A small percentage of workers had mild or moderate eczema at the start of the study; workers with eczema requiring treatment were excluded. Overall, dermatological assessment found no differences between groups at the end of the study; TEWL measurements showed statistically significant improvements in groups using pre- & post-work creams & after-work creams only with the greatest improvement in the former group. Self-assessment of skin condition also showed the greatest improvement in the group using pre- & post-work creams. The absence of any change in observed dermatitis is attributed to the limited power of the study to detect a change in this rare event. Overall, this study shows a probable benefit of skin creams (based on TEWL), the greatest effect being seen in workers using pre- & post-work creams, followed by workers using after-work creams.

EVIDENCE TABLE C

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Freeman S, et al	1991	Food	14	Cross sectional	2+	Usefulness of skin prick testing highlighted in 14 cases of workers in the food industry, some of whom were unable to return to work. Seafood/fish +ve identified in 10/14 subjects. 50% atopy.
Halbert AR, et al	1992	Various	123	Case series	3	Cases of chromate dermatitis were followed up for 6 months to 9 years. Assessment method varied between telephone interview, examination and postal questionnaire. 44 patients (37%) presented to a dermatologist within 12 months of developing symptoms, but 34 (28%) had symptoms for more than 5 years before presentation. At follow-up 52% were in the same occupation as at the time of diagnosis. Of these, 89% had persistent dermatitis and 11% had completely cleared despite continued chromate exposure. 24% of patients had severe impairment from their dermatitis. 58 patients (48%) had completely changed occupation because of their dermatitis. Despite change in occupation, 40 (69%) still had persistent symptoms, including 33 who had no obvious ongoing exposure to chromate. The presence of symptoms for more than 12 months before diagnosis of chromate sensitivity significantly predicted chronicity. No association was found between chronicity and age of onset, source of sensitisation, duration of exposure prior to onset of symptoms, or history of atopy.
Prahl P, et al	1979	Food	9	Cross sectional	2+	9 vets with history of allergy to cow obstetrics had IgE in serum examined and compared to controls (36 patients with cow prompted asthma). All 9 vets patch tested +ve to cow hair and dander and 6/9 RAST +ve results.
Usmani N, et al	2007	Various	330	Cross sectional	2+	This study explored the usefulness of skin patch testing as an adjunct to prick testing in patients referred to a dermatology clinic with suspected occupational dermatoses. Among 330 who were prick tested, 68 were positive.
Wendel de Joode BV, et al	2007	Metal work	147	Cross sectional	2+	The authors compared two self-administered questionnaire tools against dermatologist examination as a gold standard in the diagnosis of dermatitis in a population of metal workers exposed to synthetic metal working fluids (SMWF).

EVIDENCE TABLE D

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Adisesh A, et al	2002	Various	510/512	Cross sectional	2++	Predictors of time off from work with dermatitis are age (time off increased by 25% for each 10 years of age), ACD and medico legal assessment. ICD had the lowest time off work at 15.8%, and ACD the highest at 26.2%. Failure to improve may be related to longer exposure to the agent. In under 45s, those atopic failed to improve more than non atopics. Advice given regarding work practices, PPE or job changes appeared to make no difference in clinical improvement. Nevertheless the authors recommend that control of exposure especially for ICD is key.
Avnstorp C	1989b	Construction	143	Cohort	2+	Of workers who had HD diagnosed in 1981 and followed up in 1987, significantly more workers with chromate-induced ACD (12/17) had chronic HD compared to workers with ICD (2/11) (p=0.02). Those with ACD (5/19) were significantly more likely to take early retirement than those with ICD (8/122) (p<0.05). There was no significant difference for change of occupation between ACD (5/19) and ICD (12/122).
Cahill J, et al	2005	Plastics	40/1354	Nested cohort	2++	40 workers who attended a tertiary referral dermatology clinic were diagnosed with ACD from epoxy resin (ER). 20 were followed up at least 2 years post-diagnosis. No significant differences were observed between the follow-up and not followed-up groups for age, atopic status and severity. A clinician contacted patients and administered a telephone questionnaire. All patients reported improved skin condition since diagnosis. 12 patients (60%) applied for workers' compensation; all were successful. 16 ceased working with ER. Of these, 9 [56% (95% CI 29-80%)] reported complete healing, 7 (44%) reported ongoing dermatitis. 4 workers still exposed to ER all had ongoing symptoms. No conclusions could be drawn because of small sample size. Possible factors associated with poor prognosis were age, atopy, duration of symptoms and severity at diagnosis. Prognosis of ACD from ER is not always favourable, even if exposure ceases.
Cvetkovski RS, et al	2005	Various	758	Cross sectional	2+	Baseline survey on a group of cases registering with the Danish Industrial Injuries Board – the initial part of a longitudinal study. Among patients with OHE, 61.9% had occupational ICD, 21.2% had occupational ACD, 4.8% had occupational CU, 9.4% had occupational ICD and occupational ACD and 2.8% had occupational ICD and occupational CU. The prevalence of ACD and NOACD was 16.4% and 31.4% respectively
Cvetkovski RS, et al	2006	Various	758	Cohort	2++	Cases with OHD registering with the Industrial Injuries Board assessed by postal questionnaire at baseline and after 1 year. Outcomes included severity (self-assessed and dermatologist-assessed), job loss and sickness absence, depression and Dermatology Life Quality Index (DLQI). Overall improvement was 41%. Overall proportion of persistently severe or aggravated symptoms was 25%. Presence of ACD and age 25 years or greater appeared to be associated with poor prognosis. No statistically significant association between poor prognosis and sex, ACD, ICD, CU, NOACD, disease duration, occupation, or socioeconomic status, although a slight tendency toward a protective effect of high to medium socioeconomic status was found. Almost 48% of study population reported job change during follow-up. Job change was associated with younger age (52% of those reporting job change were younger than 25 years) and lower socioeconomic status (57% from the lowest level compared with 24% from the highest level). Prolonged sick leave was significantly associated with having occupational CU, being 25 years old or more and having severe OHD at baseline. Severe impairment of QOL at baseline and previous reports of prolonged sick leave were strongly associated with prolonged sick leave during follow-up.

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Dooms-Goossens A, et al	1980	Various	1000	Cohort	2++	Prognosis-chromate: 46% (46/53 +ve) was relevant to their dermatoses. M>F building & metal industries. 1% of chromate sensitised had persistence of CD despite removal of allergen. CrO4 was a factor in shoe dermatitis. Nickel- 87% (54/62 +ve) were relevant to their dermatitis F>M<30 yrs due to jewellery, costume clothing etc, in men. 34/45 nickel sensitive (75%) had persistence; 10 had eczema if came into contact with nickel alloys. HD > in nickel allergy (15% in this study) 12-60% for women 0-4% for men cobalt. Females concomitant with nickel. Cobalt with chromate > in males due to work with cement.
Estlander T	1988	Textile	5	Case series	3	Respiratory symptoms preceded skin symptoms in patients who had both. Of 5 patients only one had been able to continue in his job Employers lose experienced workers and the workers are obliged to change jobs. Series of organic textile dyes or PPD had very little value in the screening of contact allergy to reactive dyes. Reactive dyes can probably be thus being regarded as rather weak contact allergens although they are considered to be major respiratory allergens among dye house workers. The handling of dyes in powder form should be avoided.
Fischer T, et al	1983	Metalworking	853	Cross sectional	2++	Cobalt allergy hard metal workers 62 employees 20 men 42 women showed positive reactions to cobalt on individual patch test. 14 of 39 individuals with cobalt allergy had atopic background. 31 of 39 were grinding or etching. 10 individuals had changed to other metal work and 9 to non-metalwork after the appearance of cobalt allergy. 12 employees were still able to continue with the same activity. A traumatic occupation which causes ICD and/or a previous contact allergy or atopy is possibly a pre-requisite for the development of cobalt allergy. Authors advise: exclude etching, automate irritant hand grinding; patch test individuals with a history of "suspender dermatitis" (indicating nickel allergy) in order to discover nickel and or cobalt allergy before employment. "Individuals with nickel and or cobalt sensitivity as well as with AD should be barred from taking up hard metal work".
Fischer T, et al	1996	Diesel users	15	Case series	3	A group of 36 men who had reported skin disease from dyed diesel oil (green diesel) were interviewed to establish clinical history of skin disease; 28 were offered dermatological examination (remaining 8 not offered this because of geographical difficulties), and 15 accepted. These 15, along with 19 healthy volunteers underwent patch testing with relevant dyes and with 3 different dyed and un-dyed diesel oils. Results indicated that the pure dyes were not irritating; diesel oils showed irritancy potential, that was unaffected by the addition of dyes. There was no evidence for allergic responses. Differing irritancy potential was seen for the three different diesel oil products. The newer formulations, with reduced environmental impacts, showed greatest irritancy potential.
Goh CL	1985	Soldering flux company	26	Case series	3	The patients were reviewed over a 3 to 6 month period. The prognosis of the OCD appeared to be good. The 4 who were found to be allergic to aminoethylethanolamine were completely cleared of their dermatitis upon transfer to dry work. 13 workers had complete clearance of their dermatitis 1 was transferred out, and 2 continued with plastic gloves), 11 had more than 50% improvement (4 were transferred out and 6 improved using plastic or rubber gloves). 2 workers defaulted on follow-up. Thus most workers were able to return to their work with appropriate protective clothing.
Guo YL, et al	1994	Hairdressing	98	Cross sectional	2+	Duration of skin lesions of >1 year in 60% of subjects and <1 year in 40% and of greater severity in apprentices than in stylists. 43% sensitive to at least 1 allergen when patch tested and previous ear piercing seen as significant predisposing factor for nickel sensitivity. Infrequent use of protective gloves found. Those with more severe dermatitis tended to work shorter hours, suggesting a "healthy worker" effect.

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Halbert AR, et al	1992	Various	123	Case series	3	Cases of chromate dermatitis were followed up for 6 months to 9 years. Assessment method varied between telephone interview, examination and postal questionnaire. 44 patients (37%) presented to a dermatologist within 12 months of developing symptoms, but 34 (28%) had symptoms for more than 5 years before presentation. At follow-up 52% were in the same occupation as at the time of diagnosis. Of these, 89% had persistent dermatitis and 11% had completely cleared despite continued chromate exposure. 24% of patients had severe impairment from their dermatitis. 58 patients (48%) had completely changed occupation because of their dermatitis. Despite change in occupation, 40 (69%) still had persistent symptoms, including 33 who had no obvious ongoing exposure to chromate. The presence of symptoms for more than 12 months before diagnosis of chromate sensitivity significantly predicted chronicity. No association was found between chronicity and age of onset, source of sensitisation, duration of exposure prior to onset of symptoms, or history of atopy. Loss of work resulted from chromate dermatitis in 52% of cases, with 8% being off work continuously for more than 2 years. 40% claimed they had suffered financially. Among those with persistent dermatitis despite changing occupation, 91% had lost time from work with 18% having been off work continuously for more than 2 years
Holm JO	1994	Hairdressing	124	Cross sectional	2+	Postal survey of hairdressers 3-5 years after qualifying achieved 43% response rate. 37% had left their career, although musculoskeletal problems were a more common cause for leaving than dermatitis. Only 6.5% had left because of the latter. Some non-respondents to postal survey were telephoned: of the 21 reached, 9 had also dropped out.
Holness DL, et al	1995	Various	230	Cross-sectional	2+	Patients were identified from all who had undergone skin patch testing in a Canadian clinic. Follow-up at least 2 years after diagnosis was undertaken by telephone interview. Among 230 with a diagnosis of OSD, 40% still had dermatitis at the time of follow-up. 78% were working, 31% had experienced no time off work, but 35% had had more than a month off work. Women were less likely than men to have taken time off work. Those who had changed jobs had a better outcome.
Holness DL	2004	healthcare	78	Case series	3	100 workers with HD were enrolled and observed for 6 months after assessment. A diagnosis of OCD was made for 78 and 60 of these attended for review at 6 months. The mean duration of rash prior to diagnosis was 25 months. 91% noted their skin was worse at work and 87% noted improvement when on vacation. At the time of diagnosis 10% were not working and 75% of these because of their skin problem. Of those still working, 38% reported improvement and 83% were in the same jobs. 95% saw their family physician for a median of 3 visits (range 1-90). 6 months later 38% were not working, 96% because of their dermatitis. Of those still in work, 68% were in the same jobs. Patients reported that 67% of family physicians asked about their job, but only 3% asked for further information about work and none asked for a Material Safety Data Sheet (MSDS). 71% of patients had seen a dermatologist for a median of 3 visits (range 1-50). 53% asked about their job, 5% asked for additional information about work and 3% asked for an MSDS.
Hutchings CV, et al	2001	Various	70	Case series	3	70/181 (39%) patients, diagnosed with occupational contact dermatitis over a period of 3 years (1996-1999), responded to a questionnaire based on the Dermatology Life Quality Index (DLQI) and the Short Form-36 (SF-36). The median DLQI score was 5, with a mean score 6.6 (SD 6.4), similar to that seen in Behçet's syndrome and urticaria. There was no statistically-significant difference between male and female median scores and no significant correlation between age and DLQI score nor between DLQI score and time from diagnosis. Males scored highest in problems associated with work, relationships and treatment. Females scored highest in problems associated with symptoms and feelings, daily activities and leisure. OCD has an appreciable impact on quality of life for at least the first 3-4 years after diagnosis.
Johnson ML, et al	1971	MWF use	87	Case series	3	Between 6-13 yrs after contracting skin disease, 87 of 100 workers were contacted to obtain histories. 42 had oil dermatitis, 10 oil dermatitis with constitutional eczema and 17 had constitutional eczema. The remainder could not be classified. Of those with oil dermatitis 24 were clear, 11 better and 7 unchanged; 82% changed their jobs. Of those exposed <1yr 14 cleared whereas of 30 exposed for longer only 15 cleared. There was no evidence that age affected prognosis. Those with constitutional eczema did not fair as well as those with just oil dermatitis.

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Kalimo K, et al	1999	Various	423	Cohort	2+	Survey of 201 ICD-only past patients 5 years after referral. Good response (124 of which 108 occupational). Nurse had given "education" to all. Scoring method for current severity was not validated. 32% were still "high" severity 5 years on. Survey relied on patients' memory of recurrences. Many still did not use gloves. 42 did not use hand creams at all - use was significantly related to complaints of recurrence (reactive not proactive?). Gender difference found - women had not reduced their occ. exposure levels as much as men. Perhaps reduction not possible in their job categories - e.g. hairdressers group had changed employers but exposures were not reduced.
Keogh SJ, et al	2006	Various	5	Case series	3	The authors aimed to ascertain the incidence of persistent post-occupational dermatitis symptoms among a population of dermatitis clinic attendees. 5 of 1100 met the case definition (<0.5%), 4 female, 1 male aged 19-52 years. 4 had nickel and 2 thiuram allergy. 5 had an irritant aetiology and 3 an allergic component. All had significant long term adverse effects on employment. Persistent dermatitis after removal from occupational exposure is rare but has serious consequences. The study quality is limited by very poor information about method for identifying cases.
Krajewska D, et al	1976	Various	126	Case series	3	Study at 31 work sites in 8 factories at which 422 persons were employed. In seven years there were 126 cases of dermatitis. Of the 80 patients who changed their occupation, there were relapses in 50 within one year. Relapses were more frequent in persons who continued to work with epoxy resins for more than three months after the appearance of dermatitis and in those simultaneously sensitive to allergens in the standard series
Lazarov A, et al	2005	Healthcare	190	Case series	3	A study of hydrotherapists and self reported skin disease, by phone and questionnaire for those with reported symptoms. Skin problems reported pruritus, stinging, erythematous patches, xerotic skin. Thought to be irritant reactions. Of 400 graduates, 248 were contacted but only 190 provided adequate response to questionnaire. Atopy not found to be a risk factor-any statistically significant differences between a history of AD, seasonal rhinitis, allergic conjunctivitis or asthma in affected versus non affected group. Smoking and higher exposure to pool water were independently associated with dermatological disease. Quality of life :18.8% being on sick leave because of skin problems. 9.9% had to change jobs. Decrease in income 7.1%. Sleep disturbance because of pain 20% Need for expensive creams for treatment 34.1%
Lazarov A, et al	2006	Various	70	Case series	3	40% stopped work in their profession because of OCD, 28.6% resigned because of worsening OSD. 67.1% were working but some changed jobs, 47.1% were unemployed, 52% changed occupations 47.1% were in the same job although advised otherwise. Of 28 that stopped working 57.1% recovered completely, 14.3% partially, 28.65% has persistent dermatitis after stopping work. Disability compensation was claimed by 41%. No significant relationship between atopic background, type of dermatitis and improvement after cessation of work. Changes in job type due to OD were less satisfactory, rewarding and the ability to earn a living was adversely affected. Loss of employment was not the only effect. Interpersonal relationships, relationships within the family, daily and recreational activities, mental health and vitality were all reported as being affected. "Because job change is not always associated with improved prognosis, unless it means a complete avoidance of a specific allergen, all attempts should be made to minimize current workplace exposure and maximise patients' awareness and knowledge, prior to a change of employment.
Lips R, et al	1996	Construction	95	Case series	3	Study of the outcome of chromate avoidance in workers diagnosed with chromate OCD up to 5 years following job change. Follow-up was possible in 88/95 workers. Dermatitis had resolved in 63/88 (72%); 11/88 (12%) had persisting dermatitis; and outcome was unknown in 14/88 (16%). Information on occupational status was available for 80 workers - 56 were employed in new work; 8 took early retirement and 16 were unemployed. None were out of work solely because of dermatitis. Nearly all patients received financial support immediately following cessation of work due to chromate dermatitis; 44% were in ongoing receipt of financial support because of markedly reduced income.

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Nethercott JR, et al	1988	Healthcare	13	Case series	3	ACD to glutaraldehyde was found in 13 HCWs. HD was the uniform presenting complaint, arms were occasionally affected. 1 individual had involvement of the feet. All but 2 had been in jobs with exposure to glutaraldehyde for 4 years or more. The eruption persisted for more than 6 months in 10 subjects. In 5, the skin disease forced the worker to leave their occupation.
Rabin B, et al	2007	Various	70	Cohort	2+	28 (40%) of participants had stopped working in their profession because of OCD. 8 (28.6%) were fired and 20 (71.4%) resigned because of exacerbation of OCD. Of the 70 workers, 47 (67.1%) were currently working although some changed jobs and 23 (32.8%) were unemployed. Change in the type of work was recommended in 46 (65.7%) suffering OCD and job modification with use of protective equipment was recommended in 24 (34.3%). 37 (52.9%) changed their occupation after a diagnosis of OCD and 33 (47.1%) remained in the same job although advised otherwise. Only 29 patients (41.4%) claimed compensation. Compensation was received in 24.3% of claims and refused in 68.6%. 30% were on sick leave. Change in type of work was recommended in 65.7% and implemented by 52.9%. 19/70 subjects reported that the disease only affected them occupationally. The rest reported that the disease affected other areas of their lives as well: interpersonal relationships, relationships within the family or between spouses, daily activities, and mental health, and vitality. Those who had to leave or change their work place reported that their ability to earn a living was adversely affected, they suffered an economic decline, their career and professional development were damaged, and they were less satisfied. The workplace was the only option for earning a living, and those who resigned, could not find alternative employment and were left with no source of income. 45.7% reported feelings of shame and rejection from their immediate and distant surroundings. 18.6% experienced family difficulties. Women had difficulties in performing simple household chores such as cooking, washing dishes, or doing the laundry. 24.3% reported that the disease affected their mental health. Some experienced trouble sleeping, others had periods of irritability, depression, and great anguish caused by the disease.
Rademaker M	2000	Various	16	Case series	3	Epoxy exposure causes ACD within 3/12. 'Cured' epoxy may still pose a problem as 25% may remain uncured. Epoxy can penetrate plastic and rubber gloves. Heavy duty vinyl offers some protection. Prognosis in this study was poor probably owing to ongoing exposure. Education of workers remains important.
Rystedt I	1985	Various	445	Case series	3	Patients first attending an Occupational Dermatology Clinic during 1978-9 were identified from medical records and sent a postal questionnaire up to 3 years later. 445 replied, of which 368 had HD at the first consultation. 148 (40%) had changed occupation because of HD at follow-up. Change of occupation was more common in those with a history of AD in childhood (with no other atopic features – asthma or rhinitis) than in non-atopics. Among atopics 13-17% healed after a change of job, compared to 34% healing after job change for non-atopics. There was no significant difference in rate of healing between those who changed jobs and those who remained in the same job.
Sajjachareonpong P, et al	2004	Various	6	Case series	3	For some workers persistent post-occupational dermatitis (PPOD) involves cyclical flare ups of HD. However when re-patch tested years after having positive results on the original patch test, tests are negative, causing patients to lose workers' compensation claims at review. Other negative outcomes are redeployment with reduced rate of pay, unemployment, self removal from exposure and career change. 5/6 patients were not considered to be atopic. PPOD should be particularly suspected in non atopic individuals with persistent dermatitis, as endogenous eczema is less likely to be the cause. A range of predictive factors for PPOD has been reported in the literature including duration of disease, inability to avoid causative agents and age. Ageing may be a contributing factor with these cases as the aged stratum corneum is more susceptible to irritants. Consideration of age may be important when advising patients with regards to their future work plans. Younger workers may improve if able to avoid irritants and allergens completely for a certain period, although this duration is not known with any certainty at this stage.

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Shah M, et al	1998	Metal	51	Case series	3	Biocides in cutting oil were the most common cause of allergic reactions. A postal questionnaire was sent out between 1 and 5 years after patch testing to assess current dermatitis. 51 people responded. 22 patients were still working with oils, and 19 of these were still symptomatic. Only 6 patients still working with oils had taken steps to reduce their oil contact 29 (57%) were no longer working with oils. Of these 16 had retired or were unemployed, and 13 had found new work not involving contact with oils. The majority of these patients had had no oil or metal contact for at least 2 years. 23 (79%) of these were still symptomatic, and 19 had experienced a HD within the previous 3 months. 13 subjects had taken time of work due to their dermatitis. "Our postal survey demonstrated the poor prognosis of HD in metalworkers. Most remained symptomatic whether or not they continued with oils or metals. Unemployment or a change of job had a little effect on the outcome."
Soder S, et al	2007	Catering and cleaning	212	Cohort	2+	212 cleaners and kitchen workers being contacted 12 months after attending a seminar (Nov 04 - Oct 06 seminars) to ascertain disease status and impact on quality of life using a QL and Skindex-29 survey. These scores were than standardised. The disease was found to have occurred for more time in men than in women. Only 20.8% reported using emollients on a regular basis. 48.6% reported absence from work. In terms of QL, it was found that the older a worker was, the lower the QL score was. Only 130/212 subjects were interviewed one year on. In 32% there had been no change. 23% were no longer in their former occupation, 9% of all given up due to skin disease. The authors report a greater use of protective measures one year after the seminar. The authors postulate that ICD can become ACD (type 4) in such occupations.
Susitaival P, et al	1995	Agriculture	896	Cohort	2++	A group of Finnish farmers with dermatitis were identified from a previous baseline survey that had been carried out in 1979. This paper describes the follow-up of these farmers 12 years later (1991), looking at the risk factors for persistence of dermatitis at follow-up. More than half of the group had left farming by the time of follow-up. Persistent symptoms were common, 26% of men and 21% of women had current hand/forearm dermatitis at follow-up, and 44% of men and 39% of women reported symptoms within the past year. The following risks were identified as being predictors for continuing dermatitis: continuing in farm work, history of atopy, metal allergy, age <45 years.

EVIDENCE TABLE E

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Adishes A, et al	2002	Various	510/512	Cross sectional	2++	Predictors of time off from work with dermatitis are age (time off increased by 25% for each 10 years of age), ACD and medico legal assessment. ICD had the lowest time off work at 15.8%, and ICD the highest at 26.2%. Failure to improve may be related to longer exposure to the agent. In under 45s, those atopic failed to improve more than non atopics. Advice given re work practices, PPE or job changes appeared to make no difference in clinical improvement. Nevertheless the authors recommend that control of exposure especially for ICD is key.
Baack BR, et al	1996	Various	30	Cohort	2+	46 individuals with HD wore cotton liner on one hand and Dermapor semi permeable glove on the other.(waterproof but allow water vapour to evaporate) Worn both at home and at work, often under other PPE gloves.. Used as treatment glove with steroids and/or moisturiser. 30 people attended for follow up. No difference in outcome but most patients found Dermapor glove more acceptable.
Cahill J, et al	2005	Plastics	40/1354	Nested cohort	2+	40 workers who attended a tertiary referral occupational dermatology clinic were diagnosed with ACD from epoxy resin (ER). 20 of these patients were followed up at least 2 years post-diagnosis. No significant differences were observed between follow-up and not followed-up groups for age, atopic status and severity. A clinician contacted patients and administered a telephone questionnaire. All patients reported improvement of their skin condition since diagnosis. 12/20 [60%[95% confidence interval (CI) 56-94%]] patients had applied for workers' compensation; all of these claims were successful. 16 had ceased working with ER. Of these, 9 [56% (95% CI 29-80%)] reported complete healing and 7 [44% (95% CI 19-70%)] reported ongoing dermatitis. 4 workers still exposed to ER all had ongoing symptoms. Although no conclusions could be drawn because of small sample size, factors that may be associated with a poor prognosis were age, atopy, duration of symptoms and severity at diagnosis. Prognosis of ACD from ER is not always favourable, even if a worker ceases exposure.
Dooms-Goossens A, et al	1980	Various	1000	Cohort	2++	Prognosis-chromate: 46% (46/53 +ve) was relevant to their dermatoses. M>F building and metal industries 71% of chromate sensitised had persistence of CD despite removal of allergen. Cro4 was also a factor in shoe dermatitis. Nickel - 87% (54/62 +ve) were relevant to their dermatitis F>M<30 yrs due to jewellery, costume clothing etc, in men usually occupational testing could be -ve due to low test conc., recommended to increase conc. of test sol. 34/45 nickel sensitive (75%) had persistence; 10 had eczema if came into contact with nickel alloys. HD > in Nickel allergy (15%in this study) 12-60% for women 0-4% for men cobalt. Females concomitant with nickel. Cobalt with chromate > in males due to work with cement.
Fischer T, et al	1996	Diesel users	15	Case series	3	A group of 36 men who had reported skin disease from green diesel were interviewed to establish clinical history of skin disease; 28 were offered dermatological examination (remaining 8 not offered this because of geographical difficulties);15 accepted. These 15, along with 19 healthy volunteers underwent patch testing with relevant dyes and with 3 different dyed and undyed diesel oils. Results indicated that pure dyes were not irritating; diesel oils showed irritancy potential, that was unaffected by addition of dyes. There was no evidence for allergic responses. Differing irritancy potential was seen for 3 different diesel oil products. Newer formulations, with reduced environmental impacts, showed greatest irritancy potential.
Goh CL	1985	Soldering flux company	26	Case series	3	Patients were reviewed over a 3 to 6 month period. Prognosis of OCD appeared to be good. 4 who were allergic to aminoethylethanolamine were completely cleared of their dermatitis upon transfer to dry work. 13 workers had complete clearance of their dermatitis 1 was transferred out, and 2 continued with plastic gloves), 11 had more than 50% improvement (4 were transferred out and 6 improved using plastic or rubber gloves). 2 workers defaulted on follow-up. Thus most workers were able to return to their work with appropriate protective clothing.

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
Goh CL, et al	1993	Metalworking	20	Case series	3	Hydrocarbon compounds in dielectric fluids can provoke ICD - probably by exerting its solvent effect on stratum corneum and upper epidermal cells. Straight chain (paraffinic) hydrocarbons are least likely to do this. Most cases of ICD due to poor personal hand hygiene. Reductions in ICD followed: 1/ wearing gloves (although this risked increased accidents through loss of dexterity). 2/ Use disposable hand towels to dry hands - not contaminated rags which may irritate by chemical exposure and chaffing. 3/ Personal hygiene and proper hand cleansers. 4/ Cleaning facilities conveniently available. Following these interventions, there were no further cases ICD and all staff were able to continue working.
Graham M, et al	2005	Healthcare	13	Case series	3	HCWs diagnosed to have ICD caused by alcohol-based hand rub (ABHR) in hospital wards were followed up. 9 had a history of pre-existing skin problems such as dermatitis/eczema. All were advised to increase their use of skin moisturizers, so that at 9 months 3 HCWs used ABHR without problems, 7 used ABHR intermittently and 3 avoided ABHR use.
Holness DL, et al	1991	Various	230	Cohort	2+	A questionnaire was administered to patients patch tested in a clinic to gauge their knowledge of their condition & treatment. There were no clear cut differences in sex, age, actual diagnosis or type of work between those that did and those that did not understand their diagnosis. Findings suggest that paying more attention to conveying information to workers regarding their disease improves outcome. Those who correctly identified their diagnoses were linked with less current dermatitis (OR1.95, p=0.0354) and were more likely to report improvement (OR2.14, p=0.0451). Those that didn't know were linked with changed jobs (OR 2.27, p=0.0420) or still have skin problems (OR3.02, p=0.0732).
Kalimo K, et al	1999	Various	201	Case series	3	Survey of 201 ICD patients 5 years after referral. Good response (124 of which 108 OCD). Nurse had given education to all. Scoring method for current severity was not validated. 32% were still "high" severity 5 years on. Survey relied on patients' memory of recurrences. Many still did not use gloves. 42 did not use hand creams at all - use was significantly related to complaints of recurrence. Women had not reduced their exposure levels as much as men. Perhaps reduction not possible in their job categories - e.g. hairdressers group had changed employers but exposures were not reduced.
Kiec-Swierczynska M, et al	2005	Electronics	81	Cross sectional	2+	ACD was found in significant numbers in workers manufacturing electric coils for television displays. Lesions occurred several weeks to months after starting work with glues. 40 showed lesions of which 21 were thought to be OCD .12 of these reacted to acrylates. Workers had been using vinyl gloves with tips cut off. Acrylates can penetrate vinyl gloves, and the plaster fabric absorbed the glue, causing even higher exposures to acrylates. Recommendations were for using suitable (material) gloves and that glue should be UV cured twice. 3 people had positive tests but no lesions were found at the time of testing. In the past they had complained of lesions and had been redeployed to packing of finished products.
Nethercott, JR, et al	1984	Pharmaceutical	3	Case series	3	Study describes a reaction to sodium benzoate, which, when dissolved in sweat becomes benzoic acid. 3 workers describe transient urticaria, lasting about 30 minutes described as tingling, burning or itching, thought to be a chemically induced non-immunological reaction. Patch testing was done on the 3 workers affected and 3 controls. 2 of the 3 had increased susceptibility to urticaria when sweating, as sweat lowers the skin's pH. Increased control of exposure by long rubber gloves gowns and increased ventilation led to reduced exposure and the urticarial reactions ceased.
NHS Plus	2008	Healthcare	-	Systematic review	2+	All but the most severe cases of latex allergy can be managed without the need for redeployment, ill-health retirement or termination of employment. Adjustments include careful personal avoidance of latex at work. In employees who are latex allergic/sensitised, taking latex avoidance measures results in cessation or diminution of symptoms. Change from powdered to powder free latex gloves associated with significantly reduced HD (p=0.0001) at follow up and disappeared in 7 cases (29%). Urticaria disappeared in 44% but was still present on contact with latex gloves in 24%. Interventions designed to eliminate or reduce latex exposure in latex HCWs with urticaria were universally effective. NRL avoidance can reduce markers of sensitisation and symptoms in the workplace.

Author	Year	Sector	No. of subjects	Study design	Level of evidence	Authors' main conclusions
NHS Plus	2009			Systematic review	2+	There is only a very small body of consistent evidence from two small studies that conditioning creams improve skin condition in workers with damaged skin. Two small studies found that pre-work creams did not improve clinical indicators of skin condition.
Pedersen NB, et al	1982	Printing	7	Case series	3	7 cases of sensitivity to Nyloprint acrylamide newspaper printing plates. 4 from one location out of 17 workers, 3 at other places. Fractions extracted from plates and used in various patch tests on the 7, and on 8-10 controls. +ve fractions analysed as containing acrylamide derivatives. Better controls reduce the dermatitis. References other papers where active allergen ingredients identified in other photo polymerising printing plate ingredients: Letter flex, Napp and Dycril.
Rystedt I	1985	Various	445	Case series	3	463 patients attending a national (Swedish) Occupational Dermatology Clinic for the first time during 1978-9 were identified from medical records and sent a postal questionnaire up to three years later in 1982. 445 replied, of which 368 had HD at the time of the original consultation. 148 (40%) had changed occupation because of eczema at follow-up. Change of occupation was more common in those with a history of AD in childhood (with no other atopic features – asthma or rhinitis) than in non-atopics. Among atopics 13-17% healed after a change of job, compared to 34% healing after job change for non-atopics. There was no significant difference in rate of healing between those who changed jobs and those who remained in the same job. The data suggest that changing jobs did not necessarily improve occupational dermatitis particularly among those with a history of atopic eczema.
Saary J, et al	2005			Systematic review	2++	Systematic review of evidence for prevention and treatment of contact dermatitis. The review found good and fair quality evidence for the effectiveness of some barrier creams in the prevention of irritant contact dermatitis; good quality evidence for the effectiveness of moisturisers with high lipid content in the prevention and treatment of irritant contact dermatitis; and good quality evidence that fabrics treated with fabric softeners can prevent irritant contact dermatitis. Use of occlusive gloves in a fair quality study was found to worsen irritant contact dermatitis, an effect that was mitigated by the use of a cotton liner. For allergic contact dermatitis, there was some fair quality evidence for the effectiveness of some allergen-specific preventative treatments; and good and fair quality evidence for the use of moderate to high potent steroids as effective treatment measures. There was no information on return to work or quality of life measures.
Shah M. et al	1998	Metal	51	Case series	3	A study of outcome of 64 metalworkers diagnosed with HD between 1988 and 1993. Biocides in cutting oil were the most common cause of allergic reactions. A postal questionnaire was sent out between 1 and 5 years after patch testing to assess current dermatitis. 51 people responded. 22 patients were still working with oils, and 19 of these were still symptomatic. Only 6 patients still working with oils had taken steps to reduce their oil contact. 29 (57%) were no longer working with oils. Of these 16 had retired or were unemployed, and 13 had found new work not involving contact with oils. The majority of these patients had had no oil or metal contact for at least 2 years. 23 (79%) of these were still symptomatic, and 19 had experienced a HD within the previous 3 months. 13 subjects had taken time of work due to their dermatitis. Postal survey demonstrated the poor prognosis of HD in metalworkers. Most remained symptomatic whether or not they continued with oils or metals. Unemployment or a change of job had a little effect on the outcome.
Stingeni L, et al.	1995	Healthcare	212	Cross sectional	2+	212 cleaners and kitchen workers being contacted 12 months after attending a seminar (Nov 04 - Oct 06 seminars) to ascertain disease status and impact on quality of life using a QL and Skindex-29 survey. These scores were than standardised. The disease was found to have occurred for more time in men than in women. Only 20.8% reported using emollients on a regular basis. 48.6% reported absence from work. In terms of QL, it was found that the older a worker was, the lower the QL score was. Only 130/212 subjects were interviewed one year on. In 32% there had been no change. 23% were no longer in their former occupation, 9% of all given up due to skin disease. The authors report a greater use of protective measures one year after the seminar.

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APPENDIX: ELECTRONIC SEARCHES

Two electronic databases were used to access papers as follows:

MEDLINE	1950 to 2009
EMBASE	1980 to 2009

The following limits were applied to the searches:

Papers with abstracts
Humans
English

The electronic databases were last searched on 30th September 2009.

Search strategy

Generalising search terms produced a huge number of abstracts. Combinations of search terms were used to narrow down the papers and find the right balance between too many and too few papers to address scoping questions.

Scoping question topic area	Search terms
Dermatitis & urticaria	"contact dermatitis" OR urticaria OR hives
	AND
Work related	Work OR occupation*
	AND
Frequency, jobs, causes	incidence OR prevalence OR surveillance OR reporting
Personal risk factors	OR risk OR hand\$wash* OR "hand rinse" OR immerse* OR "dermatologic agent" OR "wet work"
	OR atopy OR asthma OR rhinitis
	OR haplotype OR HLA OR genetic OR family
	OR employment OR prospect* OR "mult\$agents" OR lik* OR synerg*
Pre-placement / pre-employment	OR "at risk" OR recruit\$ or pre\$exist* OR pre\$employment OR pre\$placement OR pre\$dispose* OR history
Effectiveness of risk assessments, education programmes, risk communication and training	OR "risk assess*" OR "risk communication" OR "health education" OR "health promotion"
Effectiveness of health surveillance and self-examination	OR "health surve*" OR "health screen*" OR examin*
Effectiveness of protective gloves, barrier creams, skin care creams in prevention	OR prevention OR " prevent* measures" OR control\$ OR substitute* OR "hand protect*" OR gloves OR cream\$ OR emollient\$
Investigation and management	OR diagnos* OR "skin prick test\$" OR "patch test\$" OR investigation\$ OR treat* OR "therapeutic management" OR care
What is the impact of occupational dermatitis or urticaria on the worker?	OR prognosis OR "social factors" OR outcome OR redeploy* OR adjust* OR adapt OR "social implications" OR "medical implications"
What evidence is there for benefit of rehabilitation and redeployment	OR rehabilitat* OR re\$employ* OR "return to work"

Key to operators used

Boolean search operators AND, OR and SAME were used to combine terms.

- AND used to find records containing *all* terms separated by the operator.
- SAME to find records where the terms separated by the operator appear in the same sentence. A sentence is defined as:
 - the title of an article;
 - a sentence in the abstract; or
 - a single address
- OR used to find records containing any of the terms separated by the operator.

Wildcards were used in all search fields that allowed words and phrases. They were used in a search query to represent unknown characters.

- The asterisk (*) represents any group of characters, including no character.
- The question mark (?) represents any single character.

The dollar sign (\$) represents zero or one character Wildcards in MEDLINE (given in the table above) were slightly different to the wildcards used in EMBASE. The equivalent wildcards were used in the EMBASE search.

