Final Report

To the

British Occupational Health and Research

Foundation

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GLOSSARY

ACD	Allergic contact dermatitis
ICD	Irritant contact dermatitis
OCD	Occupational contact dermatitis
OCU	Occupational contact urticaria
ODREC	Occupational dermatology research and education centre
OSD	Occupational skin disease
PPD	Paraphenylenediamine
PPE	Personal protective equipment
PPOD	Persistent post occupational dermatitis

EXECUTIVE SUMMARY

Occupational contact dermatitis (OCD) is a skin condition caused by work-related exposures. It occurs in workers who are exposed to irritating or allergenic substances, or specific physical factors in the workplace. There are limited previous studies assessing prognosis in occupational contact dermatitis.

With support from the British Occupational Health and Research Foundation, we have recently undertaken 2 years of research into occupational contact dermatitis: outcomes, prognostic factors and assessment.

Research has undertaken in four different areas:

SkinWatch: This is a long term follow up study of patients previously diagnosed with occupational contact dermatitis. Key outcomes to date from this study include:

- 225 people reassessed, 123 assessed in person
- Development of a skin exposure assessment tool (SEAT)
- Development of an Occupational contact dermatitis outcome algorithm
- Data supports results from previously published studies
- 24% clear and 42% clear with occasional flare at follow up
- Worker outcomes described in OCDOA scores
- Identification of 21 cases of Persistent post occupational dermatitis (PPOD)
- Data collection on psychosocial impact of occupational contact dermatitis

Future analysis from this data will include:

- Describing demographics for patients developing PPOD
- Identification of factors contributing to PPOD
- Full assessment of psychosocial impact of OCD
- Assess ICD and ACD as prognostic factors
- Assess other variables as prognostic factors (age, sex, job change), patient knowledge of disease, attendance at follow up and job change

This work has already been presented at several international meetings and first publications have recently been submitted.

Short term follow up study: This study was undertaken because of the difficulty in tracing patients in the long term follow up study. Patients were assessed between 4-6 months after initial diagnosis with OCD in the clinic. Key outcomes from this study include:

- 63 patients assessed (over 96% patients contacted)
- Short term prognosis appears better than that seen in SkinWatch
- Identification of some patients who have already failed to improve (24%)
- 10% did not follow treatment advice
- 20% did not follow avoidance advice
- 6% failed to use appropriate PPE
- Highlights the importance of a review clinic in cases of OCD, especially where there is a lack of improvement.

This work has been presented at international meetings and will be published in due course.

Hand washing study: Wet work is a major cause of occupational ICD of the hands. Some countries (Germany) have legislation to monitor those at risk, whilst others (Australia) have produced guidelines. However, these guidelines are based on expert opinion with little supporting scientific data. This study was undertaken to assess the number of times people wash their hands during a day. It was also used to validate a question from the Skin exposure assessment tool (SEAT). Key outcomes from this study include:

- Data collected of 54 patients
- Average mean hand washing during day was 12
- Significant correlation between recorded hand washing and each of three day assessments and the average
- Females washed their hands more than males
- Patients with hand eczema washed their hands less than those with no hand eczema
- Validation of the question 'How many times do you wash your hands during a day?'

This work has been presented nationally and will be published in due course.

Hazard surveillance in the workplace: Several countries collect epidemiological data on occupational contact dermatitis and this has lead to an increasing understanding of those workers most at risk and the primary diagnosis. However, there has been little research into the area of hazardous exposures to the skin in the workplace. This study investigated exposures to wet work, powdered latex gloves and uncured epoxy resin in four different work groups: healthcare workers, hairdressers, food handlers and epoxy resin handlers. These groups were chosen as workers are at significant risk of OCD. Key outcomes from this study include:

- Data collected on 200 workers
- Data collected using modified SEAT questionnaires
- Hairdressers inappropriately wore latex gloves, which were almost always powdered
- In most circumstances healthcare workers wore appropriate non powdered latex or nitrile gloves, with the exception of two cases where vinyl gloves were worn, which provide suboptimal protection from blood borne pathogens
- Epoxy resin workers often wore gloves which do not offer sufficient protection from epoxy resins
- Food handlers, hairdressers and healthcare workers washed their hands many times during a working day, and often more than recommended by national and international guidelines
- Moisturiser use was suboptimal in those who performed wet work, suggesting the need for a comprehensive skincare program in workplaces

Other key outcomes from this research include:

- 15 publications in international peer reviewed journals
- 14 oral presentations at international meetings
- 5 poster presentations at international meetings

Dr Jason Williams will submit areas of the above work for his MD, registered at the University of Manchester. We anticipate that as further work is presented at international meetings it will subsequently be published in international peer reviewed journals.
A copy of the final MD will be supplied to BOHRF on acceptance by the University of Manchester. Further publications stemming from this work will continue to acknowledge the support of the BOHRF and will be made available to the BOHRF.

OCCUPATIONAL CONTACT DERMATITIS

Background

Contact dermatitis is a skin condition caused by external factors, particularly substances, interacting with the skin. It predominantly affects the hands in occupational cases, although other exposed areas may be involved, such as the arms and face. There are 3 main types of contact dermatitis. Approximately 75% of occupationally related cases are caused by irritant contact dermatitis (ICD) and 25% by allergic contact dermatitis (ACD). Approximately 1% of cases are caused by contact urticaria (CU).[1]

While there are many causes of occupational skin disease (OSD), the major cause in approximately 90% of cases is OCD. Sometimes the diagnosis of OCD is not straightforward and is complicated by pre-existing atopic eczema or hand eczema. People with a history of atopic eczema are more likely to experience OCD. In addition, it is quite common for individuals to have a combination of these conditions.

Irritant Contact Dermatitis

What is irritant contact dermatitis?

ICD is caused in an acute setting when strongly acidic or alkaline substances contact the skin, damaging its natural barrier function. ICD can also be caused by the cumulative effect of substances, such as water, soaps, detergents and solvents. These substances dry and irritate the skin, eventually causing an inflammatory reaction. Wet work is a significant risk factor for ICD. [2] Wet work has been defined as where:

- any part of your body is in water or other liquids for longer than 2 hours a shift
- any part of your body is in waterproof or other occlusive personal protective clothing for longer than 2 hours a shift
- wet objects are handled for longer than 2 hours a shift
- hands are washed more than 20 times a shift

Predisposing factors – Atopy, hand eczema

People who have an atopic background, that is, past eczema, asthma or hayfever, or a strong family history of these conditions, are at higher risk of developing ICD.[3] In addition, people who are not atopic but have a background of hand eczema are also at increased risk.[4]

Diagnosis

There is no routine diagnostic test for ICD. The diagnosis may be suspected from the clinical history of the condition and exposure to workplace irritants. It is frequently necessary to perform patch testing to exclude ACD, as these forms of contact dermatitis can appear similar or may coexist.

Treatment and prevention of irritant contact dermatitis

There are a number of factors that are important in the treatment and prevention of ICD. These include reduced exposure of the skin to contact with irritants by substitution where possible, awareness of risk factors for the development of ICD and appropriate preventative measures, use of personal protection and skin care.

Allergic Contact Dermatitis

What is allergic contact dermatitis?

ACD is caused by a reaction known as delayed hypersensitivity (Type IV immune response) to a chemical which contacts the skin and which has the ability to induce an allergic reaction. The skin reaction is often delayed, occurring some 24-48 hours after skin contact, and may take days or even weeks to settle.

A chemical that has the potential to cause an allergic reaction is called an allergen, however only approximately 3% of all chemicals are allergens. For example, solvents are frequent causes of skin irritation but not allergy. The development of an allergic reaction to a particular chemical is a mechanism unique to certain individuals, whereas all people may develop skin irritation given sufficient exposure to an irritant. Sensitisation to a substance may occur after days, weeks or years of exposure. Once a person is sensitised, the allergy is likely to be lifelong.

If the skin is already damaged or irritated, such as with preceding ICD, there is an increased likelihood of developing ACD. This condition can have a similar appearance to that of ICD, although it may be more severe. Initially the rash may only appear in the site of contact with the allergen. A rash may appear in other areas as a result of spread via hands contaminated with the allergen; or even in sites which have never been in contact with the allergen.

Diagnosis

Patch testing is a technique used by dermatologists to diagnose ACD. There are over 400 commercial allergens that are available for testing and in addition, patients are tested to their own samples, appropriately diluted, from work. Allergens are applied to the patient's back for two days, and then the patient is reviewed after a further two to four days, when an interpretation is made of any reactions. Chemicals which may irritate the skin are generally not used for testing.

When an individual develops a positive patch test reaction, the relevance and work-relatedness of the reaction must be considered. This is done after consideration of the individual's work environment and the use of the Mathias criteria.[5] This set of criteria uses objective measures that assess the probability of a causal relationship with employment.

Sometimes a positive test reaction occurs because of previous sensitisation to a chemical, and thus the reaction is classed as being of past relevance only eg to nickel, present in costume jewellery.

Common causes of allergic contact dermatitis

The most common causes of occupational ACD at the Occupational Dermatology Clinic at the Skin and Cancer Foundation in Melbourne are rubber accelerators and vulcanisers used in the manufacture of rubber gloves, chromate in leather and cement, hairdressing allergens such as paraphenylenediamine (hair dye), ammonium persulphate (hairdressing bleach) and glyceryl monothioglycolate (perming solution) and epoxy resins.[6]

Treatment and prevention of allergic contact dermatitis:

This is similar to the treatment and prevention of ICD and involves awareness of potential allergens, substitution of allergens where possible, and skin protection. In

cases of ACD where other measures have failed, job modification or even change may be required.

Contact Urticaria

What is contact urticaria?

CU is caused by an immediate hypersensitivity reaction (Type 1 immune response). It usually presents as reddening and itching of the skin, within fifteen minutes of skin contact with an allergen, which is usually a protein-containing substance such as natural rubber latex or some foods.

The skin usually returns to normal within a few hours after contact ceases, although an ongoing inflammatory skin reaction may develop. This ongoing reaction generally occurs where there is repeated exposure to a causative allergen, such as when people who are allergic to latex continue to wear latex gloves.

Latex allergy is of special concern because of the risk of anaphylaxis, which is a life threatening allergic reaction. This can occur in an individual who has direct contact with latex, but has also been reported in people who eat food prepared by personnel wearing latex gloves. Latex allergy is more likely to occur in workers who frequently use products containing latex, such as healthcare workers, in workers whose skin is already damaged, such as with pre-existing irritant contact dermatitis and in those who have an atopic background. Use of powdered latex gloves further increases the risk as the powder appears to facilitate transfer of the latex allergen to the skin.

Synthetic gloves that do not contain latex include those made of vinyl, nitrile, neoprene or polyurethane. Vinyl gloves, whilst suitable for food handlers, do not offer appropriate protection against infectious agents found in bodily fluids. Nitrile gloves are suitable for this purpose.

Diagnosis

Prick testing is used to test for this type of allergy, by pricking small amounts of substances into the skin and observing the reaction over 15-30 minutes. Radioallergosorbent testing (RAST) is also performed, and is preferred when screening for latex allergy, since severe reaction may develop on prick testing.

Causes

These include natural rubber latex from powdered latex gloves and raw proteins from seafood, red meat, chicken, some fruits and vegetables and flours, as handled by chefs and bakers. In addition, ammonium persulphate or bleach, used in hairdressing, may also cause contact urticaria.

Treatment and prevention of contact urticaria

This involves awareness of potential allergens, use of gloves where possible, and skin protection. Use of powdered, disposable latex gloves should be avoided by all workers.

International and Local Rates of Occupational Contact Dermatitis

Available statistics indicate that OCD presents a considerable occupational disease burden. Incidence rates have been estimated at between 50-190 cases per 100,000 full time workers per year in western industrial countries.[7] However, estimations of the incidence and prevalence of OCD vary *from one country to another. The reasons for this variation are not definitely established.*.

Sources of information include national occupational disease registers, workers' compensation data and voluntary reporting schemes. It is also recognised that many

cases of OCD never reach medical attention, hence studies of workplaces reveal higher rates of disease than workers' compensation data or clinic based studies.[8] Furthermore, when workers do seek medical care, the medical practitioner may not always recognise the occupational cause or contribution.

Studies have generally indicated that 90-95% of occupational skin disease is comprised of contact dermatitis.[9]

Some occupations are associated with a higher risk of developing OCD than others, depending upon the nature of exposure in the workplace. It has been proposed that occupations may be classified as 'exceedingly high-risk', having an incidence rate of at least 70 cases per 100,000 workers and 'high risk' having between 30-70 cases per 100,000 workers.[11] The ranking of various high-risk occupations may vary between reporting centres and also between countries, depending upon a range of factors including specific working conditions.

Prognosis in Occupational Contact Dermatitis

The prognosis of a disease has been referred to as a forecast of the probable course of the disease. Research has indicated that the prognosis of OCD is often poor, although there is marked variation between published studies. According to published rates, between 20-80% of individuals with OCD will continue to be affected after a minimum of six months from the time of initial diagnosis[12-14]. Reported predictive factors include a background of atopy, age of the affected worker, causative agent and length of exposure to causative agent.

In 1972, Burrows reported on 113/184 patients with severe cases of OCD, who had been assessed for medico-legal reports 10-13 years earlier, by himself or one other physician.[12] In this study, patients were interviewed and examined by the author, 79% were still having problems with OCD.

Since the first follow up study of contact dermatitis reported in 1938,[15] there have been less than a dozen studies on the outcome of OCD, where the patients have been re-examined. In a number of reports, patients have been re-assessed by different doctors. The majority of studies have been conducted by questionnaire, either completed by the patient without supervision, or by telephone.

The early literature was comprehensively reviewed by Hogan in 1990.[16] It was stated that "Many workers with occupational dermatitis do not recover for unknown reasons. It has been suggested that the capacity of the skin to repair itself may become exhausted or that contact dermatitis may enter a self-perpetuating cycle or that endogenous eczema is triggered by contact dermatitis." In a later review article,[17] Hogan listed factors, identified in previous studies, which may be important in persistent dermatitis. In his opinion, the chief reasons for persistence included: misdiagnosis, continued exposure to irritants, iatrogenic contact dermatitis from topical medicaments, atopy, chronicity, continued exposure to allergens, insufficient advice to patients, non-dermatologic factors, endogenous hand dermatitis and multifactorial hand dermatitis. He commented that "workers with severe hand dermatitis usually requires 2-10 weeks off work, and some never fully recover….It is clear both on clinical experience and basic immunologic investigations, that both irritant dermatitis and allergic dermatitis may precipitate a self-perpetuating cycle of dermatitis". He also alluded to work by Edman:[18]

"It is clear that the more the patient knows about their relevant allergens and irritants, the better the prognosis"

Holness and Nethercott[13] reported work outcome with follow-up of 230 of 339 workers utilizing a telephone questionnaire, at least 2 years (mean 4 years) post-diagnosis of patients seen between 1980-86. The original diagnoses were ACD (38%), ICD (52%), atopic eczema (7%) and psoriasis (3%). They found that 40% of workers reported having ongoing problems with their skin. 78% were still working, but 57% of those had changed their job, 67% of those changing had done so because of their skin condition. 31% had lost no time from work, while 35% had lost more than one month. Only 43 % had applied for workers compensation and of those 87% had received it. It was found that older workers were more likely to not be working and to have applied for workers' compensation. There were no significant differences in work and compensation outcomes between those with ACD and those with ICD. As with much of the older literature the outcome of OCD in this study was relatively poor. Factors important were age, sex, occupation, diagnosis and physician advice.

In a review article which included occupational and non-occupational contact dermatitis, [19] Goh pointed out that it was difficult to compare outcome studies because of a lack of standardization of the assessment of clinical improvement, persistence and worsening of dermatitis. In addition there were difficulties with performing these studies. These included recalling patients, getting patients to re-attend, finding suitable control groups and lack of accurate clinical records. However, he suggested that studies post 1990 were associated with better patient outcomes.

In 2002 a report was published on prognosis for patients who had been initially reported to the United Kingdom voluntary surveillance scheme EPIDERM.[20] Dermatologists or occupational physicians, who had originally referred the patients to the EPIDERM study, were sent questionnaires asking for additional follow-up information on their patients' dermatitis. Nearly one in six of their study population (49/313) showed no improvement between the initial and the final visit. The three factors which were associated with time off work were: age, a diagnosis of ACD and attendance at the reporting clinic for a medicolegal assessment. Failure to improve was associated with longer exposure to the causative agent

There is limited data on age of the affected worker as a predictive factor for OCD. This issue warrants further investigation. In some industries, where younger workers (apprentices) are at increased risk of OCD, it is likely that a proportion of these choose to leave the industry if the OCD persists, often with significant improvement in OCD and hence outcome. In other industries, e.g. engineering, there is an increasing acceptance that hands may become "burnt out" after years of cumulative exposure to irritants or allergens. With repeated exposure, the skin takes longer and longer to recover, until it fails to do so.

References

1. Occupational contact dermatitis in Australia, April 2006. The Office of the Australian Safety and Compensation Council. Available: www.ascc.gov.au

2. Diepgen TL, Fartasch M. General aspects of risk factors in hand eczema. In: Menne T. Maibach HI (eds) Hand eczema. CRC Press, Boca Raton, 1993, pp 141-156.

3. Coenraads PJ, Diepgen TL. Risk for hand eczema in employees with past or present atopic dermatitis. *International Archives of Occupational & Environmental Health* 1998; 71: 7-13.

4. Lammintausta K. *Hand eczema*, Second edn. Boca Raton: CRC Press, 2000.

5. Mathias CG. Contact dermatitis and workers' compensation: criteria for establishing occupational causation and aggravation. *Journal of the American Academy of Dermatology.* 1989; 20: 842-8.

6. Williams JDL, Matheson MC, Frowen KE, Noonan AM, Dharmage SC, Nixon RL. Occupational contact dermatitis: A review of 12 years of data from an occupational dermatology clinic. Submitted for publication

7. Diepgen TL, Coenraads PJ. The epidemiology of occupational contact dermatitis. *International Archives of Occupational & Environmental Health* 1999; 72: 496-506.

8. Nixon R, Frowen K. Allergic contact dermatitis to epoxy resins. *J Occup Health Safety* 1991; 7: 417-24

9. Lushniak BD. The epidemiology of occupational contact dermatitis. *Dermatol Clin* 1995; 13: 671-80.

10. Keegel T, Cahill J, Noonan A, Dharmage S, Saunders H, Frowen K, Nixon R. Incidence and prevalence rates for occupational contact dermatitis in an Australian suburban area. *Contact Dermatitis* 2005; 52:254-9.

11. Dickel H, Kuss, O.,Blesius, C.R., Schmidt, A., Diepgen, T.L. Occupational skin diseases in Northern Bavaria between 1990 and 1999: a population based study. *Brit J Dermatol* 2001; 145: 453-62.

12. Burrows D. Prognosis in industrial dermatitis. *Br J Dermatol* 1972: 87: 145-148.

13. Holness DL, Nethercott JR. Work outcome in workers with occupational skin disease. *Am J Ind Med* 1995: 27: 807-815.

14. Wall LM, Gebauer KA. A follow up study of occupational skin disease in Western Australia. *Contact Dermatitis* 1991 24: 241-3

15.

16. Hogan DJ, Dannaker CJ, Maibach HI. The prognosis of contact dermatitis. *J Am Acad Dermatol* 1990: 23: 300-307.

17. Hogan DJ. The prognosis of occupational contact dermatitis. *Occup Med* 1994: 9: 53-58.

18. Edman B. The usefulness of detailed information to patients with contact allergy. *Contact Dermatitis* 1988: 19: 43-7.

19. Goh CL. Prognosis of contact and occupational dermatitis. *Clin Dermatol* 1997: 15: 655-9.

20. Adisesh A, Meyer JD, Cherry NM. Prognosis and work absence due to occupational contact dermatitis. *Contact Dermatitis* 2002: 46: 273-9

The aims of the SkinWatch project are to:

- Identify and evaluate poor prognostic factors for occupational contact dermatitis
- Describe the clinical entity of 'persistent post occupational dermatitis'
- Describe risk factors for 'persistent post-occupational dermatitis'
- Identify differences in prognosis for those with irritant vs allergic contact dermatitis
- Characterise prognosis for different allergens in occupational allergic contact dermatitis
- Compare the differences in outcome in patients diagnosed with significantly vs partially work-related contact dermatitis
- Characterise prognosis in different occupational and industry groups
- Describe effect of job modification or change on outcome
- Develop and validate a skin exposure assessment questionnaire for use by medical and occupational health practitioners internationally, to aid assessment of skin exposure to irritants and allergens over time

Skin Exposure Assessment Tool

The 'gold standard' for diagnosis of ACD is the patch testing procedure. Where positive tests are found, and relevance shown, a diagnosis of ACD can be made, whilst the diagnosis of ICD is one of exclusion: the presence of a dermatitis, exposure to known irritants and negative patch tests having excluded allergy. One difficulty, which has been highlighted in the literature, is that patch testing has reportedly only 70% sensitivity and 50% relevance[1]. Diepgen and Coenraads have suggested that there are individuals who will be wrongly classified as ICD or ACD, because of the inherent inefficiencies in the patch testing procedure[2].

One important recent approach has been to assess dermal exposure in the workplace. This rapidly increasing field has recently been reviewed[3], with the majority of work emanating from the field of occupational hygiene. One European study, RISKOFDERM[4], has developed a toolkit for dermal exposure risk management. The toolkit has been designed for use by employers, safety officers, technical staff and consultants in companies, and requires access to hazard labels on products, safety data sheets, information on the specific exposure at the workplaces, and possibly further supplementary information only available from product suppliers. The toolkit therefore requires extensive knowledge about a particular hazard and the exposure level to produce a risk scoring. After data has been input, a risk score is produced, and suggestions are made as to how this risk may be reduced. The authors acknowledge that the toolkit has several limitations: high uncertainty about the data input regarding both chemical hazard and level of exposure; and concerns with regards the algorithms used to develop the overall risk score. Overall, the toolkit is useful for rough estimation of risk for a particular worker task where details on chemical hazard and level of exposure are known.

In 1999, Schneider et al. proposed a consistent terminology based on a compartment model for assessment of dermal exposure[4]. They described a model with six compartments, two barriers and eight transport processes. They highlighted the importance of measuring the concentration of contaminant and not mass per area in the skin contaminant area. They subsequently proposed a measurement strategy for dermal exposure assessment based on a tiered approach[5]. According to this approach,

chemical substances used in the workplace and their toxicity are first identified. Subsequently, patterns of work and sources of dermal exposure are described. Finally, a semi-quantitative assessment of dermal exposure should be performed. If dermal uptake of hazardous substances cannot be ruled out, a quantitative assessment of dermal exposure should be performed.

There are few validated semi-quantitative dermal exposure tools applicable to the workplace. Within the United Kingdom, the UK Health and Safety Executive has developed a knowledge-based model called EASE (Estimation and Assessment of Substance Exposure).[6] EASE was originally developed as a screening tool for regulatory risk assessments for new chemicals to be introduced into the European market, and its developers accepted that any uncertainty should result in an overestimation of exposure. The model has been compared to Schneiders' conceptual model to determine the appropriateness of its structure.[7] More recent work has highlighted weaknesses in the model, with gross overestimations of skin exposure being seen from the predictive model.[8]

A separate group have developed a method for semi-quantative dermal exposure assessment (DREAM),[9] with the specific aim of evaluating occupational dermal exposure to chemical agents, to be used in occupational hygiene. DREAM has also been based on Schneiders' theoretical model.[4] It consists of two sections, an inventory and an evaluation. The inventory part consists of a hierarchically structured questionnaire with six modules: company, department, agent, job, task and exposure. Within the department module, specific information is collected on chemical or biological agents that occur in the work environment and cleaning activities at the department. Within the agent module, the physical characteristics of the substances is explored, including concentration of active ingredients, physical state, boiling temperature, viscosity, formulation (powder, granules), dustiness and stickiness. Information on hygiene and number of people in this job is collated in the job section. The percentage of time spent performing each task and the number of people performing the task is collected in the task section. The probability and intensity of dermal exposure routes (per body part), the use of clothing (per body part) and contamination of the workplace are explored in the final module. The evaluation part involves all variables being assigned numerical values (which increase or decrease the final score), and these are summed to produce a final score: the total actual dermal exposure estimate at job level. The group did acknowledge the limitations of the DREAM tool. Firstly, the values assigned to the exposure determinants were educated assumptions. Secondly, the tool estimates exposure at a task level, and therefore requires thorough definition of tasks for reproducibility of results. Finally, the tool is time consuming, taking about 15- 20min to assess exposure for one person carrying out one task. One benefit is that tasks may be ranked according to their DREAM score, enabling easier and more targeted hazard reduction at the workforce and individual worker level. The results from DREAM have been shown to be replicable between observers.[10]

Apart from these assessment tools, the majority of the literature on dermal exposure has focused on specific measurement of dermal exposure in individual tasks[11], individual occupational groups[12,13] or with individual chemical substances[14-17].

The majority of work on dermal exposure has therefore emanated from the field of occupational hygiene. Whilst dermatology groups have developed questionnaires for surveys of dermatitis, they have often focused on dermatitis affecting specific areas of

the body and have been designed to aid the estimation of dermatitis in the general population[18,19] or in a specific population of workers[20,21].

The most comprehensive attempt to develop a questionnaire-tool for surveying occupational skin diseases and skin exposures is the Nordic Occupational Skin Questionnaire (NOSQ-2002),[22] which has been specifically developed and validated to aid surveys on occupational skin disease and exposures to environmental factors. It consists of two questionnaires, a short questionnaire designed for screening possible work-related skin disease, and a long questionnaire designed as a more in-depth survey-tool for research purposes. The short questionnaire is an excerpt of the long questionnaire, and only includes the most important questions needed to estimate the prevalence of hand dermatitis in a population. Whilst it is quick and easy to use as a screening tool, it provides limited information with regards the underlying cause of the dermatitis and is best considered a screening tool to estimate the prevalence of dermatitis in a general population. The long questionnaire includes more detailed questions on patient demographics and occupational history, history of atopic symptoms, exacerbating factors of dermatoses, consequences and life impact of dermatoses, skin symptoms, exposures, general health, household size and self-reporting of contact urticaria or eczema on the hands or forearms. The specific exposure section includes important questions on glove use, and the chemical agents to which the individual is exposed at work, questions about potentially relevant exposures at home, and one question on hand washing. Information gained from this more in-depth survey can be used to assess the relative importance of different environmental exposures. However, there are drawbacks in that it has limited information on specific exposures and their duration. The questionnaire is designed solely for assessment of hand dermatitis, and little information is collected relevant to other body areas.

In summary, the majority of information on dermal exposure emanates from the field of occupational hygiene, and is targeted at the individual assessment of a single task with a single chemical or hazard. There is no questionnaire-based tool to aid the investigation of occupational or non-occupational dermatitis in the clinical setting, which could help the clinician differentiate the exposures leading to the diagnoses of ICD and ACD and assist in the determination of work-relatedness. Such a tool should be relatively quick and simple to perform and include information on exposures in the workplace and at home.

We developed a skin exposure assessment tool based on the questionnaires currently available and personal experience of the common causes of ACD and ICD. The tool is divided into 11 sections, and takes approximately 15 minutes to complete. Early validation work is covered under hand washing data. The finalized Skin Exposure Assessment Tool (SEAT) is APPENDIX 2. .

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References

1. Nethercott JR. Practical problem in the use of patch testing in the evaluation of patients with contact dermatitis. *Curr Probl Dermatol* 1990; **2:** 97-123
2. Diepgen TL, Coenraads PJ. The epidemiology of occupational contact dermatitis. *Int Arch Occup Environ Health* 1999; **72:** 496-506.
3. Oppl R, Kalberlah F, Evans PG, van Hemmen JJ. A toolkit for dermal risk assessment and management: an overview. *Ann Occup Hyg* 2003; **47:** 629-40.
4. Schneider T, Vermeulen R, Brouwer DH, Cherrie JW, Kromhout H, Fogh CL. Conceptual model for assessment of dermal exposure. Occup Environ Med. 1999 Nov;56(11):765-73.
5. Schneider T, Cherrie JW, Vermeulen R, Kromhout H. Dermal exposure assessment. *Ann Occup Hyg* **44:** 493-9.

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6. Cherrie JW, Tickner J, Friar J et al. (1996) Evaluation and further development of the EASE model 2.0 HSE Research Report 136. HSE Books, ISBN 0 7176 2714 4.
7. Creely KS, Tickner J, Soutar AJ, Hughson GW, Pryde DE, Warren ND, Rae R, Money C, Phillips A, Cherrie JW. Evaluation and further development of EASE model 2.0. *Ann Occup Hyg* 2005; **49:**135-45.
8. Hughson GW, Cherrie JW. Comparison of measured dermal dust exposures with predicted exposures given by the EASE expert system. *Ann Occup Hyg* 2005; **49:** 111-123
9. Van-Wendel-de-Joode B, Brouwer DH, Vermeulen R, Van Hemmen JJ, Heederik D, Kromhout H. DREAM: a method for semi-quantitative dermal exposure assessment. *Ann Occup Hyg* 2003; **47:** 71-87.
10. van Wendel de Joode B, van Hemmen JJ, Meijster T, Major V, London L, Kromhout H. Reliability of a semi-quantitative method for dermal exposure assessment (DREAM). *J Expo Anal Environ Epidemiol* 2005; **15:**111-20.
11. Hughson GW, Aitken RJ. Determination of dermal exposures during mixing, spraying and wiping activities. *Ann Occup Hyg* 2004; **48:** 245-55.
12. van der Jagt K, Tielemans E, Links I, Brouwer D, van Hemmen J. Effectiveness of personal protective equipment: relevance of dermal and inhalation exposure to chlorpyrifos among pest control operators. *J Occup Environ Hyg* 2004; **1:** 355-62.
13. Monge P, Partanen T, Wesseling C, Bravo V, Ruepert C, Burstyn I. Assessment of pesticide exposure in the agricultural population of costa rica. *Ann Occup Hyg* 2005; 49: 375-84
14. Fransman W, Vermeulen R, Kromhout H. Occupational dermal exposure to cyclophosphamide in Dutch hospitals: a pilot study. *Ann Occup Hyg* 2004; 48: 237-44.
15. Lind ML, Boman A, Surakka J, Sollenberg J, Meding B. A method for assessing occupational dermal exposure to permanent hair dyes. *Ann Occup Hyg* 2004; **48:** 533-9
16. van Wendel de Joode B, Tielemans E, Vermeulen R, Wegh H, Kromhout H. Dermal exposure assessment to benzene and toluene using charcoal cloth pads. *J Expo Anal Environ Epidemiol* 2005; **15:** 47-50.
17. Eriksson K, Wiklund L. Dermal exposure to styrene in the fibreglass reinforced plastics industry. *Ann Occup Hyg*. 2004; **48:** 203-8. Epub 2004 Mar 2.
18. Smit AH, Coenraads PJ, Lavrijsen AP Nater, JP. Evaluation of a self-administered questionnaire on hand dermatitis. *Contact dermatitis* 1992; **26:** 11-16
19. Meding B, Swanbeck G. Prevalence of hand eczema in an industrial city. *Br J Dermatol* 1987; **116:** 627-634
20. Berg 1, Axelson O. Evaluation of a skin questionnaire for facial skin complaints related to work at visual display units. *Contact Dermatitis* 1990; **22:** 71-77
21. Wrangsjo K, Wallenhammar LM, Ortengren U, Barregard L, Andreasson H, Bjorkner B, Karlsson S, Meding B. Protective gloves in Swedish dentistry: use and side-effects. *Br J Dermatol* 2001 Jul;145(1):32-7
22. Susitaival P, Flyvholm MA, Meding B, Kanerva L, Lindberg M, Svensson A, Olafsson JH. Nordic Occupational Skin Questionnaire (NOSQ-2002): a new tool for surveying occupational skin diseases and exposure. *Contact Dermatitis* 2003; 49: 70-6

Occupational Contact Dermatitis Outcome Algorithm

In previous follow up studies, there have been many different outcomes of occupational dermatitis. These include:

(i) Clinical outomes including complete improvement, partial improvement or no improvement at all[1-12];
(ii) Occupational outcomes, including whether workers are able to remain in the same job, perform modified duties, work in a different job or are unable to work at all [1, 4, 5, 9, 11];
(iii) Financial and medico-legal outcomes, involving whether workers' compensation is received or not and the financial impact on the worker [5, 11,12];
(iv) Psychosocial outcomes and impact on quality of life [13-16].

In a recent review, it was observed that the majority of outcome studies in occupational contact dermatitis (OCD) reported a poor rate of complete healing (mean 37.7%); however, most studies reported a higher rate of improvement (mean 80.2%) [17]. Increased patient knowledge and earlier diagnosis appeared to be associated with an improved prognosis, whereas job change did not make a significant difference. A number of variables have been suggested in the literature as possible risk factors for poor prognosis. These include the effects of older age, atopy, duration of dermatitis, female sex, severe impairment of quality of life at baseline and allergy to particular substances, such as chromate [11, 12, 17].

OCD has a significant impact on quality of life [13-17]. Some patients develop persistent post-occupational dermatitis (PPOD), which was originally defined as an ongoing skin disease for which there was no obvious present cause and where that skin disease had been precipitated by prior development of occupational skin disease [1, 18].

During the SkinWatch study, we developed the concept of an algorithm to express the different clinical outcomes encountered. This algorithm was modified during the study. The aim of the algorithm was to be able to assist clinicians to ascertain why some workers do not achieve optimal resolution of their dermatitis and thus identify strategies for future management. See APPENDIX 3.

The explanation for the clinical progress observed is outlined in Table 4 and expressed in the algorithm, APPENDIX 3. This includes just one major explanation per patient, although if there were multiple reasons, these were also recorded. The most common reason for failure to improve was patients either declining or being unable to follow the advice given to avoid exposures. The algorithm was broadly divided into reasons associated with improvement of OCD and reasons associated with ongoing dermatitis, although sometimes this had improved compared to baseline. Some of the differences between categories were subtle but nevertheless thought to be important.

Major reasons for improvement included reduction of relevant exposures and appropriate treatment.

1 Modification of work practices. This included relatively minor changes at work, such as wearing gloves or a different type of gloves.

2 Task/work modification. This incorporated a more substantial change in work duties, such as a theatre nurse scrubbing less often to reduce exposure to wet work.

3 Job change. The patient was employed in a different job with different work practices.

4 Company change-employer decision. The employer terminated the job task, for example bringing in a mechanical dish washer and sacking the individual.

5 Company change-employee decision. The patient was employed doing the same job for a different company, but with improved work practices.

6 Non-occupational exposure reduction. An important non-occupational exposure was identified and reduced.

7 Treatment-suitable. Many patients could manage their skin condition once they had suitable treatment (19).
8 Excessive or inappropriate treatment. One patient had not experienced dermatitis for years and yet still continued to attend his dermatologist twice weekly for phototherapy!

Major reasons for lack of improvement or ongoing dermatitis included continuing exposures, inadequate treatment, diagnostic complexity, pre-existing or underlying skin condition, new skin condition or persistent post-occupational dermatitis [1, 18].
10 Original occupational exposure-lack of understanding. This was exemplified by workers who did not understand that they were still being exposed to their allergen, such as a cement worker with chromate allergy who continued to wear leather boots.
11 Patient declined or unable to follow advice. This important and large group included those who chose to continue working, predominantly with irritants, such as healthcare workers. Many workers chose to put up with their dermatitis rather than consider alternative duties.
12 Original exposure-company declined to reduce exposure. This was exemplified by a worker who reacted to a cutting oil, but the company declined to change the oil and the worker decided to continue working despite dermatitis.
13 New work exposure. This included exposure to a different irritant or allergen identified at follow up appointment.
14 Original non-occupational exposure. This included exposures which were actually non-occupational in the first instance and ongoing. It was exemplified by a worker caring for small children at home, involving appreciable wet work.
15 New non-occupational exposure. Again, this was often contributed to by domestic exposure to wet work, such as child care.
16 Inadequate treatment-advice given to patient. Sometimes this problem could be compounded by the pharmacist dispensing a corticosteroid cream, not an ointment, or advising that such treatment only be used for short period of time, for example 7 days. Sometimes the patients could not recall receiving written advice about skin care.
17 Inadequate treatment-patient unable to comply. The patient may not have been able to travel long distances for a specialized treatment or been able to afford the costs of treatment. Alternatively they may have been advised to apply emollients more regularly than they were able to do at work.
18 Inadequate treatment-patient declined. The patient may have declined to follow up with a dermatologist or general practitioner or just been unable to follow the advice given in the clinic.
19 Complexity of diagnosis. The patient may not have understood all the factors contributing to their skin problem, so that issues such as wet work or latex allergy were not addressed. This was especially important in cases where there were multiple contributing factors to their skin condition.
20 Pre-existing or underlying skin condition. As the study included those with partially work related conditions, they may have also had underlying conditions such as hand eczema, atopic eczema or psoriasis.
21 New skin condition. Some patients developed definite psoriasis or other skin conditions which they mistakenly assumed to be a continuation of the previously diagnosed OCD.
22 Persisting post-occupational dermatitis (PPOD). When the skin condition appeared to be initiated by work, and initially improved away from work but then persisted (even if cyclical) and there was no new patch test allergen or exposure to irritants to account for the persistence, then PPOD was diagnosed. It is admittedly difficult in this context to distinguish PPOD from a new case of endogenous hand eczema. However the key features remain the occupational onset and initial improvement away from work [1,18].

Patients and Methods

Study population

Individuals diagnosed with occupational contact dermatitis (OCD) who attended the Occupational Dermatology Clinic between January 1997 and December 2003 were eligible for entry into the study. Their dermatitis was classified to be substantially or partially work-related. An example of partially work-related dermatitis would be a patient with pre-existing hand eczema or atopic eczema whose condition was worsened by occupational factors, but not wholly caused by the occupation.

Inclusion criteria

All individuals were diagnosed with substantially or partially work-related OCD at least two years, maximum 8 years, prior to the commencement of the study. (1997-2003).

Information to be collected/ Study instruments

Previous literature describing the prognosis of OCD was used to identify possible variables considered to be associated with poor OCD prognosis. Additional demographic questions were based on questions used in 2003 in the National Census Questionnaire (Australian Bureau of Statistics). Additional questions were designed to collect more precise detail regarding workers' compensation, retention of clinician recommendations made at the original diagnosis and about the experience of living with persistent occupational contact dermatitis. The questionnaire also included two internationally validated data collection tools, the Dermatology Life Quality Index (20) and the Nordic Occupational Skin Questionnaire (NOSQ) (21). The NOSQ has full instructions for translation from the English master copy. The NOSQ was deliberately written in professional language with instructions for translation from the English master copy into local layperson terms, easily understood by the target population.

These questions were combined into an interviewer-administered questionnaire. There were two forms of this questionnaire, with a short question version used over the telephone with individuals who declined to attend for a clinical assessment, but gave verbal consent to answer questions. The long version of the questionnaire was administered face-to-face by an interviewer after obtaining written consent from the study participant.

Questionnaire modification, translation and piloting

After ethics approval, both the long and short versions of the questionnaire was modified and translated into layperson terms as recommended by the NOSQ, using a focus group. The focus group consisted of potential study participants, as well as interviewers and the chief investigator. After modification the questionnaires were piloted with attendees from the Occupational Dermatology Clinic,

Clinical assessment

Study participants had their skin condition reviewed by the clinician who made their initial diagnosis (RN). Information obtained through the clinical assessment was recorded using a standard data collection form. The study participant's skin condition was rated on

a four point scale (clear, clear with occasional flares, persistent with occasional clearing, persistent) in relation to their original diagnosis.

Ethics

This study was approved by the Human Research Ethics Committee based at St. Vincent's Hospital, Melbourne, Victoria, Australia (HREC 025/02). All patients used in this study gave their consent at initial presentation.

Results

Response rate

Of the 225 who agreed to an appointment n=123 attended, and n=102 completed a telephone interview. Excluding those who are deceased, this was a response rate of 30.2% (225/744) (Table 1). It represented 48.9% of those who were contactable. Non-responders were found to be significantly younger at time of diagnosis and were more likely to have hay fever (Table 2).

Table 1: Response rate to follow up

Total	750
Attended in person	123 (16.4)
Telephone interview	102 (13.6)
Refused by mail	122 (16.3)
Refused by telephone	113 (15.1)
Post office undeliverable	68 (9.1)
Uncontactable	216 (28.8)
Deceased	6 (0.8)

Table 2: Comparison of responders and non-responders

Characteristics	Responders N=225	Non-Responders N=524	P value
Age at 1st appointment	39.5	34.9	**0.00001**
Age at follow-up	45.7	41.3	**0.00001**
Gender - male	117 (51.8%)	278 (53.1%)	0.747
Atopic	97 (42.9 %)	211 (40.3%)	0.498
Family history - asthma	49 (21.7%)	125 (23.8%)	0.518
- eczema	57 (25.2%)	102 (19.5%)	0.077
- hayfever	46 (20.4%)	100 (19.08%)	0.687
Personal history – asthma	53 (23.5%)	116 (22.1%)	0.693
- eczema	46 (20.4%)	118 (22.5%)	0.510
- hayfever	89 (39.4%)	154 (29.4%)	**0.007**
Initial major diagnosis			
Irritant contact dermatitis	91 (40.3)	232 (44.3)	
Allergic contact dermatitis	72 (31.9)	166 (31.7)	
Endogenous eczema	33 (14.6)	53 (10.1)	
Psoriasis	8 (3.5)	17 (3.2)	
Contact urticaria to latex	11 (4.9)	17 (3.2)	
Non latex contact urticaria	5 (2.2)	13 (2.5)	
Persisting post-occupational dermatitis	1 (0.4)	3 (0.6)	

Other	5 (2.2)	22 (4.2)	
Not known	0 (0.0)	1 (0.2)	**0.501**

Clinical outcome

Table 3 lists the clinical outcomes, both subdivided into 4 clinical categories and into improvement or ongoing dermatitis. Overall, 65.8% of people followed up were either clear or 'clear with occasional flare' at follow-up (Table 3). No significant differences existed in demographic factors for those patients with different clinical outcomes. Even when patients reported considerable improvement, we observed that following an episode of dermatitis, they often reported that their skin was more easily irritated by factors such as heat, sweating, skin irritants and stress. We termed this "post occupational dermatitis skin sensitivity".

Table 3: Clinical outcome

Characteristics	Responders N=225 (%)
Clear	53 (23.6)
Clear with occasional flare-up	95 (42,2)
Persistent with occasional clearance	45 (20.0)
Persistent dermatitis	24 (10.7)
Unknown	8 (3.5)

Occupational Contact Dermatitis Algorithm

The explanation for the clinical progress observed is outlined in Table 4 and expressed in the algorithm, APPENDIX 3. This includes just one major explanation per patient, although if there were multiple reasons, these were also recorded. The most common reason for failure to improve was patients either declining or being unable to follow the advice given to avoid exposures. The algorithm was broadly divided into reasons associated with improvement of OCD and reasons associated with ongoing dermatitis, although sometimes this had improved compared to baseline. Some of the differences between categories were subtle but nevertheless thought to be important.

Table 4: Occupational dermatitis outcomes

Outcome	N (%)
Reasons for improvement	
1 Work practices changed	24 (10.6)
2 Task or work modification	20 (8.9)
3 Job change	20 (8.9)
4 Company change-employer decision	1 (0.4)
5 Company change-employee decision	2 (0.9)
6 Non-occupational exposure reduced	1 (0.4)
7 Suitable/appropriate treatment	11 (4.9)
8 Excessive/inappropriate treatment	1 (0.4)
9 Reason for improvement unknown	1 (0.4)
Reasons for ongoing dermatitis	
10 Continued exposure-lack of understanding	1 (0.4)
11 Continued exposure-patient declined/unable to follow advice	41 (18.1)
12 Continued exposure-company declined to follow advice	4 (1.8)
13 New work exposure	4 (1.8)
14 Original non-occupational exposure	3 (1.3)
15 New non-occupational exposure	8 (3.5)
16 Treatment inadequate - advice	6 (2.7)
17 Treatment inadequate-pt unable to comply	3 (1.3)
18 Treatment inadequate-pt declined to comply	0
19 Complexity of diagnosis	2 (0.9)
20 Pre-existing/underlying skin condition	9 (4.0)
21 New skin condition	24 (10.6)
22 Persistent post-occupational dermatitis	33 (14.6)
Missing	6 (2.2)

Questions for clinicians when workers fail to improve

Based on the algorithm, Table 5 provides a list of questions to assist the clinician in deciding the main reasons why a worker has not improved. The emphasis is on detecting lack of understanding of the diagnosis and all the factors contributing to the skin condition, continuing exposures and sub-optimal skin care and treatment. New skin conditions need also to be considered, as well as exposures to new irritants and allergens. Finally PPOD is the diagnosis of exclusion.

Table 5: Questions for the clinician in cases of persisting OCD

1. Questions relating to diagnosis
What was the skin condition(s) that was/were diagnosed and the advice given? (worker recall)
2. Questions relating to exposures
What were the relevant occupational irritants, allergens and urticants?
What exposure is there currently to these factors?
Does the worker experience improvement away from work? Did they previously?
What changes in job, work practices or tasks have occurred to reduce exposures?
What personal protection is being used and how often?
Are there problems relating to glove use eg heat, sweating?
3. Questions relating to treatment
What skin care measures and prescription treatments are being used? How often?
Did the worker have time off work for their skin to heal?
Did the worker follow up with treating practitioner?
4. Questions relating to compensation claim/workplace response
How has the workplace assisted the worker?
5. Other
Are there any non-occupational or occupational exposures that may be relevant?
Are there any new or different skin conditions?
Is repeat patch testing necessary to exclude new allergens?

Discussion

This study has described contributing factors to the outcomes of OCD. Outcomes may be different: they may be classified by the clinical outcome of hand dermatitis, effects on work, financial and medico-legal outcomes and the effect on the person, assessed as quality of life. We have chosen to subdivide our algorithm based on clinical measures initially, better or worse, and then these are subdivided according to the reasons thought most apt in each individual worker's case. Some have particular relevance to the state-based workers' compensation systems in Australia, where workers with dermatitis may choose not to submit a workers' compensation claim and remain working.

Workers may improve for a variety of reasons, such as reduced exposure to allergens and/or irritants through modification of work practices or behavioural change; job modification and actual job change, which may be either voluntary or forced. Workers may fail to improve because of continuing exposure, and this is a particular problem for many nurses, who often cannot continue to work without ongoing exposure to wet work, antiseptic skin cleansers which are irritants or occlusive gloves, causing sweating. Other reasons for failure to improve may include new exposures, either occupational or non-occupational, inadequate treatment, diagnostic complexity, pre-existing or underlying skin condition or a new skin condition. In clinical practice, we have combined this with a pathway to target future therapies or investigations. In total, we have identified 22 reasons why people improve, or fail to improve. Persistent post-occupational dermatitis is number 22, the diagnosis of exclusion.

The majority of respondents managed their OCD by behavioural means, that is, avoiding the tasks that were associated with exposures which caused their dermatitis. This provides further evidence that job change is certainly not inevitable in OCD.

The questions in Table 5 provide some guidance to assist clinicians in their deciding why a worker with OCD has failed to improve. This clinical scenario is not uncommon, and this study has confirmed previous findings that a significant number of workers fail to recover from OCD (1-12). In our series, with a follow up period of 3-9 years, 33 workers (14.6%) developed PPOD (Table 4). While most of these workers were characterised with persistent dermatitis (Table 3), some were also classified as "persistent with occasional clearance". This proportion is similar to that reported by Wall and Gebauer[1]. The OCD of 23.6% had cleared completely and 42.2% were predominantly clear. Those with PPOD were diagnosed on the basis that they had had avoided irritants and allergens, complied with appropriate treatment and yet experienced persistent dermatitis, although it may be cyclical in nature.

It was therefore necessary to patch test a number of patients again, to exclude allergic contact dermatitis to a new allergen. Of these, 2 had developed new, relevant allergies, including a nurse who had become allergic to ingredients of a hand wash used at work. This emphasises the importance of considering the possibility of new diagnoses in this group of patients and being prepared to re-patch test them again as necessary. PPOD remains a difficult and somewhat subjective diagnosis to make clinically, however we believe that it is important to recognise its existence, in order to ensure that affected workers are able to access worker's compensation [18].

We also noted that some patients whose dermatitis had improved still complained that there skin was more sensitive than previously, to a variety of factors such as heat, sweating, skin irritants and stress. We termed this "post occupational dermatitis skin sensitivity" (PODSS) and hope to comment more on this phenomenon when the final Skin Watch study results are published.

A total of 225 workers agreed to participate, representing a disappointing response rate of 30.4%. Non responders were likely to be younger and had less hay fever but otherwise there were no significant differences (Table 1). This response rate compares poorly to the study reported by Wall and Gebauer from Perth, Australia[1]. Historically, studies emanating from Perth and also Tasmania in Australia have been associated with high follow up rates, as a result of the relatively small populations present in those areas and their tendency not to move away. By contrast, follow up rates in Melbourne and Sydney tend to be lower[6]. In addition, workers attending the Occupational Dermatology Clinic are generally from a lower socio-economic demographic, performing manual work, and are hence less likely to have their own homes, making tracing more difficult even in an election year with the resources of the Australian Electoral Office. In fact 37.9% were uncontactable. When adjusted for those who were not contactable or deceased, the follow up rate was 48.9%.

Patients with persistent disease (with or without clear periods) were more likely to be unable to avoid exposures in their work. They may have decided to accept a degree of OCD in order to keep working in their trade or profession. This was generally the case in those patients with persistent disease with occasional clear periods (20.0%). Surprisingly in 24 (10.6%) of cases, people had actually developed another, non occupational skin condition, such as psoriasis. Sometimes they had developed eczema and we have previously noted that eczema may be precipitated by occupational dermatitis[22].

In conclusion, we believe that this study contributes to the literature on outcomes in OCD. We have developed an algorithm to characterise outcomes in OCD and have applied it to this group of patients. We believe that the algorithm and the questions generated by it, can assist the clinician to systematically examine reasons why a worker's dermatitis has not improved.

Further analysis of the collected data will seek to explore the following areas:

- Explore ACD and ICD as prognostic factors for OCD
- Explore age and sex as prognostic factors for OCD
- Descriptive paper for PPOD patients (33 identified)
- Prognostic factors for PPOD development
- Psychosocial impact of OCD

References

1. Wall L M, Gebauer K A. A follow-up study of occupational skin disease in Western Australia. *Contact Dermatitis* 1991: 24: 241-3.
2. Burrows D. Prognosis in industrial dermatitis. *Brit J Dermatol* 1972: 87: 145-8.
3. Fregert S. Occupational dermatitis in a 10-year material. *Contact Dermatitis* 1975: 1: 96-107.
4. Keczkes K, Bhate S M, Wyatt E H. The outcome of primary irritant contact dermatitis. *Br J Dermatol* 1983: 109: 665-8.
5. Holness D L, Nethercott J R. Work outcome in workers with occupational skin disease. *Am J Ind Med* 1995: 27: 807-15.
6. Rosen R H, Freeman S. Prognosis of occupational contact dermatitis in New South Wales, Australia. *Contact Dermatitis* 1993: 29: 88-93.
7. Nethercott, J R, Holness D L. Disease outcome in workers with occupational skin disease. *J Am Acad Dermatol* 1994: 30: 569-74.
8. Goh C L. Prognosis of contact dermatitis following secondary preventive measures. *Curr Probl Dermatol* 1996: 25: 154-62.
9. Adisesh A, Meyer J D, Cherry N M. Prognosis and work absence due to occupational contact dermatitis. *Contact Dermatitis* 2002*:* 46: 273-9.
10. Jungbauer F H W, van der Vleuten P, Groothoff J W, Coenraads P J. Irritant hand dermatitis: severity of disease, occupational exposure to skin irritants and preventive measures 5 years after initial diagnosis. *Contact Dermatitis* 2004: 50: 245-51.
11. Meding B, Lantto R, Lindahl G, Wrangsjo¨ K, Bengtsson B. Occupational skin disease in Sweden- a 12-year follow-up. *Contact Dermatitis* 2005: 53: 308-13.
12. Cvetkovski R S, Zachariae R, Jensen H, Olsen J, Johansen J D, Agner T. Prognosis of occupational hand eczema. *Arch Dermatol* 2006: 142: 305-11.
13. Hutchings C V, Shum K W, Gawkrodger D J. Occupational contact dermatitis has an appreciable impact on quality of life. *Contact Dermatitis* 2001: 45:17-20.
14. Kadyk D L, Hall S, Belsito D V. Quality of life of patients with allergic contact dermatitis: an exploratory analysis by gender, ethnicity, age and occupation. *Dermatitis* 2004: 15: 117-24.
15. Lazarov A, Rabin B, Fraidlin N, Abraham D. Medical and psychosocial outcome of patients with occupational contact dermatitis in Israel. *J Eur Acad Dermatol Venereol* 2006: 20: 1061-5.
16. Cvetkovski R S, Zachariae R, Jensen H, Olsen J, Johansen J D, Agner T. Quality of life and depression in a population of occupational hand eczema patients. *Contact Dermatitis* 2006: 54: 106-11.

17. Cahill J, Keegel T, Nixon R. The prognosis of occupational contact dermatitis in 2004. *Contact Dermatitis* 2004; 51:219-226
18. Sajjachareonpong P, Cahill J, Keegel T, Saunders H, Nixon R. Persistent post-occupational dermatitis. *Contact Dermatitis* 2004: 51:278-283.
19. Moyle M, Keegel T, Noonan A, Nixon R. Skin care in occupational contact dermatitis of the hands. *Australas J Dermatol* 2006: 47: 97-101.
20. Finlay A Y, Khan G K. The Dermatology Life Quality Index: a simple practical measure for routine use. *Clin Exp Dermatol* 1994: 19: 210-216.
21. Flyvholm, M-A, Nordic Occupational Skin Questionnaire - NOSQ-2002. Nordic questionnaire for surveying work-related skin diseases on hands and forearms and relevant exposures. 2002: Copenhagen, Nordic Council of Ministers. TemaNord 518.
22. Williams J, Cahill J and Nixon R. Occupational autoeczematisation or atopic eczema precipitated by occupational contact dermatitis? *Contact Dermatitis* 2007: 56:21-26.

SHORT TERM FOLLOW UP

The decision was made to undertake a short-term follow up study of patients attending the ODREC clinic diagnosed with OCD for two reasons:

1. The difficulty in tracing patients in the long term study
2. Poor patient recall of diagnosis and advice when assessed in the SkinWatch study

The poor patient knowledge of original diagnosis in the SkinWatch study was apparent and it was important to clarify whether this was caused by the delay between diagnosis and review or whether this lack of knowledge was apparent earlier. The poor recall of original diagnosis and advice also highlighted the need for the institution of a review clinic or reinforcement phone call.

Study Population
Individuals diagnosed with occupational contact dermatitis who attended the Occupational Dermatology Clinic between January 2006 and September 2006 were entered into the study.

Inclusion Criteria
All individuals were diagnosed with substantially or partially work-related OCD during the trial period.

Information to be collected/ Study instruments
Basic demographic data and data on diagnosis and severity was collected at time of diagnosis. Information on recommended treatment and advice was also collated. Patients were subsequently reviewed in clinic or contacted by telephone between 4 and 6 months after original diagnosis. Information on clinical progress was collated at time of review. Further information on understanding of diagnosis, use of personal protective equipment, following of treatment regimen and OCDOA outcomes was also collected.

Ethics
As this project was taking the form of a review clinic it was not necessary to obtain formal ethical approval.

Results
A total of 63 patients were reviewed in person or by telephone during the study period.
Table 1 summarises the basic demographic data for these patients.

Table 1 : Summary of baseline assessment

	N (%)	
AGE N=63	33.8±13.0	17-63
Duration of skin problem N=66	1.35 (0.7-3)	
SEX		
- Male - Female	28 (41.8) 39 (58.2)	
Current Smoker		
- No - Yes - missing	33 (49.3) 25 (37.3) 9 (13.4)	
Primary Diagnosis (N=67)		
Endogenous Irritant CD Allergic CD Contact Urticaria Latex Allergy Psoriasis PPOD Other Missing	6 (9.0) 31 (46.3) 21 (31.3) 4 (6.0) 1 (1.5) 1 (1.5) 1 (1.5) 2 (3.0) 2 (3.0)	
Severity of skin disease as assessed by the doctor N=65	Median (IQR) 3 (1-6)	Mean (SD) 3.51 (2.67)
Severity of skin disease as assessed by the patient over the 2 months N=67	8 (6-9)	7.13 (2.75)
Severity of skin disease as assessed by the patient today N=67	4 (2-6)	4.24 (2.88)
ODDI score N=66	3 (2- 4)	3.09 (1.19)
Treatment		
A Soap substitute	63 (94.03)	
B Moisturiser	64 (95.52)	
C steroid treatment	57 (85.07)	
D Other	19 (28.36)	
E allergen irritant avoidance	61 (91.04)	
F PPE change/use	38 (56.72)	
G Time off work	9 (13.43)	
H Review		
- nil - ODREC - Dermalogist - GP - Other - missing	15 (22.4) 28 (41.8) 13 (19.4) 2 (3.0) 5 (7.5) 4 (6.0)	
Doctors Prognosis		
- Good - Fair - Poor - missing	38 (56.7) 23 (34.3) 4 (6.0) 2 (3.0)	

Table 2 presents the information collated at review. This data shows that 70% of patients were clear or clear with only an occasional flare up at the time of follow up. The patient understanding of diagnosis was good or fair in 79% of cases. However, 7/57 patients had not followed their treatment regime and nearly 20% had not followed avoidance advice.

Table 2 : Summary of Follow-up assessment

	N (%)	
Clinic Progress		
Clear	26 (38.8)	
Clear occasional flare-up	21 (31.3)	
Persistent occasional flare-up	12 (17.9)	
Persistent	4 (6.0)	
missing	4 (6.0)	
Patient understanding of diagnosis		
Good		
Fair	31 (46.3)	
Poor	22 (32.8)	
missing	7 (10.5)	
	7 (10.5)	
Current ppe glove		
No	4 (5.97)	
Yes	43 (64.18)	
missing	20 (29.85)	
Current Skin care hand washing		
1 Excessive	1 (1.49)	
2 Adequate	52 (77.61)	
3 Inadequate from Dr	1 (1.49)	
4 Inadequate from patient	3 (4.48)	
Missing	10 (14.93)	
Current Skin care emollient regime		
1 Excessive	0 (0.0)	
2 Adequate	46 (68.7)	
3 Inadequate from Dr	3 (4.5)	
4 Inadequate from patient	4 (6.0)	
Missing	14 (20.9)	
Treatment - No	7 (10.45)	
- Yes	50 (74.63)	
- missing	10 (14.93)	
Avoidance - No	13 (19.40)	
- Yes	45 (67.16)	
- missing	9 (13.43)	
PPE Use - No	4 (5.97)	
- Yes	26 (38.81)	
- missing	37 (55.22)	
Time off - No	1 (1.49)	
- Yes	6 (8.96)	
- missing	60 (89.55)	
Review - No	1 (1.49)	
- Yes	20 (29.85)	
- missing	46 (68.66)	
Severity assessed by doctor today	Mean 0.5 (IQR0-2)	

n=16	1.375 (1.821172)	
Severity assessed by patient last 2mths n=62	2 (1-3) Mean 2.39 (Std. Dev. 2.13)	
Severity assessed by patient today n=63	Median 1 (IQR 0-3)	

Severity of the dermatitis at the time of assessment was graded by both doctor and patients on a scale of 0-10 and by the patients as an average of the last 2 months. Table 3 shows the correlation for these assessments.

Table 3: Correlation between severity of skin disease as assessed by the patient and their doctor at baseline assessment.

	Patient assessment - over the last 2mths	Patient assessment - today
Doctor assessment - today	Intraclass correlation = 0.39678 Asy S.E.= 0.31871 (95% CI= 0.00000,1.02145)	Intraclass correlation = 0.86446 Asy S.E.=0.10256 (95% CI= 0.66344,1.06547)
Patient assessment - over the last 2mths		Intraclass correlation = 0.64128 Asy S.E.= 0.15513 (95% CI=0.33723,0.94533)

School of Population Health
Comment: This is the correlation between two assessments. 0.40 is moderate correlation.

School of Population Health
Comment: This is very good corrlation

School of Population Health
Comment: The confidence intervals give the possible range of results for the correlation between these two outcomes for a sample such as thisone.

So you can say you have 95% confidence that the true correkation, between the patients and the doctors assessment of their skin disease severity on the day of assessment, falls between 0.66 and 1.0.

These figures show that we can have 95% confidence that the true correlation, between the patients and the doctors assessment of their skin disease severity on the day of assessment, falls between 0.66 and 1.0.

The OCDOA classification for patients at time of follow up is shown in Table 4. Patients with multiple OCDOA scores have had their scores graded into order of priority. As the majority of patients had improved, the OCDOA classification mainly explains reasons for improvement, with the most common reason for improvement being behavioural change on behalf of the worker. In pure numerical terms, adequate treatment was nearly as commonly considered to be partially responsible for improvement.

Table 4 :OCDOA grades in total group

OCDOA	Primary Result	Secondary Result	Tertiary Result
N=67	N (%)		
1 behaviour	31 (46.27)	1 (1.49)	
2 job	3 (4.48)		
3 job change	9 (13.43)	1 (1.49)	
6 non-occupational		1 (1.49)	
7 suitable	5 (7.46)	26 (38.81)	
9 unknown	1 (1.49)		
10 lack of understanding	2 (2.99)		
11 pt declined/unable to follow	5 (7.46)	5 (7.46)	7 (10.45)
12 company declined	1 (1.49)		1 (1.49)
13 new work exposure			1 (1.49)
14 original non-occ		1 (1.49)	
16 inadequate advice	1 (1.49)		
17 pt unable to comply		1 (1.49)	
20 Pre-existing/underlying skin			1 (1.49)

condition			
21 other diagnosis	1 (1.49)	1 (1.49)	2 (2.99)
22 PPOD	1 (1.49)	1 (1.49)	1 (1.49)
23 PODSS			1 (1.49)
missing	7 (10.45)	29 (43.28)	53 (79.10)

Table 5 shows the OCDOA scores for patients with the initial diagnosis of ACD or ICD.

Table 5 : OCDOA grades by primary diagnosis

OCDOA	ICD	ACD
	N=31	N=21
1 behaviour	14 (45.16)	11 (52.38)
2 job	0 (0.0)	1 (4.76)
3 job change	4 (12.90)	4 (19.05)
7 suitable	1 (3.23)	1 (4.76)
9 unknown	1 (3.23)	0 (0.0)
10 lack of understanding	0 (0.0)	2 (9.52)
11 pt declined/unable to follow	3 (9.68)	0 (0.0)
12 company declined	0 (0.0)	1 (4.76)
21 other diagnosis	1 (3.23)	0 (0.0)
22 PPOD	1 (3.23)	0 (0.0)
missing	5 (16.13)	1 (4.76)

It is clear that the single case of PPOD diagnosed at initial assessment had not cleared. All patients unable to follow the advice given to them had ICD as the primary cause of their dermatitis.

Table 6 shows the actions and recommendations made at the time of follow up assessment.

Table 6 : Actions and recommendations

	Total N (%)	ICD N=31	ACD N=21
Nil Further	31 (46.27)	24 (77.4)	12 (57.1)
RAST/Prick Testing	1 (1.49)		
Patient Education	7 (10.40)		4 (19.0)
Patient & Workplace Education	1 (1.49)		1 (4.76)
Workplace Education	2 (2.99)		2 (9.52)
Skin care	3 (4.48)	3 (9.68)	
Patient Education & skin care	2 (2.99)	2 (6.45)	
Skin care & prescription	1 (1.49)		1 (4.76)
prescription	4 (5.97)	1 (3.23)	1 (4.76)
Other treatment & patient education	1 (1.49)	1 (3.23)	
Missing	14 (20.90)		

Discussion

The breakdown for primary diagnoses made at initial assessment is broadly similar to that seen in the SkinWatch study, implying that data obtained from this short-term study may be extrapolated. The mean age is lower than that seen in the SkinWatch study (34 yrs vs 39 yrs. The proportion of males in this study is less than was seen in the SkinWatch study (42% in this study vs 52% in SkinWatch). The vast majority of patients

diagnosed with OCD In the clinic are given advice on the use of appropriate use of moisturizers, soap substitutes, topical steroid use and allergen/irritant advice. 72% of patients had a review recommended with a health care professional.

At the time of review, 39% of patients were clear and a further 33% of patients were clear with an occasional flare. These results are slightly better than those seen in the SkinWatch study (24% and 42% respectively). This difference appears to be due to a number of patients being initially clear, some of whom may go on to have occasional flares. The percentage of patients with only occasional clear periods or persistent disease is broadly similar in each study, suggesting that there a cohort of patients in whom we are not able to obtain a significant improvement. This study suggests that these patients may be easily identified at an early stage, allowing further education and more intensive treatment where required. Understanding of diagnosis was good or fair in 46% and 33% respectively. Whilst this is reassuring, 11% of patients had a poor understanding of their diagnosis. This is concerning as recall of advice will only deteriorate over time. This would again suggest that it is important to review and reiterate advice given. 10% of patients failed to follow advice given on appropriate treatment and 19% of patients failed to follow avoidance advice. These figures are higher than we would expect. The lack of use of treatment would suggest that some patients are happy to tolerate some degree of skin problems compared with the onerous nature of some treatment regimes. Presumably those patients not following avoidance advice are those in whom the recall of advice was low, though we have not looked for this correlation. (% of workers had required further time of work for appointments or treatment or skin related illness. This highlights the impact of OCD on the worker and workplace.

There is a good correlation for assessment of severity between patient assessment of dermatitis and doctor assessment of dermatitis on the day. This supports the validity of data collected from similar questions asked to patients in a telephone interview.

The OCDOA scores are similar for both the short term and SkinWatch studies. The number of PPOD cases is lower in this short term study. Presumably in some of those patients with persistent disease we currently blame this on continued exposure. However, in longer term reviews, if the exposures are reduced and disease continues then these patients may be diagnosed with PPOD only at that time. The main reason for workers failure to improve is declining/ being unable to follow the advice given in both studies. In the short term study this figure is only realized if primary, secondary and tertiary results are considered. Even in the short term study, one patient had continued disease because the diagnosis had changed. This supports the data seen in the SkinWatch study. It is clear that follow up studies should ideally include re-examination wherever this is possible to ensure that alternative diagnoses are excluded.

In patients with both the primary diagnosis of ACD and ICD, the main reason for improvement was behavioural change, followed by job change. It is expected that the majority of patients unable to follow advice given to them would have a primary diagnosis of ICD. An example of this would be the theatre nurse whose primary diagnosis is ICD due to glove occlusion and frequent hand washing. It is not possible for such a worker to significantly modify her work duties without changing the nature of the job ie it is not possible to avoid wearing gloves or washing hands. However, if the main problem is ACD to a glove or hand wash constituent, then this can normally be avoided.

Finally, a significant percentage of workers with both ACD and ICD needed further intervention after reassessment. This was most marked in those patients with ACD, where a number of patients and workplaces needed further education. A significant number of patients with a primary diagnosis of ICD needed to improve their hand care and further education with regard hand care.

This study supports the data derived from SkinWatch. It also highlights the importance of worker education and supports the institution of regular follow up clinics in workers with OCD. It also suggests that those workers with a poor prognosis may be identified early in follow up, This would have important implications in targeting these workers with further education, improved treatment, or early redeployment.

HAND WASHING DATA

Background: It is well recognized that wet work is a cause of occupational irritant contact dermatitis (OICD).[1]Those workers most at risk of OICD include food handlers, hairdressers and healthcare workers.[2] Some countries, including Germany, have introduced wet work regulations (TRS 531: wet work) which defines wet work as spending over 2 hours per day exposed to a wet environment/ wearing occlusive gloves or where workers must wash their hands regularly.[3] Other countries have introduced wet work guidelines including Australia, facilitated by the Occupational Dermatology Research and Education Centre.

However, whilst wet work is recognized as a cause of OICD, the point at which wet work becomes a problem is poorly understood. The legislation and guidelines mentioned above were based on available scientific evidence and expert best opinion. Research in the area is limited. It was evident that there was a need to estimate the average number of times that an individual washes their hands, so that these guidelines could be supported. Asking the frequency of hand washing is part of the routine assessment of patients with hand dermatitis. The accuracy of the answer has not been studied, though this has a direct influence on whether hand washing is identified as a risk factor for occupational ICD of the hands.

The skin exposure assessment tool (SEAT) developed during the SkinWatch project also needed validating. Validation of individual questions from the SEAT was considered to be the best approach.

The aim of this study was to estimate the frequency of hand washing in a general population chosen randomly from patients attending the occupational dermatology or general patch testing clinics at the Skin and Cancer Foundation. A further aim was to assess the validity of the answers to the question 'How many times do you wash your hands during a day?'

Methods: Patients attending the occupational dermatology or general patch testing clinics at the Skin and Cancer Foundation were asked the question 'How many times do you wash your hands per day?' The answer given was recorded. Further demographic data was collected including age, sex, presence of atopy, presence of hand dermatitis, whether a diagnosis of occupational ICD was made (affecting the hands) and whether this was the primary diagnosis. The patients were then asked to keep a log for the next three days of how many times they washed their hands. All analyses were conducted using STATA (version 6; STATA Corporation, Texas) statistical package. Contingency tables were analysed using Chi-square test. Fisher's exact tests were used when one or more expected values were less than 5. Potential differences between proportions were assessed using the 2-sample test of independent proportions. A p value less than 0.05 was considered statistically significant.

Results: 54 participants answered the question and subsequently logged the number of times that they actually washed their hands using a 'tick chart'. The majority (81.5%) were female. Hand dermatitis was present in 72% of participants. Atopy was present in 72%, hand washing was a factor in ICD of the hands in 39% and was the primary factor in 28%. The mean number of times that participants washed their hands was 12. There was a significant correlation between the actual recorded hand washing and the estimated hand washing for each of the three days assessments and the overall average ($p<0.0001$). Females washed their hands significantly more than males (12.9 vs 7.92, $p=0.02$) whilst those with a work-related diagnosis washed their hands significantly less than those without (10.4 vs 14, $p=0.04$). There was a tendency for those with hand dermatitis to wash their hands less than those without (11.3 vs 13.5, $p=0.23$) though this

was not significant. Age, the diagnosis of hand washing as a factor in hand dermatitis and hand washing as the primary were not significantly related to frequency of hand washing.

Conclusions: It is not surprising that females wash their hands more often than males. Whilst participants in this study have not been chosen from the general population, it is likely that this data could be extrapolated. The fact that those with a work-related skin condition washed their hands less than those with non-occupational skin disease is surprising. This may possibly be explained by the female preponderence in the study. Females are more likely to have been drawn from the general patch test clinic, whilst the males are more likely to have come from the occupational clinic. Hand washing is a less important cause of occupational skin disease in males, where irritation is more often caused by solvents. It is to be expected that those with a history of atopy wash their hands less than those with no such history. Presumably patients with an atopic diathesis are counseled on the importance of minimizing hand washing and washing in general to limit irritation.
Finally, these findings confirm the validity of the question 'How many times do you wash your hands during a day?' in the assessment of hand washing as a factor in hand dermatitis. This supports the use of a similar question in the SEAT and starts the validation process.

References

1. D1 Jungbauer FH, Lensen GJ, Groothoff JW, Coenraads PJ. Exposure of the hands to wet work in nurses. Contact Dermatitis 2004: 50: 225-9
2. Williams JDL, Matheson MC, Frowen KE, Noonan AM, Dharmage SC, Nixon RL. Occupational skin disease: A review of 12 years data from an occupational dermatology clinic. *Submitted to British Journal Dermatol*
3. D3 TRGS 531 (Technische Regeln für Gefahrstoffe) German wet work regulations.

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Having developed the SEAT, it was decided to use a modified SEAT questionnaire to assess hazards in the workplace. There is an increasing literature on the epidemiology of OCD. However, there is little literature on the hazards that workers are exposed to in the workplace. It was decide to survey healthcare workers, hairdressers, food handlers and epoxy resin handlers as they are at significant risk of either ICD, ACD or contact urticaria, all of which are potentially avoidable.

Methodology
By modifying and simplifying the SEAT questionnaire and adapting it to four different populations of workers: those in healthcare, hairdressers, food handlers and users of epoxy resins, it was decided to interview a non-randomised population of workers in the above industries (total number 200 people, spread across the industries, with workplaces identified from our clinic contacts). Basic demographic questions were to be asked, including questions relating to the presence of rashes on the hands and information on exposures. At the time of the interview, a brief examination of the hands was also undertaken. Some of the workers counted the number of times that they are exposed to certain hazards such as washing their hands, to help validate their answers in the survey. No personally identifiable data was to be collected on any individuals, at any time.

The questionnaires were developed for our four groups, nurses, hairdressers, food handlers and users of epoxy resins. The questionnaire was converted into a format suitable for on-line completion via our website by a consultant in this area. It was proposed that this questionnaire would be computer-based but that interviews would be conducted in person and the answers either directly entered into the computer or entered from a paper copy later. Local experts working in the area of occupational asthma were asked to provide a validated questionnaire for the presence of occupational asthma, but none was available. A literature search was also unhelpful, so participants were just asked about the existence of any job-induced wheeze.

Results and Discussion

Whilst the intention was to perform the interview in person in order to check for the presence of dermatitis, this was not possible in all 203 cases and 22 completed the survey by telephone.

In these occupations there was a predominance of females (70%). There was quite a marked background of atopic eczema in the food handlers (33.3%) and healthcare area (22.1%) but particularly in hairdressing (43.2%). Similarly, there was a history of asthma in 25.1% of the total sample.

We have also observed surprisingly high rates of atopic eczema in hairdressers' previously,[1] which underlines the need for pre-employment counselling[2] and the implementation of guidelines for atopics in this high risk profession for OCD.[3]

As might be expected, those who worked in healthcare were the most qualified, with the majority completing a university degree.

Table 2 also includes the existence of dermatitis on their hands on the day of examination and over the past year. Fifty seven workers or 28.1% of the total reported

dermatitis on their hands over the last year, while 27 or 13.3% admitted to dermatitis on the day of examination. Hairdressers had the highest rate of dermatitis over the past year (37.8%) and just slightly more dermatitis on examination day (18.9%) than food handlers.

Users of epoxy resin are more likely to experience ACD not ICD caused by wet work. Excluding that group from analysis, 30.7% of the "wet work" professions, healthcare, hairdressing and food handling reported dermatitis on their hands in the last year.

Overall, people with dermatitis in the past 12 months were significantly more likely to be female (OR 2.5, 95% 1.12-5.6 p=0.03) and more likely to be younger (p=0.07). There was no relationship between age and sex with dermatitis reported on day of interview.

Participants were asked to rate their skin from 0 to 10, when 0 is normal skin and 10 is the worst it could be. This rating system is utilised in the Occupational Dermatology Clinic, as when people attend for assessment, their hands have often improved with treatment and it provides a guide as to the severity of their dermatitis. The interviewers also have experience with using the same rating system. The rating by the participant was generally less but similar to the interviewer: for the people who reported dermatitis on the day of interview (n=27) the correlation between consultant and patient rating of severity of dermatitis was moderate but significant (0.46, p=0.02).

Although they were not specifically asked in the questionnaires, it was our impression that relatively few of the participants had sought medical care for their dermatitis. This corroborates our previous findings that dermatitis is often considered by workers to be "part of the job" and that medical attention is only occasionally sought.[4] In the future, this question could be added.

Table 2: General demographics and presence of skin problems by occupational group

	Healthcare workers		Hairdressers	Food handlers	Epoxy resin users	Total
N (%)	106 (52.2%)		37 (18.2%)	33 (16.2%)	27 (13.3%)	203 (100%)
Sex (female)	86 (84.3)		32 (86.5)	22 (66.7)	2 (7.7)	142 (70.0)
Age (mean±SD)	35.2 ± 11.7		25.8 ± 7.9	36.6 ± 12.8	36.8 ± 9.7	
Age (range)	20-63		17-52	20-60	18-59	
Highest qualification						
1 Uni degree	73 (70.2)		8 (21.6)	4 (12.1)	1 (3.9)	
2 Diploma	18 (17.3)		3 (8.1)	5 (15.2)	2 (7.7)	
3 Vocational certificate	8 (7.7)		10 (27.0)	7 (21.1)	8 (30.8)	
4 Completed high school	4 (3.9)		6 (16.2)	11 (33.3)	6 (23.1)	
5 Did not complete high school	1 (0.96)		10 (27.0)	6 (18.2)	9 (34.6)	
Past eczema	23 (22.1)		16 (43.2)	11 (33.3)	2 (7.7)	52 (25.6)
Dermatitis on hands in past year	30 (28.9)		14 (37.8)	10 (30.3)	3 (11.5)	57 (28.1)
Dermatitis on hands today	13 (12.3)		7 (18.9)	6 (18.2)	1 (3.7)	27 (13.3)
Patient rating of dermatitis	2.15±1.99	0-8	4.86±2.67	2.67±1.2	2	
Mean±SD Range			2-9	2-5		
Median (IQR)	2 (1-3)		5 (2-7)	2 (2-3)	2 (-)	
Consultant dermatitis rating	0.92±1.12		0.92±1.12	2±1.67	2	
Mean±SD Range	0-3		0-3	0-4		
Median (IQR)	1 (0-1)		3 (0-7)	2.5 (0-3)	2 (-)	
Asthma ever	22 (21.2)		15 (40.5)	8 (24.2)	6 (23.1)	51 (25.1)
Job induced wheeze	9 (8.7)		2 (5.4)	4 (12.1)	1 (3.9)	16 (7.9)
Skin cancer	8 (7.7)		0	0	1 (3.9)	

Three of the industries surveyed are known to have high rates of wet work, and this was reflected in **Table 3: Wet work by occupational group**. Almost all hairdressers, but only half those in healthcare performed wet work.

Table 3: Wet work by occupational group

	Healthcare workers	Hairdressers	Food handlers	Epoxy resin users
N (%)	106 (52.2%)	37 (18.2%)	33 (16.2%)	26 (13.3%)
Wet tasks performed	52 (49.1)	36 (97.3)	27 (81.8)	0

The performance of "wet tasks" does not equate to the definition of "wet work" as mentioned above but denotes the performing of certain discrete tasks, such as showering a patient, dishwashing, shampooing hair.

The relationships in this study between any type of wet tasks being performed in healthcare workers, hairdressing and food handling and the presence of current dermatitis or dermatitis in the past year were not found to be significant (Table 4).

Table 4: Relationship between any type of wet work and dermatitis in the last year and on the day of interview in healthcare workers

	N	N (%)	Wet work OR (95% CI)	P
		52 (49.1)		
Dermatitis in the past year	31	13 (25.0)	0.71 (0.39, 1.29)	0.26
Dermatitis today	13	5 (9.6)	0.61 (0.21, 1.75)	0.35

Similarly, when wet tasks were subdivided, there were no significant relationships between wet tasks performed and dermatitis, in this sample size (Table 5).

Table 5: Risk of dermatitis in the last 12 months by type of wet work in hairdressers, healthcare workers and food handling workers

Occupational group	N	Wet work task	OR (95% CI)	P
Hairdressers	37	General cleaning	0.81 (0.36, 1.85)	0.62
		Shampooing	0.73 (0.25, 2.14)	0.60
		Handling damp hair	0.93 (0.37, 2.29)	0.87
Healthcare workers	106	Patient hygiene	1.20 (0.67, 2.18)	0.54
Food handlers	33	Dishwashing	1.33 (0.47, 3.76)	0.59
		Food preparation	0.50 (0.18, 1.37)	0.18
		General cleaning	2.20 (0.68, 7.06)	0.16
		Other	2.30 (0.85, 6.21)	0.10

Rates of hand washing are reported in **Table 6: Hand washing frequency by occupational group**. Those who washed their hands more than 20 times per shift were as follows: for food handlers, 26/33 (78.8%), for hairdressers 19/37 (51.4%) and in healthcare workers 26/102 (25.5%). Hand washing greater than 20 times per shift is a threshold utilised by previous authors.[1]

Appreciable numbers of food handlers and also hairdressers washed their hands more than 20 times per shift and this was easily assessed by the questionnaire. The German legislation relating to wet work, the Technische Regeln fur Gefahrstoffe 531, cautions against work with more than 25% of the activities that cause the hands to become wet (more than 2hr and/or frequent; more than 20 times in an 8 hour shift) because of the significant risk of hand dermatitis.[5] Guidelines were produced for OASCC on wet work in Australia incorporating some of this information.[6]

Table 6: Hand washing frequency by occupational group

	Healthcare workers	Hairdressers	Food handlers	Epoxy resin users
N (%)	106 (52.2)	37 (18.2)	33 (16.2)	27 (13.3)
< 10 times	29 (27.4)	5 (13.5)	2 (6.1)	21 (77.8)
11-15 times	30 (28.3)	7 (18.9)	2 (6.1)	3 (11.1)
16-20 times	19 (17.9)	6 (16.2)	3 (9.1)	0 (0.0)
21-25 times	7 (6.6)	6 (16.2)	5 (15.2)	1 (3.7)
26-40 times	11 (10.4)	9 (24.3)	7 (21.2)	0 (0.0)
> 40 times	8 (7.6)	4 (10.8)	14 (42.4)	1 (3.7)
missing	2 (1.9)	0 (0.0)	0 (0.0)	1 (3.7)

Table 7: Hand washing type by occupational group records appreciable use of liquid soap, particularly in hand washing by hairdressers (73.0%), but also in food handling (39.4%) and healthcare (30.2%). Interestingly, the "other" group for hairdressers involved them washing their hands with shampoo. No hairdressers or food handlers washed their hands with a soap-free wash which is recommended according to published guidelines.[7]

Not surprisingly, healthcare workers most often used antiseptic washes (62.3%). However, they also frequently use alcohol based hand rubs, also called waterless hand cleansers, as noted in **Table 8: Frequency of alcohol based hand rubs usage in healthcare workers.** In healthcare workers, 42/106 (39.6%) used these products more than 20 times a day. The use of these rubs should enable less episodes of hand washing with water.

Table 7: Hand washing type by occupational group

Type of wash	Healthcare workers N =106* (%)	Hairdressers N =37 (%)	Food handlers N = 33 (%)	Epoxy resin users N =27**(%)
Water alone	0 (0.0)	4 (10.8)	5 (15.2)	0 (0.0)
Water & antiseptic	66 (62.3)	0 (0.0)	13 (39.4)	0 (0.0)
Water & soap bar	3 (2.8)	0 (0.0)	1 (3.0)	0 (0.0)
Water & liquid soap	32 (30.2)	27 (73.0)	13 (39.4)	20 (74.1)
Soap free hand wash	3 (2.8)	0 (0.0)	0 (0.0)	1 (3.7)
Other	0 (0.0)	6 (16.2)	1 (3.0)	5 (18.5)
Brush	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

*2 missing; ** 1 missing

Table 8: Frequency of alcohol based hand rubs usage in healthcare workers

	N= 106	%
Total using alcohol based hand rubs	79	74.5
1-5 times/day	19	24.1
6-10 times/day	10	12.7
11-15 times/day	3	3.8
16-20 times/day	5	6.3
More than 20 times/day	42	53.2

Table 9 details the presence of dermatitis when compared to the use of alcohol based hand rubs more than 10 times a day. While dermatitis was not significantly more common, there was a trend of increasing amounts of dermatitis in those using rubs more frequently. This would corroborate our anecdotal experience in the clinic that sometimes healthcare workers continue to wash their hands as they did previously, as well as using the alcohol rubs.

Table 9: Risk of dermatitis in the last 12 months by amount of hand washing with alcohol based hand rubs in healthcare workers

Hand wash count	Dermatitis (N)	(%)	OR (95% CI)	P
< 10 times/day (n=30)	7	23.3	1.0	
> 10 times/day (n=50)	16	32.0	1.55 (0.55, 4.35)	0.41

Food handlers particularly perform episodic wet work for long periods, as detailed in Table 10. In fact 66.7% (22/33) admitted to more than 20 episodes per day of a task involving wet work for more than 15 minutes. This translated to longer total periods of wet work, as detailed in Table 11: Total duration of performing wet work by occupational group.

Table 10: How often wet work tasks were performed (more than 15 min) per day by occupational group

	Healthcare workers	Hairdressers	Food handlers
N (%)	106 (52.2)	37 (18.2)	33 (16.2)
Less than daily	1 (0.9)	0 (0.0)	0 (0.0)
1-5/day	43 (40.6)	6 (16.2)	2 (6.1)
6-20/day	2 (1.9)	13 (35.1)	5 (15.2)
11-20/day	5 (4.7)	12 (32.4)	2 (6.1)
Over 20/day	1 (0.9)	5 (13.5)	22 (66.7)
Don't perform wet work	54 (50.0)	1 (2.7)	2 (6.1)

Surprisingly, 72.7% of food handlers in our survey said that they performed over 4 hours wet work per day, highlighting the need for greater awareness of the issue of wet work. As mentioned previously, this includes the definition that any part of the body is in water or other liquids for longer than 2 hours a shift.

Future initiatives to reduce hand washing in food handlers could include the use of alcohol-based rubs and use of tools such as tongs to avoid wetting hands.

Table 11: Total duration of performing wet work by occupational group

	Healthcare workers	Hairdressers	Food handlers
N (%)	106 (52.2)	37 (18.2)	33 (16.2)
Less than 30 mins/day	10 (10.4)	0 (0.0)	0 (0.0)
30 mins to 2 hours/day	31 (29.3)	10 (27.0)	3 (9.1)
2-4 hours/day	8 (7.6)	12 (32.4)	4 (12.1)
Over 4 hours/day	2 (1.9)	14 (37.8)	24 (72.7)
Don't perform wet work	54 (50.0)	1 (2.7)	2 (6.1)

In Table 12, there is a significant relationship between hairdressers washing their hands more than 20 times daily with a history of dermatitis in the last 12 months. It is possible that the "homogeneity" of the hairdressing group, that is all performing similar work with similar exposures, led to this result. The results for the other work areas did not achieve significance.

Hand washing greater than 20 times per shift is a threshold utilised by previous authors.[1] Our results were assessed to see if lesser amounts of hand washing were associated with significant rates of dermatitis in the past year by hairdressers, but the sample sizes were too small in these groups. **Table 12: Risk of dermatitis in the last 12 months by amount of hand washing in different occupational groups**

Occupational group Hand wash count	Dermatitis N (%)	OR (95% CI) P
Healthcare		
< 20 times/day (n=78)	23 (29.5)	1.0
>20 times/day (n=26)	8 (30.8)	1.06 (0.41, 2.79) 0.90
Hairdresser		
< 20 times/day (n=18)	2 (11.1)	1.0
>20 times/day (n=19)	12 (63.2)	**13.7 (2.41, 78.2) 0.003**
Food handling		
< 20 times/day (n=7)	3 (42.9)	1.0
>20 times/day (n=26)	7 (26.9)	0.49 (0.09, 2.77) 0.42
Epoxy users		
< 20 times/day (n=24)	2 (8.3)	1.0
>20 times/day (n=2)	1 (50.0)	11.0 (0.48, 250.9) 0.13

The numbers of times participants said that they washed their hands was validated by giving them charts to record when they washed their hands. In fact their estimates and actual hand washing counts were reasonable for lower amounts of hand washing, but more inaccurate at higher levels, particularly 21-25 times (N=3) which was estimated at 11.60±2.22, 26-40 times (N=7) at 12.00±5.82 and >40 times (N=4) at 20.00±12.10.

Table 13: Comparison of reported hand washing and actual hand washing.

Report hand washing	N	Mean ± SD	Range
<10	9	9.75 ± 5.09	2.67 - 18.0
11-15 times	6	9.00 ± 7.50	3.30 - 22.7
16-20 times	6	16.60 ± 5.53	10.3 - 25.0
21-25 times	3	11.60 ± 2.22	9.00 - 13.0
26-40 times	7	12.00 ± 5.82	4.00 - 20.0
> 40 times	4	20.00 ± 12.10	10.7 - 37.7

Use of skincare measures was also assessed in the questionnaires, such as the use of a moisturiser for the hands. Moisturisers were most often supplied in the healthcare area, despite the fact that the above Table 12 indicates that hairdressers who washed their hands more than 20 times a day were at greatest risk of dermatitis. Although moisturisers are often supplied in some occupations, they are quite frequently never used or used less than daily. In particular, despite moisturisers frequently being supplied

for use by healthcare workers (93.4%), they were only used at least once daily by 48.5% (48/99).

Only 40.5% of hairdressers had moisturiser supplied at their workplace, despite their frequent wet work. This emphasises the importance of educational programs about skincare in workplaces. By contrast, moisturiser supply is of less importance in those workplaces where the main risk is of ACD rather than ICD, which applies to epoxy workers.

Table 14: Frequency of moisturiser supply and usage by occupational group

N (%)	Healthcare workers 106 (52.2)	Hairdressers 37 (18.2)	Food handlers 33 (16.2)	Epoxy users 26 (13.3)
Moisturiser was supplied	99 (93.4)	15 (40.5)	15 (45.5)	4 (14.8)
Never	32 (30.2)	2 (5.4)	9 (27.3)	4 (14.8)
Less than daily	19 (17.9)	5 (13.5)	4 (12.1)	1 (3.7)
1-2 times daily	25 (23.6)	2 (5.4)	1 (3.0)	
3-5 times daily	15 (14.2)	3 (8.1)	1 (3.0)	
Over 5 times daily	9 (8.5)	2 (5.4)		

Glove use was assessed and presented in Table 15. Not only did 35% of hairdressers not wear any gloves, the same percentage wore latex gloves, which are regarded as being inappropriate for hairdressing,[8] since they are associated with the risk of latex allergy. In particular, almost all of the hairdressers wore the cheaper powdered disposable latex gloves, which have a greater risk of latex allergy. We have also reported on the problem of latex allergy in hairdressers locally.[9]

The highest rate of non-glove wearing occurred in hairdressers (35.1%), followed by food handlers (27.3%).

While no healthcare workers used powdered latex gloves, two workers used vinyl gloves, which are generally not regarded as being suitable for work with bodily fluids. There has been relatively little education in the healthcare community regarding the unsuitability of vinyl gloves to adequately protect against blood-borne pathogens.

A surprising 27% of food handlers did not wear gloves, although this would need to be correlated with their exact job description. One wore latex gloves and it was mentioned earlier that this is potentially hazardous, as minute amounts of latex could be transferred to those eating the food.[10]

In the epoxy users group, 13/24 (52%) workers were assessed by the interviewer as not to be wearing the correct gloves. This result would have been higher, had we not recently been involved in an education program in the aircraft parts workforce. In the Occupational Dermatology Clinic, we have never assessed a worker with ACD to epoxy resins who was wearing the correct gloves when working with epoxies. It is well known by experts in this area that many glove types do not protect adequately against epoxy resins, as these chemicals often penetrate through gloves.

However in this cohort, the aircraft manufacturers were all wearing appropriate reusable nitrile gloves, as there had previously been an outbreak of dermatitis at the factory, with many cases of allergic contact dermatitis being diagnosed, resulting in substantial workplace education by our group. All of those working in the floor finishing area however, wore inappropriate gloves for work with epoxies.

Table 15: Glove usage by occupational group

	Glove type	Healthcare workers†	Hairdressers	Food handlers	Epoxy users††
	N	174	37	33	39
1	Cotton gloves	1 (0.6)	0 (0.0)	0 (0.0)	7 (18.0)
2	Disposable latex	88 (50.6)	13 (35.1)	1 (3.0)	10 (25.6)
	-Powdered	0	12 (13.6)	0 (0.0)	1 (10.0)
3	Disposable vinyl	2 (1.2)	3 (8.1)	21 (63.6)	0 (0.0)
4	Disposable nitrile	12 (6.9)	0 (0.0)	0 (0.0)	8 (20.5)
5	Reusable neoprene	0 (0.0)	0 (0.0)	2 (6.1)	2 (5.1)
6	Reusable rubber	12 (6.9)	8 (21.6)	2 (6.1)	0 (0.0)
7	Reusable PVC	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
8	Reusable leather/cloth	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
9	Do not know	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
10	Surgical latex	52 (29.9)	0 (0.0)	0 (0.0)	0 (0.0)
11	Surgical neoprene	4 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)
12	Reusable nitrile	0 (0.0)	0 (0.0)	0 (0.0)	10 (25.6)
	Do not wear any	3 (1.7)	13 (35.1)	9 (27.3)	2 (5.1)

†68 used more than 1 type of glove; †† 12 used more than 1 type of glove

When considering the risk of dermatitis by glove type, there was a significantly decreased tendency for dermatitis in those food handlers wearing vinyl gloves. These gloves are regarded as being appropriate for food handlers and thus this result would fit with expectations.

Given that rates of latex allergy in healthcare workers are now declining with the advent of use of non-powdered gloves, and are in the order of 5%, it is perhaps not surprising that there was no increased risk of dermatitis demonstrated with use of latex gloves in this sample size. In addition, latex allergy may present with symptoms of itching and burning, but may not necessarily present with dermatitis.

Table 16: Risk of dermatitis in the last 12 months by type of glove used in different occupational groups

Occupational group Glove type	Dermatitis N(%)	OR (95% CI) P
Healthcare workers	N=31	
Disposable latex (n=88)	24 (27.3)	0.48 (0.16, 1.44) 0.19
Disposable vinyl (n=2)	1 (50.0)	2.40 (0.15, 39.6) 0.54
Disposable nitrile (n=12)	6 (50.0)	2.68 (0.79, 9.09) 0.11
Surgical latex (n=52)	15 (28.9)	0.91 (0.39, 2.11) 0.83
Surgical nitrile (n=3)	2 (66.7)	4.97 (0.43, 56.9) 0.20
Hairdressers	N=14	
Disposable latex (n=13)	4 (30.77)	0.62 (0.15, 2.60) 0.52
Disposable vinyl (n=3)	2 (66.67)	3.67 (0.30, 44.7) 0.31
Reusable rubber (n=8)	2 (25.00)	0.47 (0.08, 2.75) 0.40
Food handlers	N=10	
Disposable vinyl (n=21)	**3 (14.3)**	**0.12 (0.02, 0.64) 0.013**

Epoxy resin users	N=3		
Disposable nitrile (n=9)	1 (11.11)	0.94 (0.07, 12.0) 0.96	
Reusable nitrile (n=10)	1 (10.0)	0.78 (0.06, 9.88) 0.85	

The gloves utilised were often considered effective, as assessed by how often liquid inadvertently entered gloves. However quite appreciable numbers reported liquid inside their gloves sometimes/usually/always: healthcare 18/99 (17.2%); hairdressing 13/24 (54.2%), food handling 17/24 (70.8%).

Table 17: Liquid inside gloves by occupational group

Frequency of liquid in gloves	Healthcare workers	Hairdressers	Food handlers	Epoxy users
N (%)	106 (52.2)	37 (18.2)	33 (16.2)	27 (13.3)
Always	1 (0.9)	2 (5.4)	2 (6.1)	0 (0.0)
Usually	1 (0.9)	1 (2.7)	2 (6.1)	0 (0.0)
Sometimes	16 (15.1)	10 (27.0)	13 (39.4)	4 (14.8)
Rarely	18 (17.0)	4 (10.8)	2 (6.1)	2 (7.4)
Never	63 (59.4)	7 (18.9)	5 (15.2)	19 (70.4)
Missing	7 (6.6)	13 (35.1)	9 (27.3)	2 (7.4)

Table 18: Problems with wearing gloves

	Healthcare workers	Hairdressers	Food handlers	Epoxy users
N	155 †	52 ‡	48 §	40 ††
Hands too hot and sweaty in gloves	53	16	11	18
Gloves tear or break easily	25	1	7	6
Forget to wear	1	2	0	1
Difficult to work with	11	6	9	9
Gloves don't go far enough up arms	8	4	4	1
Other	2	0	4	0
Water gets inside gloves	19	6	0	0
Pull out client's hair				
Missing	36	17	13	5

† n=29 multiple answers; ‡ n=10 multiple answers; § n=9 multiple answers; †† n=10 multiple answers,

This pilot study has highlighted key areas for future work in the area of skin exposure surveillance, particularly in regards to wet work, inappropriate use of latex gloves by hairdressers and food handlers and incorrect glove use by epoxy resin workers.

In regards to wet work, the survey has shown appreciable exposure to skin irritants, particularly wet work, as shown through the frequency of hand washing, the number of tasks involving wet work and total duration of wet work per shift. It is generally recognised that wet work is associated with an increased risk of ICD of the hands, although the literature detailing this risk is limited.

Food handlers, hairdressers and healthcare workers washed their hands many times during the course of a working day. Many workers washed their hands more often than recommended by international and national guidelines. Workers' own estimates of the number of hand washes were accurate for lower levels of hand washing but not for 21 or more washes per shift. Moisturiser use on the hands was suboptimal. These results reinforce the need for both workplace policies on wet work practices and workplace

education. In addition, it would be extremely useful to clarify the validity of the worker estimates for hand washing, as has occurred in two overseas' studies.

Our data highlights that latex gloves were used primarily by both healthcare workers and hairdressers. Healthcare workers have traditionally used latex gloves as they provide appropriate protection from blood borne pathogens, and they almost always used non-powdered latex gloves. Powdered latex gloves were found to be used by hairdressers, who actually do not need protection from blood borne pathogens. Use of powdered gloves is a risk factor for the development of latex allergy. There are many other more suitable glove types available for hairdressers. As well, two healthcare workers were incorrectly using vinyl gloves, which do not offer adequate protection from pathogens.

Finally, many epoxy resin workers used gloves which would not prevent exposure to these highly sensitising chemicals, rather than protective thick, reusable nitrile gloves.

The pilot study provides robust evidence to support the development of national educational campaigns by stakeholders to address some of these important and reversible risk factors for occupational dermatitis. Future approaches could include the validation of these questions through observation and a more extensive surveillance program involving many different occupations. Phased withdrawal of the use of powdered latex gloves and the widespread use of the RASH workplace training tool are important measures which merit serious consideration.

Summary of conclusions
Hairdressers inappropriately wore latex gloves, which were almost always powdered.
In most circumstances healthcare workers wore appropriate non powdered latex or nitrile gloves, with the exception of two cases where vinyl gloves were worn, which provide suboptimal protection from blood borne pathogens.
Epoxy resin workers often wore gloves which do not offer sufficient protection from epoxy resins.
Food handlers, hairdressers and healthcare workers washed their hands many times during a working day, and often more than recommended by national and international guidelines.
Moisturiser use was suboptimal in those who performed wet work, suggesting the need for a comprehensive skincare program in workplaces, such as provided by the RASH educational tool.

References

1. Jungbauer et al Exposure of the hands to wet work in nurses *Contact Dermatitis* 2004: 50: 225-229.
2. Anveden I, Liden C, Alderling M, Meding B. Self-reported skin exposure-validation of questions by observation. *Contact Dermatitis* 2006; 55:186-191.
3. Anveden I, Wrangsjo K, Jarvholm B, Meding B. Self-reported skin exposure-a population-based study. *Contact Dermatitis* 2006; 54:272-277.
4. Saunders H, Keegel T, Nixon R, Frowen K. Career counsellors and occupational contact dermatitis. *Contact Dermatitis* 2003; 48: 189-90.
5. Coenraads PJ and Diepgen TL. Risk for hand eczema in employees with past or present atopic dermatitis. *Int Arch Occup Environ Health* 1998, 71:7-13.
6. Susitaival P, Flyvholm M-A, Meding B, Kanerva L, Lindberg M, Svensson A and Olafsson JH. Nordic Occupational Skin Questionnaire (NOSQ-2002): a new tool for surveying occupational skin diseases and exposure. *Contact Dermatitis* 2003; 49: 70-76.

7. Nixon R, Roberts H, Frowen K, Sim M. Knowledge of skin hazards and the use of gloves by Australian hairdressing students and practising hairdressers. *Contact Dermatitis* 2006; 54:112-116.
8. Van Der Walle HB, Brunsveld VM. Latex allergy among hairdressers. *Contact Dermatitis* 1995; 32: 177-78
9. Sajjachareonpong P. Lee A. Nixon R. Immediate-type latex hypersensitivity in a hairdresser *Australas J Dermatol*. 2002; 43:150-1.
10. Nixon RL, Lee A. Hazards of use of latex gloves by food handlers (letter) *Med J Aust* 2001; 174:482.

PUBLICATIONS

D Slodownik, J Williams, A Lee, B Tate, R Nixon. (2007) Controversies regarding the sensitive skin syndrome. *Expert Rev Dermatol* **2** In Press

J D L Williams, A Y L Lee, M C Matheson, K E Frowen, A M Noonan, R L Nixon. (2007) Occupational Contact Urticaria: Australian data. Accepted by *Br J Dermatol.*

J D Williams, A Lee, D Slodownik, R L Nixon (2007) Occupational contact urticaria from linseed. Accepted by *Contact Dermatitis*

J D Williams, R L Nixon, A Y Lee. (2007) Recurrent allergic contact dermatitis due to allergen transfer by sunglasses. *Contact Dermatitis.* **57**, 120-1

A Hafejee, J Williams, C Lovell, J E Sansom, M H Beck. (2007) Allergic contact dermatitis to English ivy (*Hedera helix*) *Br J Dermatol* **157**, 88

J Williams, A Lee, R Nixon. (2007) Assessment of early outcomes in occupational contact dermatitis. *Br J Dermatol* **157**, 86

J Williams, M Matheson, D Slodownik, A Noonan, A Lee, R Nixon. (2007) Wet work regulations: Frequency of hand washing as a risk factor for irritant contact dermatitis. *Dermatologie in Beruf und Umwelt.* **55**, 69

R Nixon, J Williams (2007) Occupational irritant contact dermatitis: Data from an Australian occupational dermatology clinic. *Dermatologie in Beruf und Umwelt.* **55**, 68

D Slodownik, J D Williams, B J Tate. (2007) Prolonged paresthesia due to sculptured acrylic nails. *Contact Dermatitis.* **56**, 298-9

J D Williams, K E Frowen, R L Nixon. (2007) Allergic contact dermatitis from methyldibromo glutaronitrile in a sanitary pad and review of Australian clinic data. *Contact Dermatitis.* **56**, 164-7

J D Williams, M Moyle, R L Nixon. (2007) Occupational contact urticaria from Parmesan cheese. *Contact Dermatitis.* **56**, 113-4

J Williams, H Roberts, B Tate. (2007) Contact urticaria to olives. *Contact Dermatitis.* **56,** 52-3

J D Williams, J Cahill, R Nixon. (2007) Occupational autoeczematisation or atopic eczema precipitated by occupational contact dermatitis? *Contact Dermatitis.* **56**, 21-6

H Roberts, J Williams, B Tate. (2006) Allergic contact dermatitis to panthenol and cocamidopropyl PG dimonium chloride phosphate in a facial hydrating lotion. *Contact Dermatitis.* **55**, 369-70

J D Williams, B J Tate. (2006) Occupational allergic contact dermatitis from olive oil. *Contact Dermatitis.* **55**, 251-2

INTERNATIONAL PRESENTATIONS

Jason D Williams, Adriene Y Lee, Rosemary L Nixon (2007) Hazardous skin exposure in the healthcare industry. Accepted for presentation at the 9th ESCD in Estoril, Portugal, May 2008

Rosemary Nixon , Jason Williams , Amanda Palmer, Melanie Matheson and Shyamali Dharmage. (2007) Why do patients with occupational contact dermatitis not get better? Accepted for presentation at 9th ESCD, Estoril, Portugal, May 2008

J D Williams, A M Noonan, M C Matheson, K E Frowen, R L Nixon. (2007) Use of a skin exposure assessment tool in workplace hazard surveillance. Presented at the 3rd Occupational and Environmental exposures of the skin to chemicals meeting, Colorado, USA, June 2007

J D L Williams (2006) Occupational skin sensitivity. Invited to present at the 5th World Congress of the International Academy of Cosmetic Dermatology, Melbourne, December 2006

J D L Williams, A Y Lee, R L Nixon (2006) Contact dermatitis: An update. Invited to present at the Annual Meeting of the Australian Dermatology Research and Education Foundation, Sydney, September 2006

J D L Williams, K E Frowen, A M Noonan, R L Nixon (2006) Skin exposure assessment tool: The concept. Presented at 8th ESCD Congress, Berlin, September 2006

J D L Williams, A M Noonan, R L Nixon (2006) Occupational contact dermatitis outcome algorithm (OCDOA): The concept. Presented at 8th ESCD Congress, Berlin, September 2006

J Williams, A Lee, R Nixon (2006) The Importance of appropriate glove usage in occupational dermatology. Presented at Australian College of Dermatology Annual Meeting, Melbourne, May 2006. **This presentation won the John Fewings Memorial Award for best presentation in the field of contact dermatitis at the ACD 2006.**

J Williams, A Lee, R Nixon (2006) A complicated case of glove and home medicament allergy. Presented at Australian College of Dermatology Annual Meeting, Melbourne, May 2006

J Williams (2006) Development of a clinical skin exposure assessment tool in occupational dermatology. Invited to present at Occupational contact dermatitis: Where are we now? Conference, May 2006

J Williams (2006) Instructive case studies from the clinic. Invited to present at Occupational contact dermatitis: Where are we now? Conference, May 2006

J Williams, A Lee, R Nixon (2006) The Importance of appropriate glove usage in occupational dermatology. Presented at the New Zealand Dermatological Society Annual Meeting, January 2006

J Williams, R Nixon (2005) Occupational Contact Dermatitis. Invited to present at the Annual WorkCover Conference, Queensland, Australia, September 2005

R Nixon, J Williams, K Frowen (2005) Multiple Diagnoses. Presented at Occupational and Environmental Exposures of the Skin to Chemicals Conference, Malmo, Sweden, May 2005

ABSTRACTS

Jason D Williams, Adriene Y Lee, Rosemary L Nixon (2007) Hazardous skin exposure in the hairdressing industry. Accepted for presentation at the 9th ESCD in Estoril, Portugal, May 2008

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J D L Williams, M C Matheson, K E Frowen, S Dharmage, R L Nixon. (2006) Occupational contact dermatitis: Australian Data. Poster presented at the 8th ESCD Congress, Berlin, September 2006

J Williams, H Roberts, B Tate. (2006) Burning mouth syndrome caused by dental acrylates. Poster presented at the 8th ESCD Congress, Berlin, September 2006

J Williams, A Lee, M Tam, B Tate. (2006) Childhood foot dermatitis: Is patch testing justified? Poster presented at the 8th ESCD Congress, Berlin, September 2006

APPENDICES

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Appendix 22: Abstract: Hazardous skin exposure in the hairdressing industry
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Appendix 24: Abstract: Occupational contact dermatitis: Australian Data
Appendix 25: Abstract: Burning mouth syndrome caused by dental acrylates
Appendix 26: Abstract: Childhood foot dermatitis: Is patch testing justified?