



safe work australia

Australian workers' dermal exposures to wet work and chemicals and the causes and characteristics of occupational skin disease:

A summary of the findings and policy implications of three research reports



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Abbreviations

ASCC	Australian Safety and Compensation Council
NHEWS	National Hazard Exposure Worker Surveillance
OCD	Occupational contact dermatitis
OSD	Occupational skin disease

Introduction

One of the core objectives of the work of Safe Work Australia is to achieve continual reductions in the incidence of occupational disease in Australian workplaces. To this end, in 2008, the Australian Safety and Compensation Council (ASCC: now Safe Work Australia) commissioned and fielded the National Hazard Exposure Worker Surveillance (NHEWS) survey. The purpose of this research was to develop a national picture of the exposure of Australian workers to several known disease-causing hazards. This national picture would include identifying the employment and demographic characteristics of workers that are associated with increased risk of reporting exposure to these hazards and with the provision, or lack thereof, of controls for these hazards. It was hoped that this information would better inform the decisions and work of work health and safety policy makers in their efforts to reduce occupational disease.

Two of the occupational hazards targeted by the NHEWS survey were wet work (immersion of the hands and arms in liquids and/or frequent hand washing) and dermal (skin contact) chemical exposure. Exposure to both these occupational hazards (individually or together) is a risk factor for the development of occupational skin disease (OSD) and occupational contact dermatitis (OCD) in particular¹. OSD is the second most common work-related problem presenting to general practitioners in Australia (Hendrie & Driscoll 2003) and OCD is the most common OSD in westernised industrial countries – about 90-95% of all OSD (Lushniak 1995). In the nine year period 2000-01 to 2008-09 there were 10 730 workers' compensation claims for *Contact dermatitis* and *Other and unspecified dermatitis or eczema* in Australia. Of these, 3760 were serious workers' compensation claims, which involved one week or more absence from work or were a permanent incapacity. In 2008-09, a typical payment for a serious *Contact dermatitis* claim was approximately \$3000. Overall, based on a yearly estimate of about 1700 cases, *Contact dermatitis* is estimated to have a total economic cost to the Australian population of \$33.2 million annually (ASCC 2009).

Despite these statistics, the data currently available on the incidence of OCD in Australia are generally thought to underestimate the prevalence and incidence of this condition (Keegel et al. 2005; Keegel et al. 2007). There is also little information available on the occupationally relevant substances that cause or contribute to OSD and/or OCD. One of the reasons for this is that there is no mandatory reporting of OSD and therefore no database recording information pertinent to the causes and occurrence of OSD.

In an effort to obtain better quality disease data for the purpose of informing policy, in 2011 Safe Work Australia invested in the development of a database that will collect patch testing data and worker employment and demographic information from people diagnosed with OSD in specialist clinics around Australia. This project was initiated by Rosemary Nixon, Dermatologist and Occupational Physician, Adjunct Clinical Associate Professor at Monash University. In return for funding Associate Professor Nixon has provided Safe Work Australia with a report on occupational contact dermatitis based on 18 years of patch testing data from her clinic - the Occupational Dermatology Clinic in Melbourne.

The following report is a brief summary and comparison of the findings and implications for work health and safety policy of two research reports on dermal exposures to wet work² and chemicals³, and the aforementioned report on occupational contact dermatitis⁴. These reports are published on the Safe Work Australia website and interested readers are encouraged to read the individual reports to obtain a full description of their findings.

¹ Although the focus of these reports is on occupational skin diseases, in particular occupational contact dermatitis, it is important to bear in mind that occupational exposures to wet work and/or chemicals may contribute to the development of other types of diseases or conditions.

² National Hazard Exposure Worker Surveillance: Exposure of hands and arms to wet work and the provision of wet work control measures in Australian workplaces

³ National Hazard Exposure Worker Surveillance: Chemical exposure and the provision of chemical exposure control measures in Australian workplaces

⁴ Occupational contact dermatitis: A review of 18 years of data from an occupational dermatology clinic in Australia

Summary of the main findings of the research reports

This section outlines the main findings of the three reports. In addition to noting the most important findings from each paper, effort has been made to identify consistent patterns or results across the three reports. It is recommended that the reports are read in conjunction with this summary as it is beyond the scope of this report to present the findings in detail.

Overview of the main findings

- Patterns of exposure to wet work and to chemicals show considerable congruence with the main substances associated with irritant and allergic contact dermatitis, and with the occupations of workers who are diagnosed with OCD. Multiple contributing factors are typical in OSDs and workers are often exposed to multiple chemical hazards.
- The main hazards or substances of concern with respect to OSDs are as follows: wet work, detergents, disinfectants, solvents, fuels / oils / coolants, rubber accelerators, bases & alkalis including hairdressing bleach, potassium dichromate in leather and cement.
- Based on exposure, provision of controls and occurrence of OSD, the main occupations of concern with respect to OSDs are as follows: Tradespersons, Labourers, Healthcare workers, Hair and beauty workers, and Food handlers. The main industries of concern include: Health and community services, Accommodation, cafes and restaurants, Construction, Agriculture, forestry and fishing.
- Smaller workplaces were less likely to provide controls for wet work or dermal chemical exposure than larger workplaces.

What are workers exposed to and what substances are associated with occupational skin diseases?

The main liquids and chemical substances workers reported exposure to are shown in Table 1. There is a great deal of consistency between the reported liquids and chemicals and between these and the substances identified as work-relevant irritants and allergens by patch testing people diagnosed with OSD. The report summarising the 18 years of patch testing data contains lists of the most frequently implicated occupationally relevant allergens and irritants in diagnoses of OSD in Victoria. These are likely to be important resources for policy makers and for continued hazard exposure surveillance studies.

Detergents and solvents were some of the most commonly reported liquids and chemicals and these were the irritants often involved in OCD in women and men respectively. The list of allergens presented in the patch testing data report includes hairdressing bleach and chemicals in concrete. Hairdressing bleach is included in the chemical exposure category Bases and alkalis, while concrete is a Cement and lime exposure. Both Bases and alkalis, and Cement and lime were among the most commonly reported hazards in the NHEWS survey.

An important outcome of the analysis of the NHEWS dermal chemical exposure data was the assessment that many workers appear to be unaware of their specific chemical exposures. Some exposures were not reported where expert occupational hygienists would predict exposure and many workers reported product names or the action of the chemicals as their exposure, rather than specific chemicals. While this may be due in part to the limitations of telephone surveys, these findings indicate that some workers may have a poor knowledge of the chemicals they are routinely exposed to through their work.

Concurrent or multiple exposures to liquids and chemicals was a noted finding in both the wet work and chemicals reports and this is reinforced by the high frequency of multiple contributing factors in diagnoses of OSD.

Patterns of exposure and disease: worker and workplace characteristics

Exposure to wet work and chemicals was determined by separate questions in the NHEWS survey. There were two components to exposure to wet work: frequency of hand washing and

immersion of hands in liquids. It is likely that these two exposure measures captured distinct groups of workers. Workers reporting frequent hand washing tended to be female and work in higher occupational skill level positions, such as nurses. In contrast, for hands immersed in liquids, there were no differences by gender but workers in lower occupational skill level positions, such as kitchen hands or cleaners were more likely to report immersion than workers in higher skill level positions. Dermal chemical exposure was estimated more generally: workers who reported they were exposed to any type of chemical, for any length of time, were considered exposed.

Table 1 presents the employment and demographic characteristics of workers that were statistically associated with increased likelihood of reporting exposure to wet work and chemicals, and that showed relationships with patterns of diagnosis of OSD.

Approximately 37% of workers surveyed in the NHEWS study reported dermal exposure to chemicals. High levels of exposure to wet work, which includes hand washing more than 20 times per day and two hours or more spent per day with hands immersed in liquids, was reported by 9.8% and 4.5% of workers surveyed respectively. Work was a substantial or partially contributing factor in around 75% of patients referred to the specialist dermatology clinic over 18 years.

As might be expected, female workers tended to have different exposures to wet work and chemicals than males (Table 1). These were consistent with the main causes of OSD and patterns by sex as determined by the Victorian clinic patch testing data. For example, female workers had higher likelihood of frequent hand washing and exposure to detergents, disinfectants and bases and alkalis (components of cleaning products) than male workers. Irritant contact dermatitis among female workers was most commonly caused by wet work and soaps and detergents. In contrast, oils or coolants and solvents were typical causes of irritant contact dermatitis in males.

There were also consistent relationships between the employment characteristics (occupation, occupational skill level and industry of employment) associated with exposure and those associated with diagnosis of OSD. In general, lower skilled workers, such as tradespersons or labourers were most likely to report exposure to wet work and chemicals and these workers also accounted for a large proportion of the workers diagnosed with OSD. Healthcare workers and food handlers also accounted for large proportions of OSD diagnoses, and these workers can be found in industries in which workers had a high likelihood of reporting exposure to chemicals and wet work – Health and community services, and Accommodation, cafes and restaurants. Also notable is the high exposure to chemicals amongst Construction industry workers and the high rates of OSD in Labourers and Tradespersons, which are common occupations within this industry.

The highest rate of OSD was found in Hair and beauty workers. Hairdressing bleach was one of the most common occupationally relevant allergens. These findings are also consistent with high self-reported exposure to bases and alkalis amongst NHEWS respondents and the high likelihood of female workers reporting exposure to these substances.

Provision of controls for wet work and chemical hazards

The two NHEWS survey reports assessed the provision of some specific hazard exposure controls amongst workers who reported exposure to wet work and/or skin contact with chemicals. The key findings relating to control provision are summarised in Table 2.

Provision of controls for workers exposed to wet work was lower than for workers exposed to chemicals. However, exposure to both wet work and chemicals increased the likelihood that the controls surveyed for wet work exposure were provided. Overall, less than 62% of workers exposed to either chemicals or wet work or both reported that they were provided with training

while relatively higher percentages were provided with gloves⁵. Time restriction – where exposure to wet work is limited each day – is the most effective of the surveyed controls for wet work. This was only reported to be employed in around 32% of workplaces.

The most important factor affecting the provision of controls for wet work and dermal chemical exposure was workplace size. Smaller workplaces were least likely to provide the surveyed control measures and most likely to provide none of the control measures to exposed workers.

The NHEWS analyses provided some indication that casual workers and lower skilled workers were less well informed or provided with control measures for chemical exposure. There was also variation in control provision by industry (Table 2). A number of industries were found to have relatively lower likelihoods of control provision. These included the Construction and Education industries. However, it should be noted that it was beyond the scope of the NHEWS study to assess the appropriateness or adequacy of controls in workplaces. Therefore, these findings can only indicate where further research, aimed at determining control provision, use and efficacy, should be targeted.

Limitations of the data

The data contained in the three reports are subject to a number of limitations that are outlined below and in more detail in the individual reports.

NHEWS reports

Determining the risks to worker health from exposure to hazardous chemical substances requires information about the specific chemical and circumstances of exposure that was beyond the scope of the NHEWS survey to obtain. As such, the NHEWS data indicates where exposures are likely to occur but cannot determine how hazardous these exposures are.

There are some important limitations to the controls data that are outlined in the individual reports. The most important of these is that the information obtained about controls is in terms of provision, not use of controls. Research suggests that there can be a great disparity between provision and use of controls. The NHEWS survey did not collect information on the higher level (and most effective) controls e.g. engineering or substitution controls, and control provision was only assessed for exposed workers.

The data from the NHEWS survey cannot be considered nationally representative owing to the sampling scheme employed in this study. The five national priority industries, which were over-sampled, probably have the most reliable estimates for exposure and control provision. A number of industries had very small sample sizes but effort has been made not to overstate the findings for these industries and to urge the reader to consider findings with caution wherever relevant.

Occupational Dermatology Clinic report

The data presented in this report were sourced from one patch-testing clinic in Victoria. Although it is the only tertiary referral clinic of its kind in this state, it is unlikely that all patients with occupational dermatitis in Victoria are referred to this clinic. It is therefore likely that the data in the report are biased towards the most severe cases of OSD and the rates of OSD estimated in this report are likely to be underestimates of the true incidence of this illness. While the data presented pertain only to Victoria, there is no reason to believe that the rates of OSD in other Australian states vary significantly from the Victorian rates.

⁵ It should be noted that extended use of occlusive gloves can be considered a wet work exposure if the hands become moist due to sweat.

Summary of the implications for work health and safety policy identified in the reports

The reports' findings have a number of implications for work health and safety policy makers and regulators. Discussed in more detail below, these include:

- There is evidence that a significant number (13%) of Australian workers are exposed to wet work in excess of existing Australian guidance and the regulated limits of other countries e.g. Germany.
- Small workplaces appear to have poorer control provision for wet work and dermal chemical exposure.
- Specific chemical groups have been identified where there is both high incidence of exposure in the Australian workforce and high rates of attribution to OSDs.
- The nature of exposures to wet work and chemicals is likely to be specific to particular occupations, industries and worker demographics.
- Worker knowledge of their chemical exposures, in terms of what they are exposed to and the exposures they are aware of, and the provision of chemical safety training appear to be low.
- Australia has poor quality data on the incidence of OSD.

Exposure limits

Immersion of the hands in liquids for more than two hours per day and/or spending long periods wearing occlusive gloves and/or high hand washing frequency (e.g. 20 or more times per day) are considered risk factors for the development of OSD (BAuA 2008). Concurrent exposure to chemicals may increase the risk of developing OSD (Nixon et al. 2005). The NHEWS wet work exposure data indicates that approximately 13% of Australian workers may be exposed to wet work in excess of these limits.

In Germany, wet work exposure is currently subject to a technical standard (TRGS 401: Risks resulting from skin contact – identification, assessment, measures) that regulates the activities of employees that spend a large part of their work time with their hands immersed in liquids, wearing moisture proof (occlusive) gloves or who must frequently clean their hands and those workers who have dermal contact with chemicals (BAuA 2008). TRGS 401 is based on a 1996 Technical Standard specifically for wet work (TRGS 531)(BAuA 1996) and there is some evidence that this standard, in conjunction with specific rules for hazardous substances in the hairdressing trade, has resulted in large reduction in occupational dermatitis amongst hairdressers in Germany (Dickel et al. 2002).

While these same exposure levels are mentioned in the ASCC guidelines for prevention of dermatitis caused by wet work (ASCC 2005), lack of Australian work health and safety policy focussing on wet work and chemical exposures in specific occupations means there is likely to be no improvement in the incidence of OSD in the identified occupations.

Small workplaces

Although workplace size did not appear to be associated with any increased or decreased likelihood of exposure to wet work or chemicals generally, smaller workplaces were strongly associated with lower levels of control provision for both wet work and dermal chemical exposure.

Specific hazards

A number of chemical groups and specific chemicals have been identified in these three reports that have both high exposure and are commonly implicated in OSD diagnoses. The main hazards or substances of concern with respect to OSDs include wet work, detergents, disinfectants, solvents, fuels / oils / coolants, rubber accelerators, bases & alkalis including

hairdressing bleach, potassium dichromate in leather and cement. Please refer to the individual reports for more complete lists of chemicals associated with significant levels of occupational exposure and OSD.

Specific industries, occupations or exposure types

Wet work and chemical exposures are likely to be reasonably specific to particular industries and occupations. Likewise, hand washing and hand immersion are separate exposures with varying exposure profiles. Based on exposure, provision of controls and occurrence of OSD, the main occupations of concern with respect to OSDs include Tradespersons, Labourers, Healthcare workers, Hair and beauty workers, and Food handlers. The main industries of concern include Health and community services, Accommodation, cafes and restaurants, Construction, Agriculture, forestry and fishing.

Worker knowledge and training

The NHEWS report on chemical exposure indicates that most workers have a less than complete awareness of the chemicals they are exposed to while at work. Some workers do not know what they are exposed to and some are unaware of or did not report some probable exposures. Alongside this, only around 60% of workers reported that they had received chemical safety training. Training was also less likely to be provided to casual or temporary employees.

Skin disease registers

Unlike some European countries (e.g. Germany and Finland), there is no mandatory register of occupational skin disease in Australia. This makes it very difficult to determine the incidence of skin disease amongst Australian workers accurately. A register also provides useful information on the characteristics of workers with high rates of OSD and enables the identification of substances associated with OSD.

In 2011, Safe Work Australia contributed funding to the establishment of a national database of OSD through the work of Rosemary Nixon, Dermatologist and Occupational Physician, Adjunct Clinical Associate Professor at Monash University. The database is still under development but will be created by collecting patch testing data and worker employment and demographic information from people diagnosed with OSD in specialist patch testing clinics around Australia. This will be facilitated by providing these clinics with software specifically designed to capture these data from their patient records. It is hoped that this could be expanded to include other non-specialist clinics including general practices in the future. This would increase our understanding of OSD because it is thought that many patients with this condition do not receive treatment from specialist physicians. It may also provide GPs with a resource that aids in the diagnosis of this condition. The success of this database will be dependent on ongoing financial support from interested parties, such as work health and safety organisations.

Summary of the research recommendations identified in the NHEWS reports

The NHEWS reports made recommendations for future research in the field of hazard exposure surveillance and for additional specific or focussed studies. These include:

- Future chemical hazard exposure surveillance research focussing on specific nominated chemicals in particular contexts or workplace settings. The NHEWS sampling scheme should be improved to (a) obtain better samples of industries other than the national priority industries, and (b) obtain nationally representative data. Wet work exposure surveillance could also be expanded to include exposure to other parts of the body (apart from the hands or arms) because OSD can also occur on the face, feet and legs.
- Evaluation / validation of the NHEWS self-reported exposure data through comparison with formal exposure assessment data, such as Job Exposure Matrices (JEMs) or review

by an expert exposure panel / experienced occupational hygienist. Undertaking a validation process would, in particular, help identify areas of under-reporting of workplace exposures.

- Undertaking intervention research in small and medium-sized workplaces focused on understanding barriers and enablers to control provision and use, and developing tailored interventions that will be successful in the small to medium enterprise context. Intervention research could also adopt a 'top down bottom up' approach. Refer to the wet work report for more detail.
- Comparison of exposure data with patterns of workers' compensation claims for OSD and other sources of OSD statistics (e.g. state skin and cancer foundations) to identify groups of workers who may be eligible for workers' compensation for OSD but are not receiving compensation.

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Comparative results tables

Table 1. Summary of worker employment and demographic characteristics associated with exposure to wet work or chemicals and/or diagnosis of occupational skin disease

Characteristics associated with exposure and disease	Wet work exposure	Dermal chemical exposure	Occupational skin disease
Overall exposure	<ul style="list-style-type: none"> - 9.8% of workers surveyed washed their hands more than 20 times per day - 7.3% of workers surveyed had their hands immersed in liquids for more than one hour per day - 4.5% of workers surveyed had their hands immersed in liquids for more than two hours per day - Hand washing exposures were largely distinct from hand immersion exposures 	<ul style="list-style-type: none"> - 37% of workers surveyed reported that they had skin contact with at least one chemical while at work in the week preceding the survey 	<p>Work was a substantially contributing factor to OSD in 60% of patients and a partially contributing factor in 15% of patients attending the clinic</p>
Concurrent exposures	Workers who reported dermal exposure to chemicals were much more likely to report exposure to wet work than workers who did not report exposure to chemicals	Self-reported exposure to multiple chemical groups was common	Multiple contributing factors to OSD are very common – multiple diagnoses in 58% of patients
Main substances reported	<p>The most commonly reported liquids were:</p> <ul style="list-style-type: none"> - Water - Detergents, cleaning products, disinfectants - Solvents - Fuels and oils - Concrete 	<p>The most commonly reported groups of chemicals were:</p> <ul style="list-style-type: none"> - Detergents - Organic solvents - Disinfectants - Bases & alkalis - Paints, varnishes and inks - Cement & lime - Non-bituminous hydrocarbon fuels 	<ul style="list-style-type: none"> - Irritant contact dermatitis in females was more likely to be caused by soaps / detergents or wet work - Irritant contact dermatitis in males was more likely to be caused by oils / coolants and solvent exposures - Occupationally relevant allergens included: rubber accelerators, hairdressing bleach, potassium dichromate in leather or cement, hair dye and epoxy resin

Characteristics associated with exposure and disease	Wet work exposure	Dermal chemical exposure	Occupational skin disease
Age		Young workers were more likely to report exposure to Detergents and Disinfectants than older workers	
Gender	Females were more likely to report frequent hand washing than male workers.	<ul style="list-style-type: none"> - Overall, exposure to chemicals was more common for male workers than female workers - Female workers were more likely to report exposure to Detergents, Disinfectants and Bases & Alkalis. - Male workers were more likely to report exposure to Non-bituminous hydrocarbon fuels, Paints, varnishes & inks, and Cement & lime 	<ul style="list-style-type: none"> - Males were diagnosed with OCD more frequently than females. - Irritant contact dermatitis in females more likely to be caused by soaps / detergents or wet work - Irritant contact dermatitis in males more likely to be caused by oils / coolants and solvent exposures
Workplace size		Small workplaces (< 5 employees) were associated with high likelihood of reporting exposure to Paints, varnishes & inks, and Cement & lime.	
Occupation Occupational skill level Industry	<ul style="list-style-type: none"> - Lower skilled workers (tradespersons and labourers) had increased exposure to hands immersed in liquids - High exposure industries: Health & community services, and Accommodation, cafes & restaurants 	<ul style="list-style-type: none"> - Lower skilled workers (skill levels 5 and 3) were more likely to report exposure to most of the main chemical groups - High exposure industries: Accommodation, cafes & restaurants, Agriculture, forestry & fishing, Health & community services, and Construction 	<ul style="list-style-type: none"> - Most common occupations: tradespersons and labourers, health care workers, food handlers - Highest rate of OCD was in hair and beauty workers

Table 2. Summary of the demographic and employment factors associated with the provision of controls for wet work and dermal chemical exposure in the workplaces of exposed workers

	Wet work control provision	Dermal chemical control provision
Control provision assessed in NHEWS survey	Gloves Barrier creams & moisturisers Labelling and warning signs Time restriction Training & education about skin care	Gloves, including specific types Protective clothing Labelling and warning signs Washing facilities Training on safe handling of chemicals
Provision of controls – the percentage of exposed workers who reported the control was provided	Gloves – 75% Barrier creams etc – 53% Labelling & warning signs – 54% Time restriction – 32% Training & education – 43%	Gloves – 82% Protective clothing – 60% Labelling & warning signs – 69% Washing facilities – 84% Training – 61%
None of the surveyed control measures provided	13% of exposed workers	6% of exposed workers
Demographic and employment factors		
Gender		Female workers were more likely to report the provision of washing facilities but less likely to report the provision of protective clothing than male workers.
Age	Older workers were more likely to report the provision of barrier creams and moisturisers than younger workers	Young workers (15-24 years) were the least likely age group to report the provision of gloves.
Workplace size	Workers in workplaces with fewer than 20 workers were less likely to report the provision of training than larger workplaces. They were also more likely to report that none of the surveyed control measures were provided. Workers from workplaces with 5-19 employees were less likely to report the provision of gloves, barrier creams & moisturisers and labelling & warning signs.	The likelihood that controls were provided declined with declining workplace size. Workers from workplaces with fewer than 20 employees were much more likely to report that none of the surveyed control measures were provided.
Occupational skill		Skill level 4 workers were less likely to be provided with protective clothing and washing facilities than the highest skilled workers - skill level 1. Skill level 2 workers were more likely than the highest skilled workers to report the provision of chemical safety training.

	Wet work control provision	Dermal chemical control provision
Employment arrangement		Casual workers were less likely to report the provision of protective clothing, labelling and warning signs and chemical safety training than permanent or fixed term workers.
Industry	<p>The industry in which a worker worked affected the likelihood that workers were provided with controls. Industries in which consistently lower than overall percentages of workers reported control provision include:</p> <ul style="list-style-type: none"> - Construction - Transport & storage - Agriculture, forestry & fishing - Accommodation, cafes & restaurants - Education <p>Large percentages of workers in the following industries reported that none of the surveyed control measures were provided:</p> <ul style="list-style-type: none"> - Construction 16.7% - Transport & storage 19.7% - Agriculture, forestry & fishing 18.3% - Education 27.4% 	<p>Industries in which consistently lower than overall percentages of workers reported control provision include:</p> <ul style="list-style-type: none"> - Construction - Wholesale & retail trade - Accommodation, cafes & restaurants - Property & business services - Education - Cultural, recreational & personal services <p>Large percentages of workers in the following industries reported that none of the surveyed control measures were provided:</p> <ul style="list-style-type: none"> - Construction 11.5% - Cultural, recreational & personal services 9.8% - Education 8.5%