

AUSTRALIAN WORK EXPOSURES STUDY: ASTHMAGENS

The extended Australian Work Exposures Study (AWES–2) investigated self-reported work-related exposures to agents that cause or aggravate asthma. The AWES–2 research was led by Dr Lin Fritschi at the Curtin University of Technology and was funded through a National Health and Medical Research Council Partnership Project grant (with co-funding provided by Safe Work Australia, the Cancer Council Australia and the Cancer Council of Western Australia).

This summary describes the results of a national, population-based survey of Australian workers to examine the prevalence of exposures to asthmagens at work. A full description of the methodology and findings of this study and all relevant citations were published in the peer-reviewed paper "[The estimated prevalence of exposure to asthmagens in the Australian workforce, 2014.](#)"

Background

Work-related asthma includes new cases of asthma caused by exposures to asthmagens at work (occupational asthma) and cases where asthma symptoms are made worse or experienced more often by exposures to triggers (normally irritants) at work (work-aggravated asthma). A review of international studies estimated about 16 to 17 per cent of adult onset asthma cases were caused by workplace exposures to asthmagens.

Occupational asthma can be classified as either:

- sensitiser-induced (allergic)
 - characterised by exposure(s) to an agent that sensitises the airways so they react to subsequent exposures to the same agent, to other sensitisers, and to non-specific triggers, or
- irritant-induced (non-allergic)
 - typically occurs as a result of one or more high level exposures to an irritant
 - accounts for approximately 10 per cent of all occupational asthma.

Occupational asthma can be prevented. For example, a study of workers in the Australian and New Zealand aluminium industry ascribed improvements in control of exposures, respiratory protection and pre-placement medical assessments to a 96 per cent reduction in the incidence of occupational asthma in seven smelters between 1992 and 2006.

Several hundred asthmagens (agents that cause asthma) have been identified in previous research and a list of those most relevant to Australian workplaces was developed as part of this project. The final list of 277 asthmagens categorised into 27 astmagen groups was published in the [Australian and New Zealand Journal of Public Health](#) in 2014. However, prior to the AWES-2 research there was little information available on the extent of exposures to these asthmagens in Australia that was useful for prioritising potential work health and safety interventions.

The AWES–2 study

The report provides estimates of potential exposures to asthmagens among the Australian working population using data collected from AWES–2:

- a total of 4878 participants from a randomly selected population-based sample of Australian workers were interviewed between 2013–2014

- workers were asked questions about their tasks at work, including the types of materials worked with, work practices and the controls used to prevent or minimise exposures, and
- an automated expert assessment process was used to estimate potential exposures to a predefined list of asthmagens based on worker responses to one of 52 job-specific modules or, in some cases, a generic module within the web-based tool OccIDEAS—these assessments were reviewed by the researchers.

Key findings

The analyses presented in the report are based on whether or not a particular worker was ‘probably’ exposed to asthmagens at work. Workers could be exposed to more than one astmagen depending on the tasks undertaken and the materials, work practices and controls used. The results were generally reported by gender due to different profiles of occupation and exposures:

- About half (47 per cent) of all males in the sample were exposed to one or more asthmagens, with probable exposures most common amongst farmers and animal workers (97 per cent), metal workers (96 per cent), wood workers (96 per cent) and food preparation workers (92 per cent).
- The most common asthmagens that male workers in the sample were probably exposed to were bio-aerosols, which includes moulds commonly found in rotting food and metal working fluids potentially contaminated with bacteria (26 per cent), metals and metal compounds (23 per cent), arthropods or mites (21 per cent) and latex (19 per cent). Four per cent of male workers were exposed to isocyanates.
- Forty per cent of all females in the sample were probably exposed to one or more asthmagens, with probable exposures most common among farmers and animal workers (100 per cent), carers (99 per cent), cleaners (96 per cent), food preparation workers (96 per cent) and nurses (92 per cent).
- The most common asthmagens that female workers in the sample were probably exposed to were latex (25 per cent), industrial cleaning and sterilising agents (20 per cent), bio-aerosols (18 per cent) and arthropods or mites (16 per cent).
- Generally, probable exposures were more common to high molecular weight (HMW) agents such as bio-aerosols and arthropods and mites.
- Relationships between probable exposures to all asthmagens within occupational groups were also examined and these analyses were provided in supplementary materials to the research paper.

Common astmagen exposures within occupations are presented in the table below.

Table 1: Common asthmagens within occupations—by gender

Gender	Occupation	Common exposures
Males	Farmers and animal workers	Bio-aerosols, arthropods or mites, metal and metal compounds, ammonia and agents derived from animals or plants
	Food preparation	Bio-aerosols, arthropods or mites, latex, biological enzymes, foodstuffs and flours
	Wood workers	Bio-aerosols, aldehydes, epoxy resins and adhesives, reactive dyes, acrylates, wood dusts and isocyanates

Gender	Occupation	Common exposures
	Painters and printers	Metals and metal compounds, aldehydes, industrial cleaning agents, epoxy resins, anhydrides, wood dust and isocyanates
	Carers	Bio-aerosols, arthropods or mites, latex, industrial cleaning agents and ammonia
Females	Farmers and animal workers	Bio-aerosols, arthropods or mites, ammonia, agents derived from animals or plants, latex and aldehydes
	Food preparation	Bio-aerosols, arthropods or mites, latex, industrial cleaning agents, biological enzymes, foodstuffs and flours
	Wood workers	Bio-aerosols, latex, aldehydes, ammonia and wood dusts
	Hairdressers	Latex, aldehydes, industrial cleaning agents, ammonia, acrylates, amines
	Cleaners	Bio-aerosols, arthropods or mites, latex, industrial cleaning agents and ammonia

Comparisons with other research findings

Overall prevalence studies

In the European Community Respiratory Health Survey (ECRHS) about 26 per cent of the sample self-reported exposures to 'vapours, gas, dust or fumes' in their current job. This study did not identify specific asthmagens, not all dusts are asthmagenic, and by definition it did not include a wide range of agents included in AWES-2 such as latex, animals and animal products and foods.

A Norwegian study also assessed exposures to asthmagens using a job-exposure matrix and found 62 per cent of males and 59 per cent of females were exposed at some time over the previous 10 years to biological dusts, mineral dusts, gases, or fumes. Job-exposure matrices allocate the same exposures to all workers in a particular occupation or trade—i.e. tasks are not taken into account—potentially overestimating exposures. The AWES-2 approach can differentiate potential exposures of workers in the same occupation or trade who carry out different tasks. The AWES-2 methodology is therefore considered to provide a more accurate estimate of exposure to asthmagens.

Common asthmagens reported through medical surveillance

Some work-related asthma registries have collected information about common asthmagens implicated in diagnosed cases of work-related asthma. These include:

- **South Africa**—isocyanates and latex
- **Finland**—moulds, animal epithelia (dander), flour, grain and grain mites
- **Australia**—wood dust (including Western Red Cedar), and
- **United Kingdom**—isocyanates, cutting oils, adhesives, chrome, latex and gluteraldehyde.

Reporting of work-related asthma by physicians in these studies was voluntary and under-represents the total number of known cases. Reporting can be biased by diagnoses reflecting commonly recognised asthmagens or those that are a deemed cause under workers compensation or insurance schemes—i.e. the most commonly reported asthmagens might not necessarily reflect the prevalence of exposures to these asthmagens. A South Korean study used information from a range of sources, including physicians,

surveillance systems and compensation schemes and found common asthmagens to be isocyanates, flour and grains, metals and metal compounds, reactive dye and solvents.

Limitations of the AWES-2 study

- The AWES–2 approach provides population-based information on current workplace exposures to asthmagens for relatively common tasks. A raked weighting process was used to limit potential non-response bias when extrapolating results to the Australian working population. However, the sample was not random because people whose surnames began with the letters L and M made up a large proportion (81 per cent) of the sample—while this should not bias the results the impact of over or under-representing some sub-groups is difficult to quantify. There may have also been some selection bias for some occupations, particularly those where workers are often away from home for extended periods and are unlikely to be contactable.
- The 277 asthmagens included in the study were grouped into 27 asthmagen groups based on previous international research. Thus, an individual worker could be exposed to one, some or all asthmagens included in an asthmagen group and further analyses will be required to identify common exposures within asthmagen groups.
- Potential errors in estimates could occur due to reliance on self-reported data provided by workers. However, the AWES-2 approach does not rely on workers recognising and recalling specific exposures—i.e. because questions were asked about tasks, potential exposures are less likely to be missed or erroneously reported.

Conclusions

This AWES–2 research identifies:

- the types of workers most likely to be exposed to workplace asthmagens, and
- the types of workplace asthmagens commonly encountered in the workplace.

The incidence of new cases of occupational asthma and cases of work-aggravated asthma could be reduced if this information is used to focus preventative efforts. This information can also be used by medical practitioners to help identify work-related factors when diagnosing and treating patients.

Published AWES-2 research

The research paper examining the prevalence of exposure to asthmagens in Australia was published in the peer-reviewed, open access journal BMC Pulmonary Medicine:

Fritschi, L., J. Crewe, E. Darcey, A. Reid, D. C. Glass, G. P. Benke, T. Driscoll, S. Peters, S. Si, M. J. Abramson and R. N. Carey (2016). "[The estimated prevalence of exposure to asthmagens in the Australian workforce, 2014.](#)" BMC Pulm Med 16: 48.

The supplementary materials can be obtained from the [Occupational & Environmental Medicine journal](#) website.

The process for developing the list of asthmagens included in AWES–2 was published in:

Crewe, J., R. Carey, D. Glass, S. Peters, M. J. Abramson, G. Benke, A. Reid, T. Driscoll and L. Fritschi (2015). "[A comprehensive list of asthmagens to inform health interventions in the Australian workplace.](#)" Aust NZ J Public Health 40(2): 170-173.